PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
Stylesheet Version v1.2

EPAS ID: PAT3739115

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	SECURITY INTEREST
SEQUENCE:	19

CONVEYING PARTY DATA

Name	Execution Date
MR DWAYNE CARTOUCHE HANS	02/08/2016

RECEIVING PARTY DATA

Name:	THE CARTOUCHE CORPORATION
Street Address:	100 INDIAN ROCKS RD N
City:	LARGO
State/Country:	FLORIDA
Postal Code:	33770
Name:	MR DWAYNE C. HANS JR
Street Address:	1430 MAHAN AVE
City:	RICHLAND
State/Country:	WASHINGTON
Postal Code:	99354
Name:	FIRST AMERICAN FINANCIAL CORPORATION
Street Address:	1 FIRST AMERICAN WAY
City:	SANTA ANA
State/Country:	CALIFORNIA
Postal Code:	97207

PROPERTY NUMBERS Total: 6

Property Type	Number
Patent Number:	5634653
Intl Reg Number:	DM/546345
Patent Number:	6564365
Intl Reg Number:	DM/654365
Patent Number:	7654323
PCT Number:	WO1687653

CORRESPONDENCE DATA

Fax Number:

Correspondence will be sent to the e-mail address first; if that is unsuccessful, it will be sent using a fax number, if provided; if that is unsuccessful, it will be sent via US Mail.

Email: DWAYNE.HANSJR@OUTLOOK.COM
Correspondent Name: HANS INDUSTRIES
Address Line 1: FORTY EAST 52ND STREET
Address Line 4: NEW YORK, NEW YORK 11202

ATTORNEY DOCKET NUMBER:	503
NAME OF SUBMITTER:	DWAYNE CARTOUCHE HANS
SIGNATURE:	/DWAYNE CARTOUCHE HANS/
DATE SIGNED:	02/15/2016
	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 671
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PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
Stylesheet Version v1.2

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SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	SECURITY INTEREST
SEQUENCE:	5

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Property Type	Number
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Patent Number:	7670759
Intl Reg Number:	DM/985434

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BANK GUARANTEE PHASE OUT DESCRIPTION

Date: 2015-05-15

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Contents

1 Executive summary **3**

2 Document data **6**

2.1 Legal Disclaimer 6

2.2 Version history 6

2.3 Glossary and Definitions 6

3 Introduction **7**

3.1 Consequence 7

3.2 How does this affect my organization? 8

3.2.1. Clearing Clients 8

3.2.2. Client Representative/Clearing Member 8

3.2.3. Bank Guarantee issuer 8

4 Basic Client models **9**

4.1 Non Clearing Member (NCM) 9

4.2 Omnibus Account 9

4.3 Individual Client Segregated Account (ICA) 9

5 Clearing alternatives **10**

5.1 Replace bank guarantees with other types of eligible collateral 10

5.2 Transfer to a new clearing model 12

6 Contact **14**

7 Q&A **15**

Appendix 1 – Collateral List **16**

Appendix 2 – List of GCM and Clearing Members **17**

PATENT
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1 Executive summary

What

The three year exemption from EMIR that allows non-financial clearing members to use non-fully backed bank guarantees as collateral towards central counterparties (CCP) to cover for margin requirements related to power and gas expires on March 15, 2016.

Therefore clearing members using non-fully backed bank guarantees will need to:

1. Replace non-fully backed bank guarantees with other types of eligible collateral; OR
2. Transfer to a new clearing model

When

Nasdaq Clearing has set a deadline that all non-fully backed bank guarantees shall be phased out by the end of February 2016. In order to meet the deadline all affected members are required to inform Nasdaq Clearing by **June 17, 2015** which alternative that is being considered. **September 15, 2015** is the final deadline to inform Nasdaq about the decided alternative and one month later, **October 15, 2015** all required documentation shall have been submitted to Nasdaq Clearing.

The tight deadlines are set in order to allow all participants using non-fully backed bank guarantees an organized transition to any of the two alternatives prior to the removal of the non-fully backed bank guarantees.

Clearing members who wish to replace the collateral or make changes to the clearing model prior to the stated deadlines are of course welcome to do so. Please contact Nasdaq Clearing for further information.

In the table below, you will find the deadlines for the different alternatives.

Deadline	1. Replace non-fully backed bank guarantees with other types of eligible collateral	2. Transfer to a new clearing model
17 June 2015	**Deadline** to inform Nasdaq Clearing of the intention to either: 1) replace the non-fully backed bank guarantee with other types of eligible collateral; OR 2) transfer to a new clearing model. The name of the considered clearing member as well as the considered client model shall be included in the notification.	
1 Sep 2015	From this date, no new non-fully backed bank guarantees will be accepted as collateral (adjusting the amount on an existing bank guarantee will be allowed).	
15 Sep 2015	**Deadline** to inform Nasdaq Clearing about the **final decision** to either: 1) replace the non-fully backed bank guarantee with other types of eligible collateral; OR 2) transfer to a new clearing model. The name of the new clearing member as well as the considered client model must be included in the notification. Nasdaq Clearing will provide the member with the required documentation based on the chosen alternative.	

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Deadline	1. Replace non-fully backed bank guarantees with other types of eligible collateral	2. Transfer to a new clearing model
30 Sep 2015		General Clearing Members (GCM) or clearing members that considers offering services to clients transferring from other clearing models must be approved by Nasdaq Clearing and live in production by this date.
15 Oct 2015	Clearing members replacing their non-fully backed bank guarantee needs to gradually reduce the guarantee amount. Not later than Jan 18, 2016 the guarantee amount shall be reduced to 75% of the margin requirement. The remaining 25% must be covered with other types of eligible collateral. Nasdaq Clearing will communicate a preliminary amount (based on Jan-Sep average margin requirement) for which the non-fully backed bank guarantee is eligible as collateral after Jan 18, 2016.	Clients, Clearing Members and GCM must have signed and submitted all relevant legal agreements and forms to Nasdaq Clearing.
27 Nov 2015		Clearing members and the associated stakeholders will receive detailed information from Nasdaq Clearing when the positions and obligations will be transferred to the new clearing model.
Jan 8, 2016	Not later than Jan 18, 2016 the guarantee amount shall be reduced to 75% of the margin requirement. The remaining 25% must be covered with other types of eligible collateral. Nasdaq Clearing will communicate the **final amount** (based on 2015 average margin requirement) for which the non-fully backed bank guarantee is eligible as collateral after Jan 18, 2016.	
18 Jan 2016	Not later than Jan 18 the guarantee amount shall be reduced to 75% of the margin requirement. The remaining 25% must be covered with other types of eligible collateral.	
Jan – Feb		Clearing members can expect to receive a time slot when Nasdaq Clearing will transfer the positions and the obligations to the new clearing member/ overtaking member. Detailed information on when positions and obligations will be transferred is presented end of November 2015.
29 Feb 2016	Non-fully backed bank guarantees will be removed as eligible collateral from the collateral list of Nasdaq Clearing's Rules and Regulations.	
15 Mar 2016	Regulatory deadline when the non-fully backed bank guarantees expire as eligible collateral	

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Power Future in parallel with Deferred Settlement Futures

When considering alternative clearing models the clearing members shall take into consideration that Nasdaq Commodities will list Power Futures with daily cash settlement from September 2015. The Power Futures will be listed in parallel with the Deferred Settlement Futures.

Who should read this document

The intended audience for this document are all the stakeholders that are affected by the phase out of the non-fully backed bank guarantees:

- Client Representatives
- Clearing Clients
- Clearing Members
- General Clearing Members
- Bank Guarantee issuer

The document includes important information for readers in functions including Strategy, Management, Legal, Compliance, Risk, IT and Operations.

What does my organization need to do?

Clearing member that are using non-fully backed bank guarantees, must decide and inform Nasdaq Clearing which clearing model that will be used going forward when the non-fully backed bank guarantees are removed as eligible collateral. **September 15, 2015** is the final deadline to inform Nasdaq Clearing of the decided clearing model where a **preliminary answer is requested by June 17, 2015**.

For participants considering becoming a General Clearing Member or a Clearing Member with the objective to on-board clients leaving their current clearing model, the membership process must be completed by **September 30, 2015**.

Contact details

For further information regarding the bank guarantee phase out process please visit Nasdaq Clearing´s Web http://www.nasdaqomx.com/europeanclearing/collateral-management/bank-guarantee-phase-out that will be the main communication channel going forward.

You can also contact your dedicated Nasdaq Commodities Account Manager or send an email to salescommodities@nasdaq.com.

PATENT
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2 Document data

2.1 Legal Disclaimer

The content of this document is subject to change without notice. Nasdaq Clearing makes no representations or warranties with respect to the information and disclaims all liability for any use you make of the contents of this document. Nasdaq Clearing assumes no responsibility for any errors or omissions.

2.2 Version history

Ver	Date	Note
1.0	May 15, 2015	Version 1.0

2.3 Glossary and Definitions

CCP	Central counterparty (Nasdaq Clearing)
CSD	Central Securities Depository
ESMA	European Securities Market Authorization
EMIR	European Market Infrastructure Regulations
GCM	General Clearing Member
ICA	Individual Client Segregated Account
ICSD	International Central Securities Depository
NCM	Non Clearing Member
SSI	Standing Settlement Instruction

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3 Introduction

At the Pittsburgh summit in September 2009, the leaders of the G20 made a strong commitment to prevent systemic risks in the financial markets by regulatory reform the market for OTC derivatives. As a consequence the Dodd-Frank Act was introduced in the United States in July 2010. The corresponding European regulations also known as EMIR (European Market Infrastructure Regulations) was introduced in August 2012.

EMIR required ESMA (European Securities and Market Authority) to draft Regulatory and Implementing Technical Standards to further detail and implement the provisions of EMIR. The Regulatory Technical Standards entered in to force in March 15, 2013.

EMIR Article 46(1) of Regulation (EU) No 648/2012 requires that bank guarantees, used as collateral for CCP clearing of power and gas derivatives, are fully backed by collateral that meets the following conditions:

- it is not subject to wrong way risk based on a correlation with the credit standing of the guarantor or the non- financial clearing member, unless that wrong way risk has been adequately mitigated by haircutting of the collateral;
- the CCP has prompt access to it and it is bankruptcy remote in case of the simultaneous default of the clearing member and the guarantor

All CCPs were given a three year exemption in regards to EMIR Article 46 (1) allowing non-financial participants to continue to use non-fully backed bank guarantee as Collateral in respect to positions that are:

a) Derivatives relating to electricity or natural gas produced, traded or delivered in the Union;
b) Derivatives relating to the transportation of electricity or natural gas in the Union

The three year exemption period expires in March 15, 2016.

3.1 Consequence

Clearing members using non-fully backed bank guarantees as collateral to cover margin requirements related to power and gas will need to post other types of eligible collateral or find alternative clearing models to continue trading and clearing after February 29, 2016. In chapter 5 the different alternatives are further described.

PATENT
REEL: 037821 FRAME: 0024

3.2 How does this affect my organization?

3.2.1. Clearing Clients

Remain in the current clearing model:
The condition for remaining in the current clearing model is that non-fully backed bank guarantees are replaced with other types of eligible collateral. The Clearing Client model requires a Client Representative with whom the decision needs to be coordinated.

Transfer to another clearing model
Clearing Clients have the possibility to transfer to another clearing model. Through its clearing members Nasdaq Clearing offers various client models. Clearing Clients will need to understand the trading and allocation arrangements in the new clearing model. Also, documentation to transfer positions from the Clearing Client account to the new clearing model may be required.

3.2.2. Client Representative/Clearing Member

Remain in the current clearing model:
The condition for remaining in the current clearing model is that the non-fully backed bank guarantees are replaced with other types of eligible collateral. It is important that the Client Representative and its Clearing Clients coordinate the decisions.

Transfer to another clearing model
Client Representatives and Clearing Members have the possibility to transfer to other clearing models e.g. becoming an NCM and clear through a GCM in which case the GCM would be responsible for the default fund contribution, the collateral deposits and the clearing administration towards Nasdaq Clearing. The NCM will trade through its NCM membership and allocation to potential clients will be done based on arrangements with the GCM. Please contact the considered GCM in regards to what arrangements and instruments they support. Any Broker Appointments to be used in a new clearing model must be renewed and signed by the GCM. Also, documentation to transfer positions from the Client Representative´s/Clearing Member´s account to the new clearing model and to terminate the Client Representative´s/Clearing Member´s clearing membership agreement may be required.

3.2.3. Bank Guarantee issuer

From September 1, 2015 no new non-fully backed bank guarantees will be accepted as collateral (adjusting the amount on an existing bank guarantee will be allowed).

For clearing members choosing the option to maintain in their current clearing model, a reduction of the bank guarantees will commence January 18, 2016. Based on the average margin requirements during 2015, only 75% can be covered with non-fully backed bank guarantees. Any bank guarantee amounts exceeding this amount will have a collateral value of zero.

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4 Basic Client models

Nasdaq Clearing offers a wide range of client models. Further information regarding the basic client models are presented below:

4.1 Non Clearing Member (NCM)

The NCM has an exchange membership agreement with NASDAQ OMX Stockholm AB or NASDAQ OMX Oslo ASA and clears via a GCM. The NCM trades may be cleared on a GCM omnibus or ICA account depending on the GCM service.

4.2 Omnibus Account

The omnibus account is an integrated trading and clearing account for the aggregated positions of several clients. Members can choose to set up several omnibus accounts for administrative purposes. The Clearing Member/GCM is fully liable for all contract obligations. Omnibus clients do not have a legal relationship with Nasdaq Clearing. Positions and collateral are segregated between house and client but not client-by-client. No automated position netting is performed for this account. If netting is required, the member is responsible for initiating netting within the account. Cross margining and offsets are calculated within each account. The Clearing Member/GCM contributes to the default fund. If the Clearing Member/GCM defaults, positions can be ported to a backup member without the involvement of the bankruptcy administrator, provided that all clients in the omnibus account have appointed the same back-up member.

4.3 Individual Client Segregated Account (ICA)

The individual client segregated account is an integrated trading and clearing account for one individual client where positions and collateral are fully segregated in order to offer portability arrangements. Typically, NCMs and larger institutions use this clearing account. There is no direct legal relationship between the client and Nasdaq Clearing. The Clearing Member/GCM is fully liable for all contract obligations. The Clearing Member/GCM is required to open a specific custody account with Nasdaq Clearing in relation to each ICA client. The account is in the name of the member. The member is responsible for posting collateral to this account. Positions and collaterals are segregated client-by-client. Cross margining and offsets are calculated within an individual account but not with other clearing accounts. The Clearing Member/GCM contributes to the default fund. If the Clearing Member/GCM defaults, positions and collateral can be ported to a backup member without the involvement of the bankruptcy administrator.

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5 Clearing alternatives

Clearing members affected by the phase out of the non-fully backed bank guarantees will need to decide and inform Nasdaq Clearing about the clearing model going forward. The alternatives available are:

1. Replace non-fully backed bank guarantee with other types of eligible collateral; OR
2. Transfer to a new clearing model

Power Futures
Members are urged to consider the listing of Power futures from September 2015 in parallel with the Deferred Settlement Futures. The profit and loss for Power futures are adjusted on a daily basis and the margin requirement which has to be covered with eligible collateral will be lower than for Deferred Settlement futures where profit and loss is accumulated until delivery.

This chapter lays out further information regarding the different alternatives including the required actions and deadlines.

5.1 Replace bank guarantees with other types of eligible collateral

Clearing members that prefer to remain in the current clearing model with the use of other types of eligible collateral are required to inform Nasdaq Clearing of that intention no later than **June 17, 2015**. A final decision is required no later than **September 15, 2015**. For the list of eligible collateral, please see Appendix 1 – Collateral List.

Phase out process:
The phase-out of non-fully backed bank guarantees will be done in two steps:

- **Step 1:** By **Jan 18, 2016** 75% of the margin requirement can be covered with non-fully backed bank guarantee. The other required 25% needs to be covered with other types of eligible collateral. The amount corresponding to 75% of the margin requirement will be a fixed amount based on the average margin requirement during 2015. Nasdaq Clearing will communicate a preliminary amount by October 15, 2015 based on the first nine months average. The final amount is presented not later than January 8, 2016 based on the average margin requirement during 2015. Any bank guarantee amounts exceeding this amount will have a collateral value of zero after Jan 18, 2016.

- **Step 2:** By **Feb 29, 2016** the non-fully backed bank guarantees will no longer be eligible as collateral and the value of such guarantees will be set to zero. All non-fully backed bank guarantees must be replaced with other types of eligible collateral. If no other eligible collateral is posted to cover for outstanding margin requirement, default procedures according to Nasdaq Clearing Rules and Regulations might be initiated.

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Posting of eligible Collateral in the form of securities

Clearing members posting securities as collateral to Nasdaq Clearing can choose to use:

- Euroclear Sweden for eligible securities registered with Euroclear Sweden
- VP Securities in Denmark for eligible securities registered with VP Securities
- Verdipapirsentralen VPS in Norway for eligible securities registered with VPS
- Euroclear Bank for eligible securities registered with Euroclear Bank
- Clearstream Banking for eligible securities registered with Clearstream Banking

Securities posted to Nasdaq Clearing as collateral are settled through free-of-payment (FoP) settlement instructions through any of the above stated Central Securities Depository (CSD)/ International Central Securities Depository (ICSD). Clearing members are requested to provide Standing Settlement Instructions (SSI) to Nasdaq Clearing.

Clearing members that are not direct participants in required CSDs or ICSDs must use a settlement agent in order to be able to post securities as collateral to Nasdaq Clearing.

Cash optimization

For clearing members considering using cash as collateral, please familiarize yourself with the recently introduced Cash optimization facility. More information can be found on Nasdaq Web.

Deadlines

Deadline	Replace non-fully backed bank guarantee with other types of eligible collateral
Jun 17 2015	Inform Nasdaq Clearing that you intend to continue clearing under your current membership and replace your non-fully backed bank guarantee with other types of eligible collateral. Please contact your dedicated Nasdaq Commodities Account Manager or send an email to salescommodities@nasdaq.com
Sep 1, 2015	From this date, no new non-fully backed bank guarantees will be accepted (adjusting the amount on an existing bank guarantee will be allowed).
Sep 15 2015	**Deadline** to inform Nasdaq Clearing that you will continue clearing under your current membership and that you will replace your non-fully backed bank guarantee with other types of eligible collateral. Ensure that all necessary operational procedures to pledge other collateral are in place well in time before the non-fully backed bank guarantee expires. Please contact your dedicated Nasdaq Commodities Account Manager or send an email to salescommodities@nasdaq.com
Oct 15 2015	Clearing members replacing their non-fully backed bank guarantee needs to gradually reduce the guarantee amount. Not later than Jan 18, 2016 the guarantee amount shall be reduced to 75% of the margin requirement. The remaining 25% must be covered with other types of eligible collateral. Latest Oct 15, 2015 Nasdaq Clearing will communicate a preliminary amount (based on Jan-Sep average margin requirement) for which the non-fully backed bank guarantee is eligible as collateral after Jan 18, 2016.

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Deadline	Replace non-fully backed bank guarantee with other types of eligible collateral
Jan 8, 2016	Not later than Jan 18, 2016 the guarantee amount shall be reduced to 75% of the margin requirement. The remaining 25% must be covered with other types of eligible collateral. Latest Jan 8, 2016 Nasdaq Clearing will communicate the final amount (based on 2015 average margin requirement) for which the non-fully backed bank guarantee is eligible as collateral after Jan 18, 2016.
Jan 18 2016	Not later than Jan 18, 2016 the guarantee amount shall be reduced to 75% of the margin requirement. The remaining 25% must be covered with other types of eligible collateral.
Feb 29 2016	Non-fully backed bank guarantees will be removed as eligible collateral from the collateral list of Nasdaq Clearing's Rules and Regulations.

5.2 Transfer to a new clearing model

Clearing members that prefer to transfer to a new clearing model are required to inform Nasdaq Clearing of that intention no later than **June 17, 2015**. A final decision is required no later than **September 15, 2015** and one month later, **October 15, 2015,** all required documentation must have been submitted to Nasdaq Clearing.

Nasdaq Clearing requires the clearing member to submit information regarding the selected clearing model. For a list of available Clearing Members and General Clearing Members, please see Appendix 2 – List of GCM and Clearing Members.

It is important that the clearing member take all necessary actions required to understand the procedures for transferring to the new clearing model. Required preparations may include testing, verification of reports, give up procedures etc. Please contact the clearing member you are transferring to for coordination of any testing activities with Nasdaq Clearing.

Applicable documentation/agreements required for the transfer and the set-up of the different clearing models can be found on Nasdaq Clearings web. In addition, Nasdaq Clearing will distribute individually prepared documentation after the clearing member has informed Nasdaq Clearing about its final decision. Please contact your Nasdaq Commodities Account Manager to receive the correct information and documentation.

When comparing alternative clearing models, clearing members are advised to familiarize themselves with the margin concentration and position limit policy applied by Nasdaq Clearing. The limits aim to provide Nasdaq Clearing with additional default coverage in relation to significantly large and concentrated exposures.

PATENT
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Deadlines:

Deadline	Transfer to a new clearing model
17 June 2015	Inform Nasdaq Clearing of the intention to transfer to a new clearing model. The name of the considered clearing member as well as the considered client model shall be included in the notification. Please contact your dedicated Nasdaq Commodities Account Manager or send an email to salescommodities@nasdaq.com
1 Sep 2015	From this date, no new non-fully backed bank guarantees will be accepted as collateral (adjusting the amount on an existing bank guarantee will be allowed).
15 Sep 2015	**Deadline** to inform Nasdaq Clearing about the decided clearing model. The name of the chosen clearing member as well as the chosen client model must be included in the notification. Nasdaq Clearing will provide the member with the required documentation based on the chosen alternative. Please contact your dedicated Nasdaq Commodities Account Manager or send an email to salescommodities@nasdaq.com
30 Sep 2015	General Clearing Members (GCM) and Clearing Members that considers offering services to clients transferring from other clearing models must be approved by Nasdaq Clearing and live in production by this date.
15 Oct 2015	Clients, Clearing Members and GCMs must have signed and submitted relevant legal documentation to Nasdaq Clearing.
27 Nov 2015	Clearing members and the associated stakeholders will receive detailed information from Nasdaq Clearing when the positions and obligations will be transferred to the new clearing model.
Jan - Feb	Clearing members can expect to receive a time slot when Nasdaq Clearing will transfer the positions and the obligations to the new clearing member/overtaking member. Detailed information on when positions and obligations will be transferred is presented end of November 2015.
29 Feb 2016	Non-fully backed bank guarantees will be removed as eligible collateral from the collateral list of Nasdaq Clearing's Rules and Regulations.
15 Mar 2016	Regulatory deadline when the non-fully backed bank guarantees expire as collateral

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6 Contact

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PATENT
REEL: 037821 FRAME: 0031

7 Q&A

Questions and answers will be updated continuously during the phase out process. See Nasdaq Clearing Web for the latest information.

1. Can I transfer my positions and obligations to another clearing model prior to the specified deadlines?

   Answer: Yes, you can transfer to another clearing model before the specified deadlines assuming you have all your arrangements in place. Please contact Nasdaq Clearing for further information.

2. What happens to the deadlines and processes specified in the document if the regulators decided to maintain the non-fully backed bank guarantees beyond March 2015?

   Answer: The deadlines and procedures are subject to change based on new information from the regulators. If and when new information is received from the regulators, Nasdaq Clearing will communicate any changes to the phase out plan.

PATENT
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Appendix 1 – Collateral List

The current list of eligible Collateral can be found on the following address:

http://www.nasdaqomx.com/commodities/Marketaccess/legalframework

Clearing Rules, Appendix 10 “Collateral List”.

Note that the list currently includes non-fully backed bank guarantees.

PATENT
REEL: 037821 FRAME: 0033

Appendix 2 – List of GCM and Clearing Members

The current list of available General Clearing Members and Clearing Members can be found on the following address: http://www.nasdaqomx.com/commodities/Marketaccess/memberlist

GCM Contact List:

http://www.nasdaqomx.com/commodities/Marketaccess/membershipcategories/gcmcontactlist

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REEL: 037821 FRAME: 0034

NASDAQ CLEARING AS A COUNTERPARTY



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PREFACE

This document describes the clearing of equity, fixed income and commodity derivatives at Nasdaq Clearing and how the role as clearing house and central counterparty (CCP) is fulfilled. It provides the reader with information relating to central counterparty activities, the counterparty risks inherent to clearing operations, how these risks are managed and the financial resources available to support the clearing operations.

One of the principal functions of a clearing house is to guarantee that all contracts traded will be honored. Nasdaq Clearing becomes the counterparty in all transactions, i.e. acts as a buyer to the seller and as a seller to the buyer. Counterparty risk is the risk that one party in a transaction will not be able to fulfill its obligations in due time. In order to ensure that the clearing house has the capacity to fulfill its obligations, it requires and receives collateral from the participating counterparties. In addition, it holds a member sponsored default fund and retains its own capital resources as well.

The ability to manage the counterparty risk is dependent on pro-active risk management, a sound legal foundation and the financial strength of the clearing house. Furthermore, rigid financial and operational requirements are applied to its members. Nasdaq Clearing also relies on advanced portfolio based margining models to determine the amount of collateral appropriate for the counterparty risks it assumes. In the event of a loss resulting from a counterparty default exceeding margins and default fund contributions of such defaulting counterparty, Nasdaq Clearing has a member sponsored default fund as well as its own funded risk-bearing capital, the latter serving as a buffer between any defaulting counterparty and all other counterparties.

The credit enhancing effects of a centralized clearing house boost market efficiency, reduce risk and allow broader client participation. Each of these features contributes to increasing liquidity in the marketplace.

April 2015

PATENT
REEL: 037821 FRAME: 0037

CONTENTS

PREFACE 3

CHAPTER 1 INTRODUCTION 6

1.1 NASDAQ OMX GROUP 6

1.2 NASDAQ CLEARING 7

1.3 BRIEF HISTORY 7

CHAPTER 2 MARKET PARTICIPANTS 10

2.1 MEMBERS 10

2.2 CLIENTS 11

CHAPTER 3 CLEARING MODEL 12

3.1 A HARMONIZED CLEARING MODEL 12

3.2 ACCOUNT STRUCTURE 13

3.3 SEGREGATION 13

3.4 PORTABILITY 15

3.5 CLEARING ACCOUNT MODEL 16

3.6 TECHNICAL ACCOUNTS 20

CHAPTER 4 PRODUCTS 21

4.1 EQUITY 21

4.2 FLEXIBLE DERIVATIVES 21

4.3 FIXED INCOME 22

4.4 COMMODITIES 22

CHAPTER 5 CLEARING OPERATIONS 23

5.1 DAILY CASH SETTLEMENT 23

5.2 PHYSICAL SETTLEMENT 23

5.3 EXPIRATION AND EXERCISE 24

CHAPTER 6 COLLATERAL MANAGEMENT 25

6.1 OVERVIEW 25

6.2 COLLATERAL 26

6.3 CASH OPTIMIZATION 27

6.4 DAILY CYCLE 27

CHAPTER 7 PAYMENT SYSTEM 29

7.1 APPROVED SETTLEMENT BANKS 29

7.2 CONCENTRATION BANKS 29

PATENT
REEL: 037821 FRAME: 0038

CHAPTER 8 RULES AND REGULATIONS 30
8.1 LEGAL FRAMEWORK 30
8.2 THE LEGAL STATUS OF NASDAQ OMX CLEARING AB 30
8.3 RULES OF NASDAQ OMX CLEARING AB 31
CHAPTER 9 COUNTERPARTY RISK MANAGEMENT 32
9.1 COUNTERPARTY RISK 33
9.2 CLEARING RISK MANAGEMENT DEPARTMENT 33
9.3 COUNTERPARTY RISK MANAGEMENT FRAMEWORK 34
9.4 RISK MANAGEMENT PROCEDURES 34
CHAPTER 10 DEFAULT MANAGEMENT 36
10.1 DEFAULT RULES 36
10.2 DEFAULT PROCESS 37
10.3 PORTABILITY – ASSUMPTIONS AND PROCESS 38
10.4 DEFAULT HISTORY 41
CHAPTER 11 MARGIN METHODOLOGY 43
11.1 CALCULATION OF RISK PARAMETERS 43
11.2 GENIUM RISK - THE MARGINING SUBSYSTEM 44
11.3 OMS-II – EQUITY DERIVATIVES MARGINING 44
11.4 CFM - FIXED INCOME DERIVATIVES MARGINING 45
11.5 SPAN - COMMODITIES DERIVATIVES MARGINING 46
11.6 CORRELATION BETWEEN INSTRUMENTS 47
11.7 MARGIN SIMULATION 48
11.8 MARGIN BACK-TESTING 48
CHAPTER 12 CCAR 49
12.1 CALCULATING CCAR PARAMETERS 49
CHAPTER 13 FINANCIAL RESOURCES 50
13.2 CLEARING CAPITAL 52
13.3 OTHER REGULATORY CAPITAL 53
13.4 THE DEFAULT FUND CONTRIBUTION PROCESS 53

PATENT
REEL: 037821 FRAME: 0039

CHAPTER 1

INTRODUCTION

Nasdaq Clearing is part of the NASDAQ OMX Group – a leading provider of trading and clearing services, exchange technology, information and public company services across six continents.

The European arm of the NASDAQ OMX Group includes the stock exchanges in Copenhagen, Stockholm, Helsinki, Reykjavik, Tallinn, Riga and Vilnius, the central securities depositories in Estonia, Latvia, Lithuania and Iceland as well as NLX, the London based interest rate derivatives market. Derivatives operations are conducted organizationally in the business area Nordic Transaction Services, which runs the stock exchanges in Stockholm, Helsinki, Copenhagen and Reykjavik, the derivatives exchanges in Stockholm and Oslo, and the derivatives clearing house Nasdaq Clearing.

1.1 NASDAQ OMX GROUP



The NASDAQ OMX Group (Nasdaq) is a leading provider of trading services, exchange technology, information and public company services across six continents. Through its diverse portfolio of solutions, Nasdaq enables customers to plan, optimize and execute their business vision with confidence, using proven technologies that provide transparency and insight for navigating today's global capital markets. As the creator of the world's first electronic stock market, its technology powers more than 80 marketplaces, clearing houses and central securities depositories in 50 countries, and 1 in 10 of the world's securities transactions. Nasdaq is home to more than 3,500 listed companies with a market value of over $9 trillion.

The Global Market Services business comprises six exchanges in the US, as well as eight exchanges, seven growth markets, one interest rate derivatives trading venue, four central security depositories and one derivatives clearing house in Europe, and a global commodities business that provides access to the world's largest power derivatives market and one of Europe's leading carbon markets. The commodities offering also includes natural gas, freight, fuel oil, iron ore and seafood.

PATENT
REEL: 037821 FRAME: 0040

In Europe Nasdaq has created a truly integrated multi asset offering enabling members to trade and clear cash and derivatives within equity, fixed income and commodities on the same technical platform and with one membership, one account structure and one collateral report. This enables members to gain substantial cost efficiencies and collateral efficiencies.

Nasdaq Nordic serves as a central gateway to the Nordic and Baltic financial markets, with over 700 listed companies on the main markets and the growth markets, Nasdaq First North.

1.2 NASDAQ CLEARING

Nasdaq Clearing operates central counterparty clearing for derivative instruments and offers clearing of equity and index derivatives on Swedish, Norwegian, Finnish and Danish instruments; fixed income derivatives on Swedish, Norwegian and Danish underlying; commodity derivatives on Nordic power, emission rights, gas, German and Dutch power as well as freight, iron ore, fuel oil, electricity certificates and salmon derivatives and derivative contracts on the British electricity market. Nasdaq Clearing clears exchange transactions as well as OTC trades done outside the regulated markets and reported to the clearing house for clearing.

NASDAQ OMX Clearing AB is a wholly-owned subsidiary of NASDAQ OMX Nordic Oy, which itself is a wholly owned subsidiary of OMX AB (a Swedish limited liability company incorporated under the Swedish Companies Act). The clearing house is organized within the legal entity of NASDAQ OMX Clearing AB (Nasdaq Clearing). The marketplace for equity, fixed income and commodities derivatives is organized within the legal entity of NASDAQ OMX Stockholm AB. NASDAQ OMX Oslo ASA is the legal entity responsible for the commodities derivatives marketplace.

Nasdaq Clearing is authorized and supervised as a multi-asset clearing house by the Swedish Financial Supervisory Authority, and is also authorized to conduct clearing operations via its Norwegian branch NASDAQ OMX Oslo by the Norwegian Ministry of Finance. As the first CCP in Europe, Nasdaq Clearing received authorization under Regulation (EU) No 648/2012 of the European Parliament and of the Council of 4 July 2012 on OTC derivatives, central counterparties and trade repositories ("EMIR") in March 2014.

1.3 BRIEF HISTORY

1.3.1 EQUITIES AND FIXED INCOME DERIVATIVES

Equities and fixed income trading in standardized derivatives began in Sweden in 1985 when OM started its operations. OM was founded as a for-profit, privately owned derivatives exchange and was the first exchange to offer electronic trading integrated with clearing and settlement. Standardized American style call options on six Swedish stocks were the first contracts traded and Sweden thereby became the sixth country in the world to introduce standardized options trading.

In 1989, OM opened the London based derivatives exchange OM London Exchange and launched the world's first electronic link-up of exchanges with real-time trading and clearing. In 1997, the link was extended to Oslo Børs and VPS Clearing (at that time Norsk Opsjonssentral A/S), and LEC (Linked Exchange Clearing) was established. LEC was the world's first derivatives link for real-time trading and clearing between independent exchanges and clearing houses. In 2001, Copenhagen Stock Exchange and FUTOP Clearing Center joined the LEC cooperation. OM London Exchange was later replaced by EDX London and LCH Clearnet. The LEC agreement was terminated March 2008 and the cooperation came to an end in December 2009. From that point on, all members trade and clear directly with NASDAQ OMX Stockholm AB and approximately 50% of the members are located outside the Nordic region.

PATENT
REEL: 037821 FRAME: 0041

Derivatives trading in Finland started when SOM (Finnish Securities and Derivatives Exchange/Clearing house) was established in 1987 and served as an integrated exchange and clearing house for the trading and clearing of standardized derivatives instruments. In 1997, the Helsinki Stock Exchange Ltd and SOM Ltd merged to form HEX Ltd. In November 1998, HEX began cooperating with Eurex AG in derivatives trading. The most actively traded Finnish derivatives started to be traded on the Eurex trading platform and all other Finnish derivatives at OM. In 2003 OM and HEX, including the Tallinn and Riga exchanges, merged and established OMX. The acquisition of the Vilnius Stock Exchange took place in 2004.

Trading of standardized derivatives in Denmark started in 1988 when The Guarantee Fund for Danish Options and Futures began its operations as a clearing house. All derivatives instruments were traded on the Copenhagen Stock Exchange. The Guarantee Fund for Danish Options and Futures was founded in 1997 and the Guarantee Fund merged with Copenhagen Stock Exchange to form the FUTOP Clearing Center. In 2005 OMX and the Copenhagen Stock Exchange merged.

In 2006 OMX and Iceland Stock Exchange merged, and Icelandic derivatives were introduced to the market in May 2007. Since the end of 2008, Icelandic derivatives are no longer offered.

Since September 2009, Nasdaq also offers trading in Norwegian single stock and index derivatives.

Today, all trading and clearing of options and futures within the Nasdaq Nordic market is fully integrated and conducted through NASDAQ OMX Stockholm AB and NASDAQ OMX Clearing AB respectively.

1.3.2 COMMODITIES

Nasdaq Commodities Europe dates back to 1991, when the Norwegian Parliament (Stortinget) resolved to deregulate the market for power trading by passing of a new energy act. As a consequence of the new legislation, Statnett Marked AS was established as a subsidiary to Statnett SF, which is the Norwegian transmission system operator (TSO). The company was set to operate the newly formed Norwegian power market.

In 1995, the financial market was established. Market participants could initially enter into transactions in futures contracts. Forward contracts were introduced in 1997.

In 1996, Norway and Sweden set up a common market for electricity and the Swedish TSO, Svenska Kraftnät, became a co-owner; the company was renamed Nord Pool ASA. Nord Pool ASA was the world's first multinational exchange for trading and clearing of financial power contracts. Finland was integrated into the Nordic power exchange area in 1998, and Denmark followed in 1999 and 2000.

Electricity derivatives contracts with cash settlement were introduced in 2001, and Nord Pool ASA was licensed as a regulated exchange in 2002. At the same time, the clearing business was demerged into a separate company, Nord Pool Clearing ASA, which became licensed as a clearing house. The physical market activities were then demerged into a separate company, Nord Pool Spot AS, co-owned by Nord Pool ASA and the four Nordic TSOs.

The Nord Pool market established itself as the world's largest and most efficient power market, offering unprecedented transparency and liquidity for market participants. It also helped develop other energy markets in Europe and worldwide.

Nord Pool ASA started listing European Union Allowances (EUAs) as standardized exchange contracts early 2005, thereby pioneering the exchange trading of carbon credits. Trading in project-based Carbon Emission Reduction units (CERs) was introduced in 2007, becoming the first exchange market for CERs.

In 2008, the NASDAQ OMX Group acquired Nord Pool Clearing ASA and Nord Pool Consulting AS from Nord Pool ASA. The acquired companies were later merged into NASDAQ OMX Stockholm AB, and Nord Pool ASA became part of the NASDAQ OMX Group in 2010. Nord Pool Spot AS remains separate from the group and is still in TSO ownership. The acquired companies form the division of the NASDAQ OMX Group which is now called Nasdaq Commodities.

PATENT
REEL: 037821 FRAME: 0042

Nasdaq Commodities and Nord Pool Spot AS were chosen by the Futures & Options Association (FOA) in 2008 to set up a spot and cash-settled derivative wholesale power market with a full range of clearing services for the UK.

In 2012, Nasdaq acquired NOS Clearing. NOS Clearing ASA, the leading clearing house for the freight market and a specialist clearing provider to the commodities markets, was integrated into Nasdaq Clearing in April 2014.

PATENT
REEL: 037821 FRAME: 0043

CHAPTER 2

MARKET PARTICIPANTS

Market participants are admitted to NASDAQ OMX Clearing AB as members of the clearing house. NASDAQ OMX Stockholm AB offers exchange membership for trading exchange-traded equity derivatives and fixed income products. NASDAQ OMX Oslo ASA offers exchange membership for trading commodities derivatives. Exchange members of NASDAQ OMX Stockholm AB can also access commodities products under the NASDAQ OMX Stockholm AB membership, through the link from that exchange to NASDAQ OMX Oslo ASA.

2.1 MEMBERS

A member, typically a bank or investment firm, can be an exchange member trading at the exchange and/or a clearing member with the clearing house. A non-clearing member needs to have a clearing agreement in place with a member of the clearing house (CCP member).

2.1.1 MEMBERSHIP TYPES

The following membership types have access to the clearing house, except the non-clearing member (NCM) that needs to have a clearing agreement in place with a CCP member.

- GENERAL CLEARING MEMBER (GCM)
  Clears on its own behalf and on behalf of clients and NCMs.

- DIRECT CLEARING MEMBER (DCM)
  Clears on its own behalf and on behalf of clients (not NCMs).

- CLEARING MEMBER COMMODITIES (CM)
  Clears on its own behalf and on behalf of clients (not NCMs).

- CLIENT REPRESENTATIVES COMMODITIES (CR)
  Clears on its own behalf and on behalf of Clearing Clients.

- NON CLEARING MEMBER (NCM)
  The NCM has an exchange membership agreement with NASDAQ OMX Stockholm AB or NASDAQ OMX Oslo ASA and clears via a GCM.

PATENT
REEL: 037821 FRAME: 0044

2.1.2 MEMBER AND CLIENT REQUIREMENTS

The minimum standards and requirements for each membership type and for direct pledging customers and clearing clients can be found in the relevant rules. Members must meet eligibility requirements regarding management, organization, technical setup and risk management routines. Moreover, members, direct pledging customers and clearing clients must also meet financial and legal requirements.

2.1.3 MEMBERSHIP MONITORING

The Nasdaq Clearing risk management department monitors the financial conditions of all participants on an ongoing basis and establishes specific risk limits for each participant. After membership approval, each participant agrees to provide updated financial information in accordance with the rules.

2.2 CLIENTS

Clients may, depending on the member's offering, choose to have or to not have a direct legal relationship with Nasdaq Clearing. Clients can be individually or collectively segregated to varying degrees.

For clients not wishing to be individually segregated, the following client categories are available:

- OMNIBUS CLIENT
- SINGLE CLIENT (AVAILABLE IN THE FINANCIALS MARKET)
- INDIRECT PLEDGING CUSTOMER (AVAILABLE IN THE FINANCIALS MARKET)

For clients that want individual segregation, the following categories are available:

- INDIVIDUAL CLIENT SEGREGATED ACCOUNT (ICA) CLIENT
- DIRECT PLEDGING CUSTOMER (AVAILABLE IN THE FINANCIALS MARKET)
- CLEARING CLIENT (AVAILABLE IN THE COMMODITIES MARKET)

For more information on the client account offering, please see Chapter 3.

PATENT
REEL: 037821 FRAME: 0045

CHAPTER 3

CLEARING MODEL

Using a single membership, members of Nasdaq Clearing can clear both exchange traded and OTC derivatives in equities, fixed income and commodities. This means increased capital efficiencies for members and clients, through offsets between all asset classes and streamlined settlement flows. This is key in the ambition to create legal and operational efficiency for clients, members and the clearing house.

Nasdaq Clearing offers several different solutions for house and client trading and clearing, including both agent and principal clearing. Omnibus accounts and individual client accounts are set up with segregation from house accounts as well as from other client accounts.

In the agent clearing model, the client of a CCP member has limited counterparty risk towards the member due to the direct relationship between the client and the clearing house.

Clients using the principal clearing model do not have a direct relationship with the clearing house. This implies that there is counterparty risk between the client and the member. Nasdaq Clearing always assumes counterparty risk between the buyer and the seller. But where principal clearing is used, the clearing house assumes the counterparty risk towards the member and not the client.

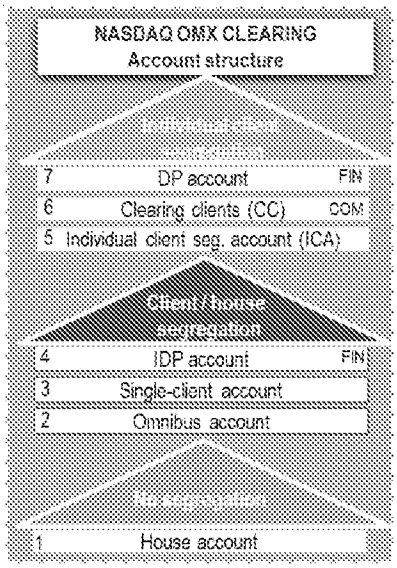
The clearing model and account structure is designed in accordance with the requirements that the regulators impose on central counterparties (EMIR), while also offering structures that are efficient from the perspectives of segregation, portability, operations and capital requirements.

3.1 A HARMONIZED CLEARING MODEL

Nasdaq Clearing has a harmonized clearing model and account structure for equities, fixed income and commodity derivatives products.

The figure below shows the harmonized account model.

Figure 1 - The harmonized account model of Nasdaq Clearing



PATENT
REEL: 037821 FRAME: 0046

Please note that there are additional technical account alternatives. Please see section 3.6 for more information.

3.2 ACCOUNT STRUCTURE

The matrix below presents an overview of the account structure. The account structure is EMIR compliant for both financial and commodities members.

	Available asset classes	Position Client by client segregation	Margin Cross margining and off-set within accounts	Default fund Member / Client responsible for contribution	Collateral Client / House Segregation	Collateral Client by client segregation	Settlement Client / House segregation	Liability Member , Client or Jointly	Agreements between client and NOMX	Portability
IDP account	All	Yes	Yes	Member	Yes	No	Yes	Jointly	Yes	Yes
Single client account	All	Yes	Yes	Member	Yes	No	Yes	Member	No	Yes
Omnibus account	All	No	Yes	Member	Yes	No	Yes	Member	No	Yes Basic
Segregated client	All	Yes	Yes	Member	Yes	No	Yes	Member	No	Yes

1) Executing member is jointly responsible for the over night risk

Figure 2 – Account structure overview

3.3 SEGREGATION

Nasdaq Clearing offers best-in-class segregation for clients that want limited risk towards members.

EMIR sets regulatory requirements on clearing houses to, at a minimum, segregate positions and collateral between the CCP and its members and also between members. The CCP should offer to segregate member positions and collateral from that of its clients (omnibus client segregation). Finally, the CCP should also offer to segregate one client's positions and collateral from that of another client (individual client segregation).

Nasdaq Clearing has a full range offering, both to CCP members and clients, in terms of segregation of positions, settlement and collateral.

Members and clients have the possibility to choose between basic segregation between members and clients (minimum level according to EMIR) and advanced account types where the counterparty risk is between the clearing house and client, including the option where collateral is posted directly to the clearing house by the client.

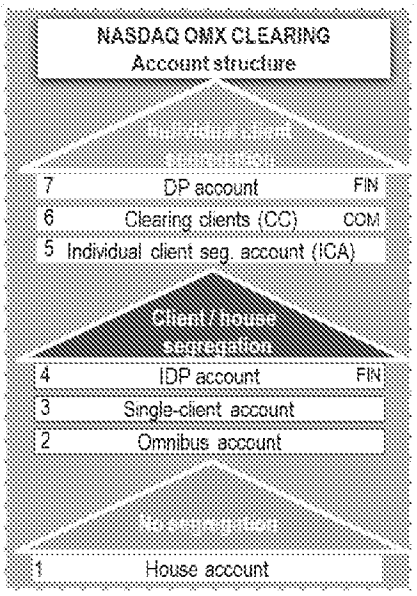
The model offers seven different account types, one for members' own positions, three where segregation is between member and clients and three where segregation is on a client by client level.

Settlement for client and house is also carried out independently and segregated from each other i.e. client and house settlement transactions are not comingled from a transaction point of view. For more information on cash settlement, please see section 5.1.

PATENT
REEL: 037821 FRAME: 0047

The figure below shows Nasdaq Clearing's EMIR compliant clearing and account model, from a segregation point of view. Position, margin requirements, collateral and cash settlement are recorded in separate records and maintained for respective account type offered (**Error! Reference source not found.**) but client variation margin and cash settlement transactions are aggregated with other client variation margin and cash settlement transactions to one client transaction per currency (**Error! Reference source not found.**).

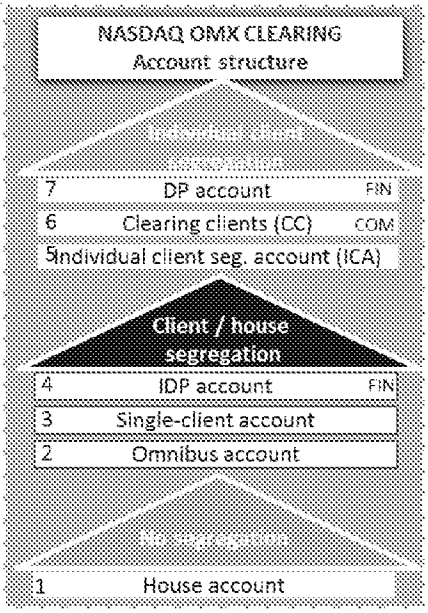
Figure 3 - Level of segregation – Clearing Records



Acct.	Position Level of segregation	Margin and Collateral Level of segregation	Cash Settlement Level of segregation
7	Client-by-client	Client-by-client	Client-by-client
6	Client-by-client	Client-by-client	Client-by-client
5	Client-by-client	Client-by-client	Client-by-client
4	Client-by-client	Client-by-client	Client-by-client
3	Client-by-client	Client-by-client	Client-by-client
2	Client / house	Client / house	Client / house
1	N/A	N/A	N/A

Cash settlement = **Premiums, fees , final cash settlement, variation margin (daily mark to market),**
Margin = **Initial margin and contingent variation margin**

Figure 4 - Level of segregation – Transaction flow



Acct.	Collateral (Margin) Level of segregation	Cash Settlement Level of segregation
7	Client-by-client	Client / house
6	Client-by-client	Client by client
5	Client-by-client	Client / house
4	Client / house	Client / house
3	Client / house	Client / house
2	Client / house	Client / house
1	N/A	N/A

PATENT
REEL: 037821 FRAME: 0048

3.4 PORTABILITY

Portability means the ability to transfer client positions and collateral from one member to another, in a situation where the first member has defaulted.

Nasdaq Clearing offers best-in-class portability which enables, as far as possible, the client to continue trading and clearing, via another member, without interruption and without having to put up new collateral.

In order to successfully and quickly port positions and collateral from a defaulting member to a back-up member, it is crucial that the clearing house is able to, in a very short timeframe, determine client obligations, market value of positions and value of posted collateral.

Nasdaq Clearing offers a number of alternatives with different levels of segregation and pre-defined portability arrangements. In other words, different levels of client protection are available in the event of a member defaulting.

There are a number of key factors to take into account when deciding on the model for a client. To choose a clearing account with individual client segregation will increase the likelihood of successful porting compared to a clearing account with client/house segregation. All rights and obligations are ported to the back-up member, partial porting is not possible, so a backup member has to be found that is willing to take on all obligations linked to an account, i.e. possibly including multiple clients.

Porting procedures are further described in Chapter 10.

3.4.1 BACK-UP MEMBER

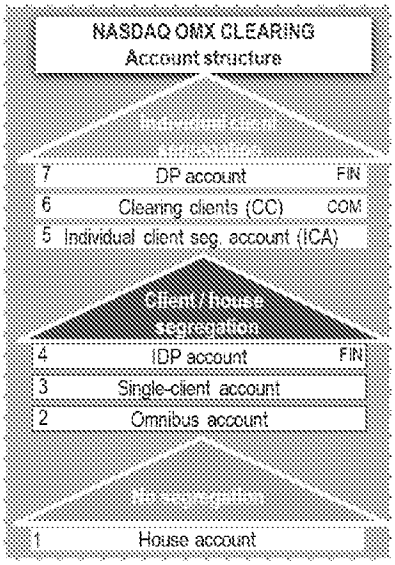
To have an agreement with a back-up member prior to the default is an important factor in increasing the likelihood of porting positions and collateral since there will be limited time to negotiate an agreement with a back-up member in a default situation.

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REEL: 037821 FRAME: 0049

3.5 CLEARING ACCOUNT MODEL

The model offers seven different clearing account types, one for members' own positions, three where the segregation is between house and clients and three where the segregation is at a client-by-client level. There are a number of technical and operational alternatives in each category and detailed specifications are presented in each section.

Figure 5 - The account types of the clearing account model



1. House: House accounts for members' own positions.
2. Omnibus: Several clients per clearing account, netting of client positions is possible. There is no legal relationship between clients and the clearing house.
3. Single-client: One client per clearing account, no netting of positions with other clearing accounts, for example used by NCMs. There is no legal relationship between the client and the clearing house.
4. Indirect Pledge (IDP): One client per clearing account, no netting of positions with other clearing accounts. The client has a direct legal relationship with Nasdaq Clearing but the CCP member posts collateral to the clearing house. Only indirect pledging customers can use this account type.
5. ICA: One client per clearing account, no netting of positions with other clearing accounts. There is no legal relationship between the client and the clearing house and the member posts collateral on a segregated client custody account.
6. CC: One clearing client per clearing account, no netting of positions with other clearing accounts. The clearing client has a direct legal relationship with Nasdaq Clearing and the client posts collateral directly towards the clearing house. Used in the Commodities market.
7. DP: One client per clearing account, no netting of positions with other clearing accounts. The client has a direct legal relationship with Nasdaq Clearing and posts collateral directly or through a clearing administrator towards the clearing house, without passing through the member's books. Only direct pledging customers can use this account type.

PATENT
REEL: 037821 FRAME: 0050

3.5.1 HOUSE ACCOUNT

A house clearing account is an integrated trading and clearing account for the member's trading and clearing on its own behalf. The member may not use the house clearing account for trading and clearing of transactions in respect of entities within the same group of companies as the member.

There are a number of technical and operational options for members e.g.:

- One or several clearing accounts for administrative purposes
- Cross margining between all or a selection of house clearing accounts
- Automated position netting within one clearing account

3.5.2 CLIENT ACCOUNTS – CLIENT/HOUSE SEGREGATION

In this category, Nasdaq Clearing offers three different alternatives for members and clients; omnibus, single-client and indirect pledge accounts. The purpose is to ease administration, reduce operational risk and offer basic segregation to support porting in the event that a member defaults. Positions, collateral and settlement are segregated between the member and its clients. For further administrative efficiency there is an option to connect several sub-accounts (portfolios) to each clearing account.

- OMNIBUS ACCOUNT

  The omnibus account is an integrated trading and clearing account for the aggregated positions of several clients. Members can choose to set up several omnibus accounts for administrative purposes. The CCP member is fully liable for all contract obligations.

  Omnibus clients do not have a legal relationship with the clearing house.

  Positions and collateral are segregated between house and client but not client-by-client.

  No automated position netting is performed for this account. If netting is required, the member is responsible for initiating netting within the account.

  Cross margining and offsets are calculated within each account.

  The CCP member contributes to the default fund.

  Cash Settlement transactions are recorded on the account before being netted with other client cash settlement amounts.

  If the CCP member defaults, positions can be ported to a backup member without the involvement of the bankcruptcy administrator, provided that all clients in the omnibus account have appointed the same back-up member.

- SINGLE-CLIENT ACCOUNT

  The single-client account is an integrated trading and clearing account for one individual client, e.g. a non-clearing member. There is only one client for each account. There is no netting of positions between accounts.

  The client does not have a legal relationship with the clearing house.

  The CCP member is fully liable for all contract obligations.

  Positions are segregated client-by-client. Collateral is segregated between house and clients but not client-by-client.

  Cross margining and offsets are calculated within a single-client account, but not between accounts.

  The CCP member contributes to the default fund.

PATENT
REEL: 037821 FRAME: 0051

Cash Settlement transactions are recorded on the account before being netted with other client cash settlement amounts.

- INDIRECT PLEDGE (IDP) ACCOUNT – EQUITY AND FIXED INCOME ONLY

  The indirect pledge account is an integrated trading and clearing account with common functions for trading and clearing that cannot be connected to other clearing accounts.

  There is a legal tri-party agreement between the IDP customer, a CCP member and Nasdaq Clearing. The CCP member and the IDP customer are jointly liable for all obligations towards the clearing house.

  Positions are segregated client-by-client. Collateral is segregated between house and clients but not client-by-client.

  Cross margining and offsets are calculated within an IDP clearing account but not between accounts.

  The CCP member contributes to the default fund.

  Cash Settlement transactions are recorded on the account before being netted with other client cash settlement amounts.

3.5.3 INDIVIDUAL CLIENT SEGREGATION

In this category, Nasdaq Clearing offers three different alternatives for members and clients; individual client segregated accounts, clearing clients and direct pledge accounts. The purpose is to offer best-in-class segregation and porting functionality in the event of the member defaulting and in addition ease administration and reduce operational risk. Positions and collateral are fully segregated, on a client-by-client basis. For further administrative efficiency, there is an option to connect several sub-accounts to each clearing account. This means that Nasdaq Clearing is able to support members with position, margin and settlement calculations on the clients' client level, i.e. indirect clearing.

These account types have been designed to increase the likelihood of being able to port the client positions and collateral in the event of the default of the CCP member. In order to achieve this, the client is recommended to have prior arrangements with a back-up member.

- INDIVIDUAL CLIENT SEGREGATED ACCOUNT (ICA)

  The individual client segregated account is an integrated trading and clearing account for one individual client where positions and collateral are fully segregated in order to offer portability arrangements. Typically, NCMs and larger institutions use this clearing account.

  There is no direct legal relationship between the client and the clearing house.

  The CCP member is fully liable for all contract obligations.

  The CCP member is required to open a specific custody accont with the clearing house in relation to each ICA client. The account is in the name of the member. The member is responsible for posting collateral to this account.

  Positions and collateral are segregated client-by-client.

  Cross margining and offsets are calculated within an individual account but not with other clearing accounts.

  The CCP member contributes to the default fund.

  Cash Settlement transactions are recorded on the account before being netted with other client cash settlement amounts.

  If the CCP member defaults, positions and collateral can be ported to a backup member without the involvement of the bankcruptcy administrator.

PATENT
REEL: 037821 FRAME: 0052

CLEARING CLIENTS (CC) – COMMODITIES DERIVATIVES CLEARING ONLY

A clearing client (CC) is an entity that has been approved by Nasdaq Clearing to clear its own transactions, that have been entered by a client representative. The clearing client is account holder of the clearing account. A clearing client is not a member of the exchange, but trades through a client representative. The clearing client is authorized to handle its own settlement and post its own collateral, but can also agree to outsource this to the client representative.

There is a legal tri-party agreement between the clearing client, a client representative and Nasdaq Clearing.

Clearing clients and client representatives are jointly liable towards the clearing house.

Positions and collateral are segregated on a client-by-client level.

Cross margining and offsets are calculated within a clearing client account but not between different accounts.

Collateral is posted by clearing clients on a specific clearing client's custody account. The account is in the name of the client.

Clearing clients are responsible for contributing to the default fund, directly or via a third party.

If the client representative defaults, positions can be ported to a backup member without the involvement of the bankcruptcy administrator. Collateral does not need to be ported, as it is posted directly by the client and held on the client's own custody account.

DIRECT PLEDGE (DP) - FINANCIALS MARKET

The direct pledge account type can be used by clients that trade through a number of different executing members, but wish to consolidate their positions into one single clearing account with one CCP member to benefit from netting. Typically, large institutions trading with several banks or brokerage firms use this account structure.

The DP customer has a direct legal relationship with Nasdaq Clearing. There is a tri-party agreement between the DP customer, the CCP member and the clearing house.

The DP customer is fully liable towards the clearing house and jointly liable with the executing member (holds trading account) for the overnight risk (until sufficient collateral has been posted to the clearing house). The CCP member's liability for the client's contract obligations is limited to payment of fees.

Positions and collateral is segregated client-by-client.

Cross margining and offsets are calculated within a direct pledge account but not between different accounts.

Collateral is posted by the CCP member, on behalf of direct pledging customers, or directly by the direct pledging customer, on a specific direct pledging customer's custody account. The account is in the name of the customer.

DP customers are responsible for contributing to the default fund, directly or via a third party.

Cash Settlement transactions are recorded on the account before being netted with other client cash settlement amounts.

If the CCP member defaults, positions can be ported to a backup member without the involvement of the bankcruptcy administrator. Collateral does not need to be ported, as it is posted directly by the direct pledging customer and held on the customer's own custody account.

PATENT
REEL: 037821 FRAME: 0053

3.6 TECHNICAL ACCOUNTS

In addition to the accounts described above, further technical accounts are available to facilitate the members' and clients' clearing arrangements. Any additional technical accounts are set up within the relevant clearing account so as to meet segregation requirements under the Clearing Rules and EMIR.

- DAY ACCOUNT

  A day account is a trading account for the temporary registration of transactions. A transaction is registred on a CCP member's day account unless another account is indicated by the member. These transactions shall, as soon as possible, be transferred to the proper account. Any contract registred on the day account when the clearing system closes is automatically transferred to the member's interim account or another compilation account stated by the member. The account does not have automatic position netting.

- INTERIM ACCOUNT

  An interim account is an integrated trading and clearing account for the temporary registration of transactions. The account does not have automatic position netting.

- SUB-ACCOUNTS

  To reduce operational risk and ease the post-trade administration, it is possible to connect sub-accounts to a client clearing account. A sub-account is an account opened by the CCP member for administrative purposes only. It is possible to trade directly on the sub-account and the position will remain on that account. On the sub-account, the member will benefit from having easily accessible historic trade information. Expiration and all types of post-trade flows are calculated on the sub-account for informational purposes only.

- ALLOCATION ACCOUNT (ONLY APPLICABLE FOR FINANCIALS MEMBERS)

  An allocation account is a trading-only account that propagates the position to a specified clearing account with a CCP member. Several allocation accounts can be linked to one single clearing account. To open an allocation account and link it to a clearing account with another CCP member, the executing and CCP members must enter into an allocation agreement. The executing member is fully liable for intraday positions on allocation accounts.

- LIQUIDITY PROVIDER ACCOUNTS (ONLY APPLICABLE FOR FINANCIALS MEMBERS)

  For clients acting as liquidity providers, one or several liquidity provider accounts are set up under a liquidity provider member ID designated for this client. A client must have the right to use sponsored access in order to be a liquidity provider.

PATENT
REEL: 037821 FRAME: 0054

CHAPTER 4

PRODUCTS

Nasdaq offers marketplace and clearing services for a broad range of products including derivatives on stocks, indices, fixed income and commodity instruments. The products are specified below. For additional information regarding each product, see chapter 3 (i) and (ii), Contract specifications in the Rules or the web site.

4.1 EQUITY

Nasdaq offers exchange-traded forwards, futures and options on single Swedish, Norwegian, Finnish and Danish stocks as well as options and futures on the OMXS30 index (which consists of the 30 most traded Swedish stocks), the OMXC20 Cap index (the 20 most traded Danish stocks), the VINX30 index (the 30 most traded Nordic stocks) and the OMXO20 index (the 20 most traded Norwegian stocks). Nasdaq also offers futures on the OMXSB (Stockholm Benchmark index), Weekly Options on the OMXS30 index, on the most liquid Swedish single stocks as well as options on ETFs and binary options (OverUnder) on the OMXS30 index and several liquid Swedish single stocks. Nasdaq also offers listed dividend futures on the OMXS30 index.

Nasdaq Clearing clears all trades in the products described above, as well as OTC trades done outside the regulated market and reported to the clearing house for clearing.

4.1.1 ON-REQUEST MARKET (OR)

The "on request" market provides trading in forwards and options on single Finnish stocks. Within this market, not all stocks have automatic generation of new series with new strike prices, but are instead generated "on-request" by members. The market allows members to request listing of forwards and options on most Finnish stocks on an "on request" basis. This method allows members to trade exchange-traded series on Finnish stocks with the possibility to set strike price and maturity.

4.2 FLEXIBLE DERIVATIVES

Market participants can clear a wide variety of OTC-traded derivatives differing on one or more terms or conditions from exchange listed instruments (regarding underlying security, exercise price, expiration day or type of contract). This service is called flexible contracts. It allows investors to take advantage of derivatives, even if the portfolio requires features that the standardized market cannot offer. Investors will still have the advantages of clearing, such as corporate action surveillance, recalculation handling, cross margins between OTC and standardized contracts—as well as post-trade information in Nasdaq's clearing system. Flexible contracts combine the flexibility and anonymity of the OTC market with the security and efficiency of the standardized market. Thus, the investor can design contracts which fit their investment strategies and goals.

Flexible contracts are offered on the following:

- Forwards and options on single Swedish, Finnish, Danish and Norwegian stocks
- Futures and options on a variety of tradable indices, such as OMXS30, OMXO20, OMXC20CAP and VINX30, the 30 most traded stocks in Sweden, Finland, Denmark, Norway and Iceland
- Forwards and options on custom-made indices
- Options on fixed income forwards

PATENT
REEL: 037821 FRAME: 0055

Other types of instruments and contract bases may also be considered as flexible derivatives upon request. However, only customized financial instruments with an underlying security that has been subject to risk analysis (and formally confirmed and approved by Nasdaq) are eligible for clearing.

4.3 FIXED INCOME

Fixed income derivatives are traded and cleared in a unique market structure. Trading is bilaterally negotiated between the buyer and seller and then reported to Nasdaq Clearing, which then becomes the counterparty to both the buyer and seller. This structure combines the advantage of a cleared market with the flexibility and the secured liquidity of a market maker driven market. Nasdaq provides a trade matching and clearing service for a variety of Nordic short term and long term interest rate derivatives and repo transactions.

Nasdaq supports the market with an integrated clearing solution for interest rate swaps and other related OTC derivatives, providing clients and members with a capital efficient service that provides risk off-set with other cleared interest rate derivatives.

4.4 COMMODITIES

Nasdaq offers exchange traded and OTC cleared commodity derivatives. The offerings comprise Nordic, continental European and UK power derivatives as well as EUA (European Union Allowance), CER (Certified Emission Reductions) instruments and electricity certificates. Nasdaq also offers UK Natural Gas futures. The power derivatives are base and peak load futures, options, and electricity price area differential contracts (EPAD). The emissions contracts are short and long term futures and options. Nasdaq Clearing provides clearing of the these instruments. The offering has been expanded to include freight, iron ore, fuel oil and seafood (listed on Fish Pool ASA) following the integration of NOS Clearing into Nasdaq Commodities in April 2014.

PATENT
REEL: 037821 FRAME: 0056

CHAPTER 5

CLEARING OPERATIONS

Nasdaq Clearing carries out expiration procedures, cash settlement and physical settlement that arise from contractual responsibilities. These procedures are described below.

5.1 DAILY CASH SETTLEMENT

The daily cash settlement is the cash flow covering all payments that need to be settled in full each business day. The daily cash settlement corresponds to the amount to cover for a participant's change in variation margin (mark-to-market settlement) for futures style products and to cover premiums, fees and other cash settlement except those directly related to physical settlement. Daily cash settlements are always settled in the respective instrument currency.

Daily cash settlement has several components:

- Variation margin – the mark-to-market value
- Premiums – premiums for options
- Fees – exchange and clearing fees

Cash settlement obligations with respect to contracts cleared with Nasdaq Clearing are settled in DKK, EUR, GBP, NOK, SEK and USD and are all settled through the collateral management system's cash optimization feature, see Chapter 6 for more information.

5.2 PHYSICAL SETTLEMENT

As a central counterparty, Nasdaq Clearing guarantees all deliveries, independent of the original counterparty's delivery or payment ability. However, the clearing house does not undertake the responsibility to fulfill the transaction on the original settlement day if the original counterparty cannot fulfill its obligation. In that case, Nasdaq Clearing has the right to buy securities and charge a delay fee for failed delivery or take other steps to complete the delivery, in accordance with the rules.

5.2.1 SHARES

Delivery of shares is made on the second business day after expiration or exercise through Nasdaq Clearing's accounts in the respective CSD as listed below. The principle "delivery versus payment" (DvP) applies for all deliveries of underlying securities due to expiration or exercise. CCP members having a delivery undertaking as a result of exercise or expiration must ensure that sufficient delivery capacity exists with respect to the relevant deliverable instrument.

- Swedish shares – Euroclear Sweden
- Finnish shares – Euroclear Finland
- Danish shares – VP Securities Denmark
- Norwegian shares – VPS Norway

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REEL: 037821 FRAME: 0057

5.2.2 FIXED INCOME

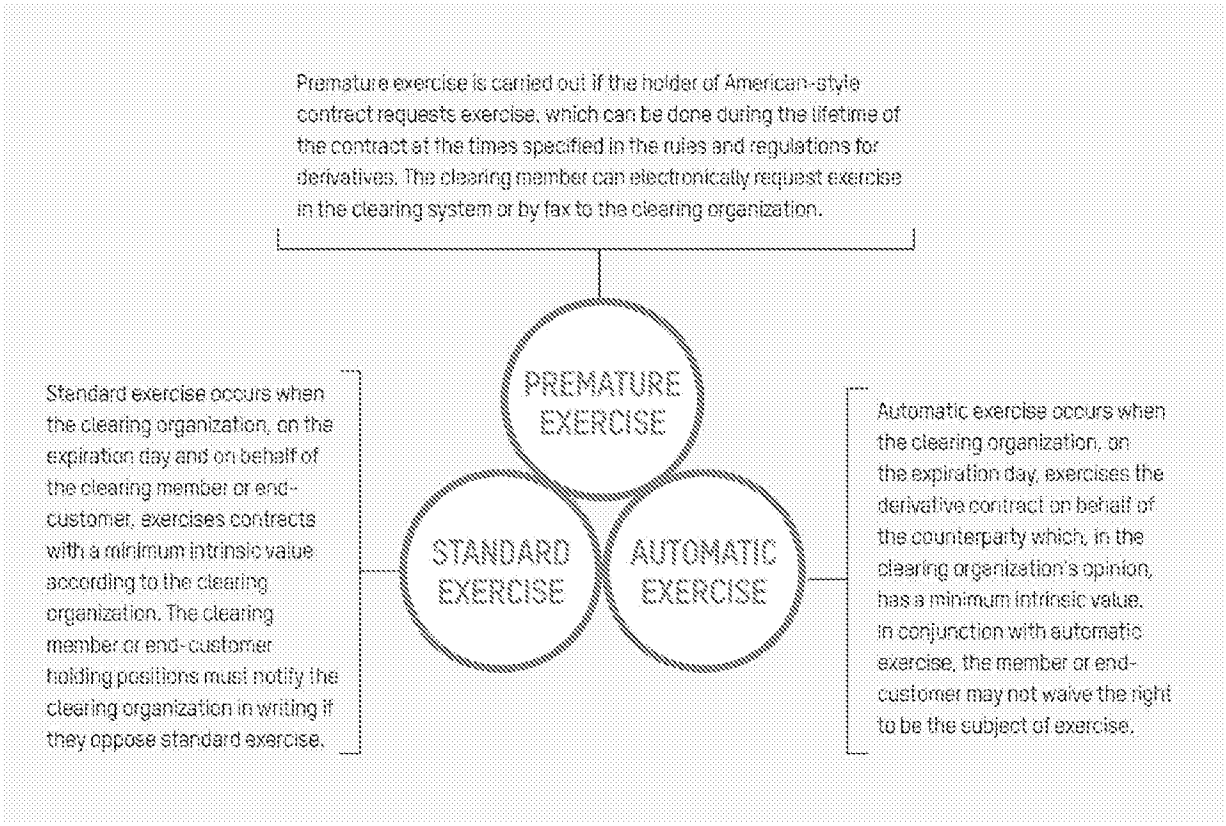
Delivery of Swedish fixed income instruments takes place in Euroclear Sweden and delivery of Danish fixed income instruments takes place in VP Securities Denmark. On the expiration day, Nasdaq Clearing provides the CCP member with settlement instructions on what is to be delivered in one or several instruments included in a contract base. Settlement of fixed income products is netted to blocks no larger than SEK/DKK 500 million in nominal value.

5.2.3 ALLOWANCES AND ELECTRICITY CERTIFICATES

Delivery of emission allowances and electricity certificates related to the exercise of DS futures and futures contracts take place over Nasdaq Clearing's accounts with the relevant registries. Open positions at the end of the final trading day will be subject to physical settlement.

5.3 EXPIRATION AND EXERCISE

Nasdaq Clearing offers clearing of American, Asian and European style options. Equity options involve delivery of shares, while index options are cash settled. European style Commodity options involve delivery of the underlying future, while Asian style Commodity options are cash settled. This section only reflects the expiration process for options. Options may be exercised through premature, standard, or automatic exercise. Premature and standard exercise is normally applied where American options are involved and automatic exercise when European and Asian options are involved.



PATENT
REEL: 037821 FRAME: 0058

CHAPTER 6

COLLATERAL MANAGEMENT

To fulfil its obligations to Nasdaq Clearing, each counterparty is required to post sufficient collateral to cover its margin requirement on a daily basis and, if deemed necessary, intra-day. Margin requirements are calculated based on a specific counterparty's trades and positions, and are determined by risk models specifically designed by Nasdaq Clearing's Risk Management department, to avoid the risk of the clearing house incurring a loss in a default.

6.1 OVERVIEW

The Collateral Management Service (CMS) is the service managing collateral and payments for clearing on Nasdaq Financial and Commodities derivatives markets. The service manages both cash and non-cash collateral for covering margin requirements as well as cash transactions for daily cash settlement. The collateral flows are managed in an advanced collateral optimization process taking into account both cash and non-cash collateral to optimize each participant's use of collateral and to minimize the number of cash transactions to and from the service.

Participants hold custody accounts with Nasdaq Clearing for use with the service and all custody accounts in the service can hold both cash and non-cash collateral integrated on the same account.

Cash and securities collateral will be held as:

- Cash – title transfer reflected on the participant's custody account
- Securities – pledged on participant's custody accounts

Collateral posted to Nasdaq Clearing can be segregated by

- House/Client
- or on a client-by-client basis,

based on the participant's account setup.

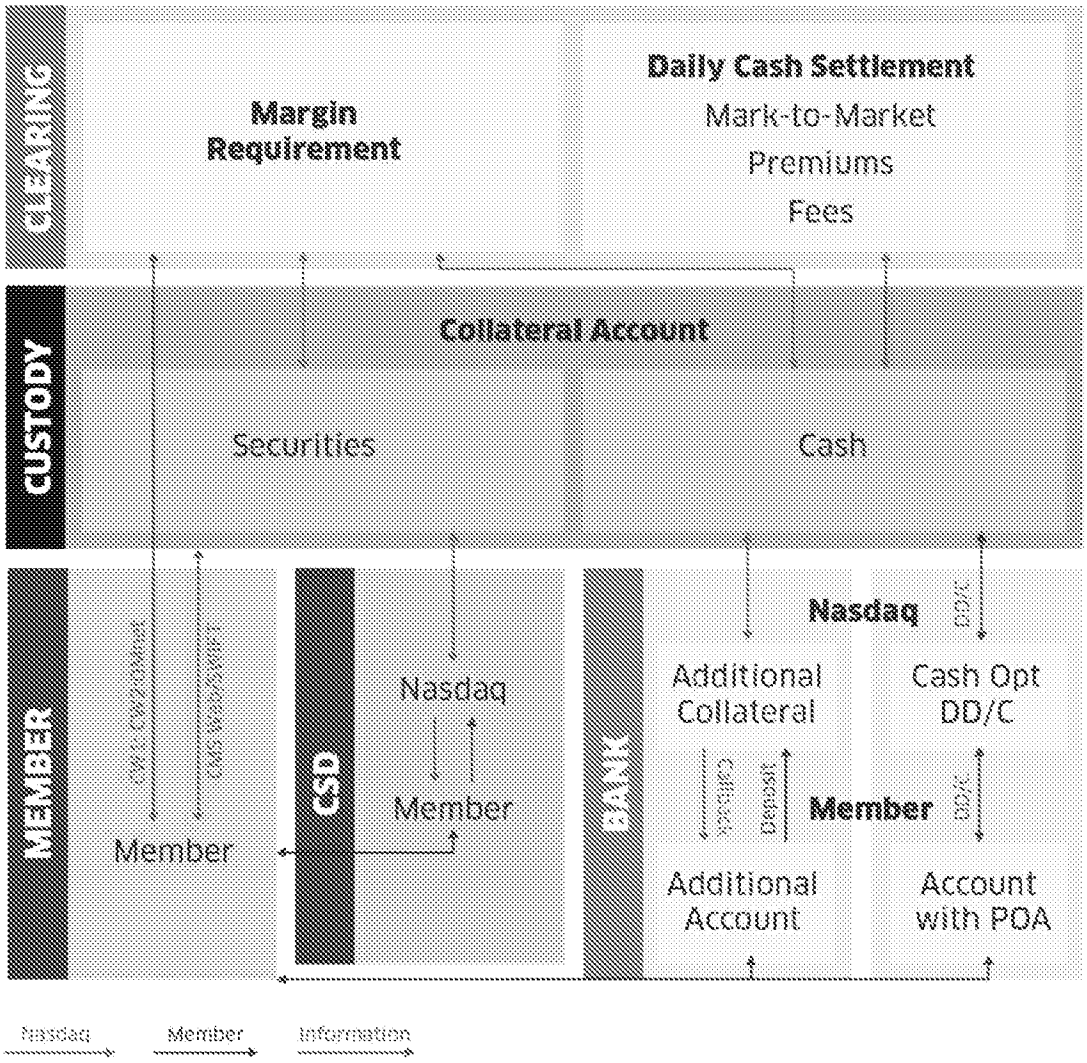
The process of valuation and evaluation of collateral is fully automated and is done per segregation category (e.g. for house, client and individual clients respectively). Posted collateral is valued daily using market prices taking into account applicable haircuts and pending transactions, and is then evaluated to make sure the collateral value is sufficient to cover the participant's margin requirement(s). In the case of a deficit a direct debit transaction is executed to cover the shortage and in the case of a surplus a credit instruction is automatically executed (subject to settings on each account).

Participants must hold bank accounts in Nasdaq's payment system in each applicable currency for managing cash transfers to and from the service. With use of the cash optimization feature and the payment system the flow of cash collateral is fully automated.

To further control the flow of collateral, participants can also instruct collateral transactions outside the automated flow. Posting of supplementary cash collateral to a custody account is achieved by depositing cash to specified account in the payment system. Posting securities to a custody account is done through one of the CSDs/ICSDs connected to the collateral management service. Participants do not need to be a direct member of a CSD or ICSD, but can use a settlement agent for executing securities transactions.

PATENT
REEL: 037821 FRAME: 0059

Figure 6 - Overview of the Collateral Management Service



6.2 COLLATERAL

Collateral refer to assets posted to Nasdaq for the purpose of covering margin requirements (cash collateral will also be used to cover daily cash settlement requirements). Participants can post both cash and non-cash assets as collateral. All collateral is subject to eligibility criteria and discounting (haircuts) according to the from time to time applicable collateral list. To fulfil its obligations each participant is required to hold sufficient collateral with Nasdaq to cover its margin requirement(s).

Cash and securities collateral are held as:

- Cash – title transfer reflected on the participant's custody account
- Securities – pledged on the participant's custody account

PATENT
REEL: 037821 FRAME: 0060

6.2.1 ELIGIBLE COLLATERAL

Eligible collateral is found in the rules and regulations of the respective market. For the Nasdaq Financial Markets, the collateral list can be found under the clearing rules appendices section (Appendix 14) of the Clearing Rules of Nasdaq Derivatives Market . For Nasdaq Commodities, the collateral list can be found under the clearing appendices section (Appendix 10) of the Clearing Rules of Nasdaq Commodities .

The collateral list includes general conditions for eligible collateral and principles regarding valuation, concentration limits, haircuts etc.

6.2.2 COLLATERAL VALUATION

Collateral held on custody accounts in the collateral management service are continuously valued.

The prices used for valuation are retrieved from an external price vendor. Securities posted as collateral are valued using the previous business day's prices. For shares and other securities traded on markets with a market close before 18.30 CET, the end of day price is used. Securities traded on markets with a market close after 18.30 CET are valued using a price taken from the price vendor at 18.30 CET. If a price for the previous business day is not available, e.g. due to a bank holiday, the latest available price is used. In case of a corporate action event that will have an impact on the price of a security, the valuation price is adjusted accordingly after closing on the day before the ex-date.

European Union Allowances (EUA) and El-Certs posted as collateral (pre-delivered assets) are valued using the previous business day's price for the nearest futures/forward contract.

The prices retrieved at market close (or 18:30 CET where applicable) are used for valuation of collateral instruments during the following business day including end-of-day valuation, intraday valuations and intraday margin calls.

6.3 CASH OPTIMIZATION

The collateral management service combines payments in respect of cash collateral and daily cash settlement into one optimized flow. For a specific custody account this is done using the following principles:

- Cash collateral on the account is used to cover daily cash settlement requirements (per currency)
- Positive daily cash settlement is recorded on the account to cover margin requirement (per currency)
- Direct debit instructions are created for the account if
  - a daily cash settlement requirement still remains after subtracting cash collateral
  - there is a total collateral deficit on the account in the base currency
- Credit instructions are created for the account (with same day value) if there is a total collateral surplus in the base currency after the daily cash settlement is finalized – the credit instructions can include both automatic cash collateral call backs and positive cash settlement

6.4 DAILY CYCLE

The daily cycle, illustrated in the figure below, provides an overview of the daily events and when they occur.

At 19:25 CET the end-of-day clearing process, including calculations of daily cash settlement and margin requirements starts. The result of the calculations are available to participants through Clearing Workstation (CW1 and CW2), the OMnet API and on CMS Web at approximately 21:30 CET. Clearing reports are then produced and are available to participants by 07:00 CET on the following day.

The final calculation for cash optimization is run at 09:30 CET. This is the deadline for manually altering collateral positions before direct debit instructions are sent.

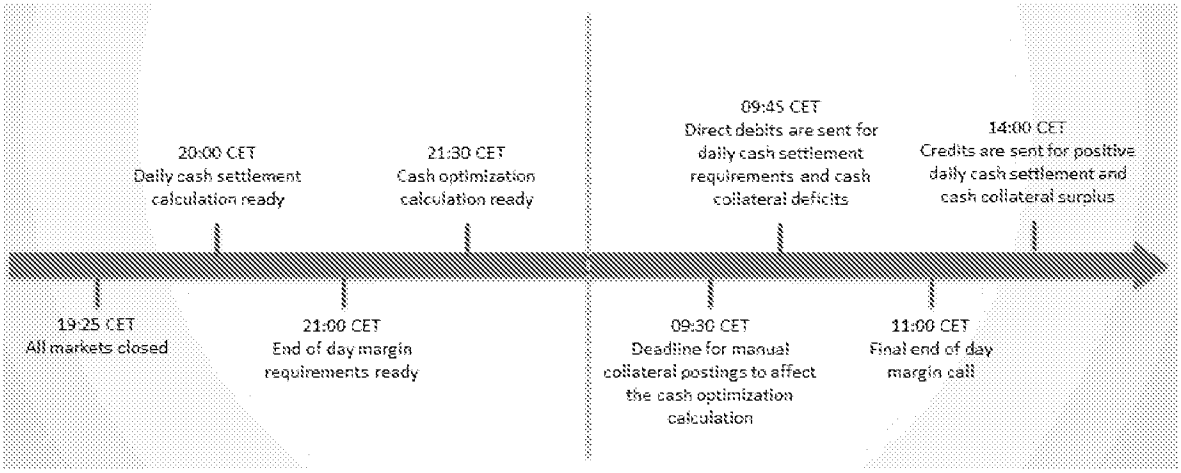
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REEL: 037821 FRAME: 0061

Direct debit payment instructions are sent at 09:45 CET to the participant's bank account. The participant must ensure that the necessary balance is available on the account for the direct debit. If the direct debit fails, any call backs of collateral will be stopped.

At 11:00 CET the end-of-day margin requirement is evaluated against the participant's collateral value.

At 14:00 CET, credit payment instructions are sent to the participant's bank account. Any direct debit instruction sent to the participant in the morning needs to be completed before any credit instructions (e.g. cash call backs) are executed.

Figure 7 - Daily Cycle



PATENT
REEL: 037821 FRAME: 0062

CHAPTER 7

PAYMENT SYSTEM

Cash transactions created in the collateral management system through its cash optimization feature are executed in Nasdaq Clearing's payment system. The payments system utilizes direct debit instructions and credit instructions to automate cash flows and to enable full straight through processing of cash transactions.

To enable automated payments between the participants and the clearing house through the payment system each participant opens bank account(s) with one or more settlement banks approved by Nasdaq Clearing. Bank accounts will need to be set up for each eligible currency in which the participant is active.

In order for Nasdaq to be able to debit the participant's account(s), the participant authorizes (i) Nasdaq Clearing to issue payment instructions, and (ii) the relevant settlement bank(s) to debit the participant's account(s) in accordance with such instructions. Such authorizations are obtained for each bank account by the following arrangements:

- under the Clearing Rules (or alternatively under a separate written and signed mandate), each participant authorizes Nasdaq Clearing to issue instructions to debit the participant's bank account(s), and
- by issuing a power of attorney in favour of the settlement bank, the participant authorizes the settlement bank to debit the participant's bank account(s) in accordance with Nasdaq Clearing's instructions.

Payments are executed on fixed points in time during the collateral management service's daily cycle as described above.

7.1 APPROVED SETTLEMENT BANKS

All payments in the payment system go through accounts with one of Nasdaq Clearing's approved settlement banks. The current list of approved settlement banks is available at Nasdaq Clearing's website[1].

Participants are required to hold a bank account with an approved settlement bank for each currency they settle in and different banks may be engaged for each currency. For each bank account, the participant needs to complete a power of attorney with the settlement bank.

POWER OF ATTORNEY

Clearing participants must sign a power of attorney with its settlement bank for each bank account used for daily cash settlement and collateral. The power of attorney is an agreement between the clearing participant and the settlement bank and gives the settlement bank the right to debit the participant's bank account on behalf of Nasdaq Clearing.

7.2 CONCENTRATION BANKS

A concentration bank acts as an intermediary between the approved settlement banks, i.e. exchange of payments are performed at the concentration bank between the approved settlement banks.

For payments in SEK, DKK, EUR and GBP; the Swedish Riksbank, the Danish Nationalbank, the Bank of Finland and the Bank of England respectively are engaged as concentration banks. For other currencies, a commercial bank is engaged as concentration bank.

[1] http://www.nasdaqomx.com/europeanclearing/settlement/approved-settlement-banks

PATENT
REEL: 037821 FRAME: 0063

CHAPTER 8

RULES AND REGULATIONS

The clearing activities of Nasdaq Derivatives Markets and Nasdaq Commodities are organized within NASDAQ OMX Clearing AB, a private limited company incorporated in Sweden and subject to Swedish company law.

Nasdaq Clearing is authorized by Finansinspektionen, the Swedish Financial Supervisory Authority, to provide clearing services under EMIR. Finansinspektionen is also the competent authority under EMIR and supervises the clearing house.

8.1 LEGAL FRAMEWORK

In Sweden, clearing is primarily governed by the following acts:

- Regulation (EU) No 648/2012 of the European Parliament and of the Council of 4 July 2012 on OTC derivatives, central counterparties and trade repositories (EMIR)
- Securities Market Act (2007:528)
- Systems for the Settlement of Obligations on the Financial Market Act (1999:1309)
- Financial Instruments Trading Act (1991:980)
- Rights of Priority Act (1970:979)
- Swedish Bankruptcy Act (1987:672)
- Financial Instruments Accounts Act (1998:1479)

In addition to the above-mentioned acts and Norwegian legislation applicable in respect of the Oslo Branch of the Company, NASDAQ OMX Clearing AB has issued Rules applicable to its clearing activities in Nasdaq derivatives markets and Nasdaq commodities market.

The Rules, together with the membership agreements, constitute the contractual framework governing the relationship between NASDAQ OMX Clearing AB and its members. The Rules become binding for members through the execution of the member agreement.

The governing law for the contractual relationships between NASDAQ OMX Clearing AB and the respective member is:

- Swedish law (for Nasdaq derivatives markets); and
- Norwegian law (for Nasdaq commodities market).

8.2 THE LEGAL STATUS OF NASDAQ OMX CLEARING AB

As noted above, Nasdaq Clearing is authorized by Finansinspektionen to provide clearing services under EMIR. Finansinspektionen is also the competent authority under EMIR and supervises the clearing house.

The clearing system has been approved by Finansinspektionen as a settlement system according to Systems for the Settlement of Obligations on the Financial Market Act and as such notified to the European Securities and Markets Authority (ESMA). The Norwegian Financial Supervisory Authority has also approved the clearing system under corresponding Norwegian legislation.

NASDAQ OMX Clearing AB has arrangements in place with relevant Central Securities Depositories in accordance with applicable laws and regulations.

PATENT
REEL: 037821 FRAME: 0064

8.3 RULES OF NASDAQ OMX CLEARING AB

Since today's financial markets display an increasing rate of innovation, the rules and regulations of any financial institution must be both comprehensive and easy to revise and amend at regular intervals. These qualities are inherent in the Rules of NASDAQ OMX Clearing AB, thus providing the market participants with fully up-to-date comprehensive legal documentation.

The Rules of NASDAQ OMX Clearing AB can be found on the following webpages:

- Nasdaq financial derivatives market:
  - http://www.nasdaqomx.com/listing/europe/rulesregulations
- Nasdaq commodities market:
  - http://www.nasdaqomx.com/commodities/marketaccess/legalframework

PATENT
REEL: 037821 FRAME: 0065

CHAPTER 9

COUNTERPARTY RISK MANAGEMENT

Nasdaq Clearing handles traditional business risks, as well as specific risks that are unique to the derivative clearing services it provides. The most noteworthy of these risks, with respect to the risk of loss, is counterparty default, the risk that one or several market participants will default on their obligations to the clearing organization.

The ability of Nasdaq Clearing to manage overall counterparty risk is dependent upon several factors, including:



Nasdaq Clearing relies on a multi-asset risk system, Genium Risk, and customized margin methodologies per individual asset class. The margin calculation determines the appropriate amount of required collateral to compensate for the counterparty risk it assumes in its capacity as a clearing organization. The validity of the margin methodologies is supported by regular back testing, sensitivity testing and validation.

Nasdaq Clearing also relies on a proprietary capital-at-risk calculation model and system (CCaR) to serve as the main driver in establishing an appropriate level of default fund and overall clearing capital. CCaR generates implied "loss given default" calculations based on extreme stress counterparty default assumptions. These are well defined, extreme stress, risk parameter assumptions applicable to an extensive range of market price movement scenarios along with well-defined counterparty default assumptions. (See Chapter 11 for more details on margin methodologies and Chapter 12 for more details on CCaR).

PATENT
REEL: 037821 FRAME: 0066

9.1 COUNTERPARTY RISK

Counterparty risk is the risk that one party in a transaction will not be able to fulfill its obligations. In return for collateral, the clearing organization assumes the obligations under each derivative contract that has been accepted, thus minimizing the counterparty risk. Nasdaq Clearing therefore enters as counterparty for both the buyer and the seller.

Nasdaq Clearing's collateral requirements are calculated based on the specific counterparty's clearing positions. The collateral requirements are determined by risk models used to calculate an individual counterparty's daily margin requirements and intraday margin calculations. The risk models and methodologies applied within Nasdaq have been specifically designed by the Clearing Risk Management department to address near worst-case scenarios.

Nasdaq Clearing always acts as seller to the buyer and as buyer to the seller which is why its portfolio is perfectly matched. Market risk, which is defined as the risk of loss from fluctuations in market price, is maintained at zero unless a counterparty defaults on its obligations or if operational errors occur that affect the balanced position of Nasdaq Clearing. If market risk occurs because of an operational error, the internal operational procedure is to close down the position immediately to minimize the potential market risk. Counterparty default events are managed by the Nasdaq Clearing Default Committee. Default management is covered in detail in Chapter 10.

9.2 CLEARING RISK MANAGEMENT DEPARTMENT

The Clearing Risk Management department within Nasdaq Clearing is primarily responsible for managing counterparty risks. This is accomplished through a comprehensive counterparty risk management framework made up of policies, procedures, standards and resources. These resources are human, informational and technological. These resources and the framework that is applied are essential to the accurate measurement, reasonable control and desired level of protection from all identifiable counterparty risks, as well as all operational risks arising within the Risk Management's scope of responsibility. The framework is also designed to meet the counterparty risk management and related corporate governance objectives of Nasdaq Clearing.

The day-to-day work is dedicated to achieving the following goals:

- Asses and manage the counterparty risk associated with Nasdaq´s existing and/or new products and services
- Ensuring that executive management and relevant Boards of Directors are appropriately informed of all significant counterparty risk control issues which occur
- Maintaining compliance with international industry standards specific to risk management
- Making continuous improvements to the Nasdaq Clearing counterparty risk management framework

The Clearing Risk Management department manages changes in counterparty risk exposures against a range of risk limits on a daily and intraday basis. The Clearing Risk Management department relies on well-established margin methodologies, which are validated regularly by automated back testing, sensitivity testing and validation.. The Clearing Risk Management department also monitors and responds to noteworthy changes in risk exposure and changes in the financial markets, which can affect the risk profile of the counterparties.

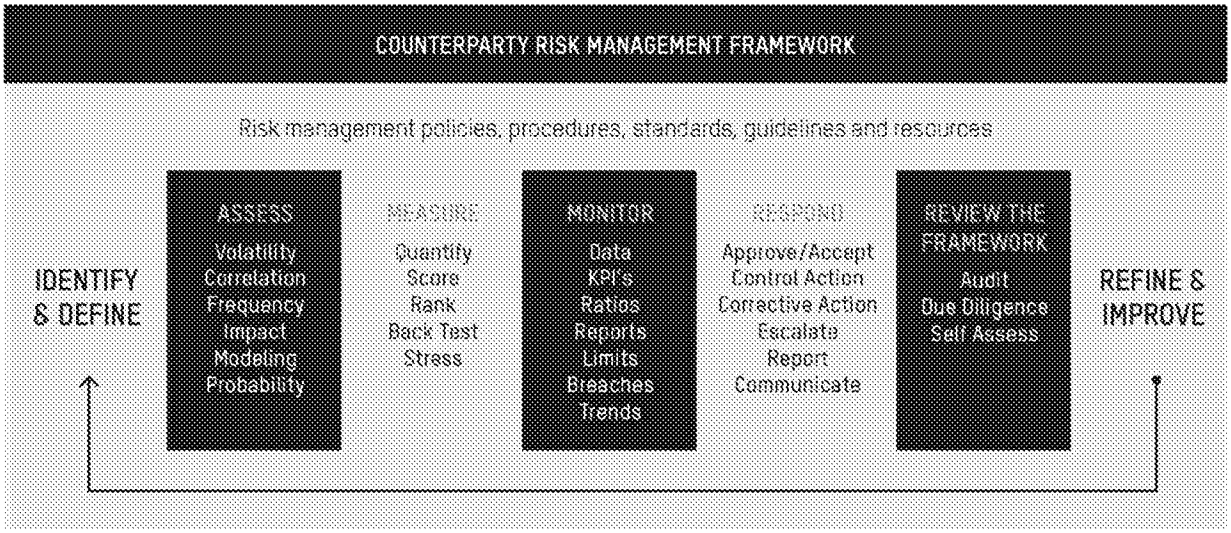
The Clearing Risk Management department responsibility also includes:

- Screening of the creditworthiness and financial performance capacity of:
  - Clearing members, direct pleding customers (DP) and clearing clients (CC)
  - Settlement banks, custodian banks, and liquidity providers
  - Collateral issuers
- Responding to regulatory authority and other significant stakeholder inquiries concerning Nasdaq Clearing's counterparty risk management framework
- Providing analysis and recommendations on counterparty risk issues relating to new markets and products.
- Analyzing and recommending what shall be approved as eligible collateral

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REEL: 037821 FRAME: 0067

9.3 COUNTERPARTY RISK MANAGEMENT FRAMEWORK

The following depicts the overall counterparty risk management framework that the Clearing Risk Management department applies in its approach to managing counterparty risk within Nasdaq Clearing. This overall framework is purposely designed to incorporate continuous improvement to the methods used in professionally managing counterparty risk.



9.4 RISK MANAGEMENT PROCEDURES

The following procedures within the Clearing Risk Management department are worthy of specific emphasis and comment:

- Procedures for handling parameter breaks
- Intraday risk reporting and monitoring
- Intraday margin calls
- Pre-novation checks
- Blocking of trades and offsetting trades

9.4.1 PARAMETER BREAKS

Each morning, the Clearing Risk Management department is made aware of any risk interval parameter breaks, or situations where the change in day-to-day market prices has exceeded the approved risk interval parameter level for any underlying instrument. The following is tracked when a parameter break occurs:

- The day-to-day price movement of the underlying instrument that has resulted in a parameter breach
- The approved parameter of the underlying instrument
- The change in price relative to the parameter
- The volume of outstanding contracts for the respective underlying product

When a risk interval parameter break occurs, the respective affected counterparty accounts are reviewed in detail, the cause of the price movement is also reviewed and a decision is taken by the Clearing Risk Management department as to what action, if any, is required, immediately or during the course of the day in response.

PATENT
REEL: 037821 FRAME: 0068

9.4.2 INTRADAY RISK MONITORING

Intraday risk reports are generated every hour (starting at CET 09:00 and ending at CET 18:00) or more often if deemed necessary. Each intraday margin calculation reflects any clearing member's or direct pledging/clearing client's change in exposure, with updated positions and real time prices, during the clearing day. In case of a breach by a participant of the intraday risk limit, Clearing Risk Management will issue a margin call.

Different types of risk limits and alarms are established by the Clearing Risk Management department. It is also worth noting that breaching of a risk limit is not grounds for default; it simply serves as one of many early warning measures applied by the Clearing Risk Management department.

9.4.3 INTRADAY MARGIN CALLS

Nasdaq Clearing has both the authority and the capacity to calculate and require intraday margin in order to maintain a desired level of margin coverage. The Clearing Rules stipulate that the new margin requirement shall enter into force immediately and be met by the participant no later than 90 minutes after the clearing house notified the clearing member that a new margin requirement has been calculated.

9.4.4 PRE-NOVATION CHECKS

Trades in certain products are subject to pre-novation checks by Nasdaq Clearing prior to acceptance for clearing. A pre-novation check means that Nasdaq Clearing will verify that sufficient collateral is in place on the Clearing Member's account in order to accept the trade for clearing.

9.4.5 BLOCKING OF TRADES AND OFFSETTING TRADES

Excluding default events (covered under Default History section of this document), Nasdaq Clearing has not found it necessary to exercise its right to block the trades of any counterparty since 2000. There have been instances where counterparties have been contacted and instructed to discontinue any additional trades in a given instrument in order to limit the concentration risk of a specific position, or to prevent an increase in a position of the counterparty in question. In all such instances, the counterparties have complied and cooperated in full with Nasdaq Clearing's instructions.

There have also been instances where counterparties have been requested by the Clearing Risk Management department to offset trades to reduce the current margin requirement to a level where the counterparty is capable of delivering margin.

PATENT
REEL: 037821 FRAME: 0069

CHAPTER 10

DEFAULT MANAGEMENT

The rules governing when a CCP member or customer is considered to be in default are stated in section 1.8 in the Clearing Rules of Nasdaq Derivatives Markets and in section 8 in the General terms of the Clearing rules of Nasdaq Commodities.

10.1 DEFAULT RULES

CCP members, indirect pledging customers (IDP), direct pledging customers (DP) or clearing clients (CC) are considered to be in default in either of the following circumstances:

- They breach the Rules of Nasdaq or other regulations regarding Nasdaq's exchange and clearing operations.
- In the judgment of Nasdaq Clearing, there is a substantial risk that the CCP member or client will breach these rules or other regulations regarding the exchange or clearing operations.

If exchange members, CCP members or IDP/DP/CC clients are in default, Nasdaq Clearing has the right to take one or more of the measures below, at the expense of the defaulting party and without necessarily consulting the defaulting party in advance:

- Withhold settlement or delivery due to the defaulting party.
- Offset settlements or deliveries due to the defaulting party against settlements or deliveries due to Nasdaq Clearing.
- Refuse exchange transactions, registration, and the settlement of contracts, in their entirety or in part, to the extent that is deemed necessary to avoid sustaining damage. In this respect, Nasdaq Clearing has the right to buy or sell contracts on behalf of the defaulting CCP member or client, and to forcibly settle the defaulting CCP member or client's contracts in advance.
- Seize and realize collateral provided.
- Purchase deliverable instruments and also, where the covering purchase is caused by a delay or lack of delivery from a CCP member or client (or if, in Nasdaq Clearing's judgement, there exists a risk for delay or lack of delivery) to revoke the delivery and receive payment corresponding to the difference between Nasdaq Clearing's costs for the covering purchase, together with the fees for the delay in or lack of delivery, and the exercise price or forward price of the contracts in question.
- Sell the contract base and, where a sale is caused by a delay in, or lack of, settlement by the CCP member or client (or if, in Nasdaq Clearing's judgment, there exists a risk of delay or lack of settlement), revoke the settlement and receive payment corresponding to the difference between the proceeds realized and the exercise price, futures price or equivalent cost for the relevant underlying instrument, together with the fees for default settlement.
- Exclude the exchange member, CCP member or client from Nasdaq through the termination of their respective member or client agreements. Upon termination of an exchange member or CCP member, Nasdaq Clearing may forcibly settle those contracts into which the exchange member or CCP member has entered on its own behalf.
- In respect of customer portability, Nasdaq Clearing has arrangements in place to transfer clients' positions. Should such transfer not be possible or deemed to take too long time to execute, Nasdaq Clearing will close out the open positions. The decision on what is constituted as acceptable time frame is taken by the Clearing Default Committee and depends on the risk profile of each individual portfolio. Participants' proprietary positions will be forcibly closed out in case of a participant default.

PATENT
REEL: 037821 FRAME: 0070

- Option contracts in Freight and Seafood may be subject to forced termination in accordance to the relevant contract specification. The forced termination may be applied to all or parts of the positions at a forced termination contract price/premium calculated by Nasdaq Clearing.

10.2 DEFAULT PROCESS

The Nasdaq Clearing Default Committee is the single decision-making authority within Nasdaq Clearing, for evaluating default situations and events and deciding which—if any—actions will be taken as permitted under its Rules as well as any applicable legal agreements. The Default Committee is made up of the following representatives, in order to help ensure that all decisions are well informed.

The Default Committee shall include the following ordinary members:

- President of NASDAQ OMX Clearing AB
- Chief Risk Officer
- Chief Technology Officer
- Associate of Clearing Risk Management
- Head of Clearing Operations

Furthermore, the Default Committee shall also include associate members as follows:

- Representative of Legal
- Representative of Global Risk Management
- Representative of Communications
- Representatives from Treasury

Associate members may assist in matters handled by the Default Committee, by sharing expert knowledge, but they do not participate in the decision-making process. Associate members will be invited to a meeting of the Default Committee as needed.

The Default Committee has the mandate to act in every possible way to reduce the risk in the portfolio. This means that Default Committee is authorized by the Board of Directors to choose whatever solution adequate to reduce or eliminate the risk exposure. In this respect, there are different ways to reduce and eliminate the risk exposure:

- Open new trades/positions to create synthetic hedges (does not need to be a perfect hedge as long as it has a substantial risk reducing effect)
- Close out trades
- Hold risk neutral positions (RNP) unchanged
- Create new RNPs through open up new positions in overlapping products
- Neutralize exposure by making RNP look-alikes
- Prioritizing close out based on a risk assessment

The Default Committee decides the progress in the close-out trades/risk reduction but the progress will be depending of internal and external factors. The Default Committee shall consider all possible ways to close down positions:

- Close out trades through the OTC market via brokers
- Directly towards CCP members; open or closed "auction sale", collect binding bid/ask prices from CCP members
- Supervised close out, let the defaulting party do the close out trades itself
- Close out trades through the exchange, depending on liquidity and impacts on market prices

PATENT
REEL: 037821 FRAME: 0071

10.3 PORTABILITY – ASSUMPTIONS AND PROCESS

In order to successfully and quickly port positions and collateral from a defaulting member to a back-up member, it is crucial that the clearing house is able to, in a very short timeframe, determine client obligations, market value and value of posted collateral.

Nasdaq Clearing offers a number of clearing model alternatives with different levels of segregation and pre-defined portability arrangements. In other words, different levels of client protection are available in the event of a member defaulting.

The intention in this section is to present the portability process for a number of clearing accounts but not all (clearing client, direct pledge and individual clearing account).

There are a number of key factors to take into account when deciding on the model for a client, for example:

- CHOSEN CLEARING ACCOUNT/CLEARING MODEL

To choose a clearing account with individual client segregation will increase the likelihood of successful porting compared to a clearing account with client/house segregation.

In Nasdaq Clearing's unique Direct Pledge (DP) model there are no margin obligations to consider for a back-up member, only administration obligations. This gives this model a great advantage compared to other models where client obligations are part of the porting process.

- BACK-UP MEMBER

To have an agreement with a back-up member prior to the default is an important factor in reducing the risk of failing to port positions and collateral since there will be limited time to negotiate an agreement with a back-up member in a default situation.

Be aware that the porting processes presented shall be regarded as guidelines and not a fixed processes since Nasdaq Clearing, members and clients might be forced to act differently due to specific market conditions.

PATENT
REEL: 037821 FRAME: 0072

10.3.2 PORTING PROCESS - DP AND CC ACCOUNT

The assumption is

- The defaulting member's administrator will put all transactions (both house and client) on hold once the member is in default.
- All positions for a particular client are ported to a back-up member. Partial porting is not possible.
- There is no need to port collateral since collateral is held in a specific DP/CC client custody account.

Porting process

1. Nasdaq Clearing declares a member in default. It will then publish a statement to that effect on the Nasdaq Clearing's website. The information will also be made available via the Nasdaq Clearing subscription service.
2. The DP/CC client is responsible for contacting the back-up member with a porting request to accept positions according to the agreement between the client and the back-up member.
3. The back-up member is responsible for contacting Nasdaq Clearing with a porting request from the back-up member to port client positions.
4. Porting.
5. Nasdaq Clearing will port positions to the back-up member. No close-out and re-open mechanism is needed.
    a. Porting of positions and collateral will be processed by Nasdaq Clearing on the business day following the day when Nasdaq Clearing receives the porting request from a backup member.
    b. Nasdaq Clearing issues confirmation to the client, the back-up member and the defaulting member.
6. Default fund
    a. There is no need to call for additional contributions since there is no change in the relationship between Nasdaq Clearing and the DP/CC client.

10.3.3 PORTING PROCESS - ICA ACCOUNT

1. Nasdaq Clearing declares a member in default and publishes a statement to that effect on the Nasdaq Clearing website. This information will also be made available via the Nasdaq Clearing subscription service.
2. The ICA client is responsible for contacting the back-up member with a porting request according to a back-up agreement between the client and the back-up member.
3. The back-up member is responsible for contacting Nasdaq Clearing with a porting request from the back-up member to port client positions and collateral.
4. Nasdaq Clearing will determine the value of collateral posted in relation to an ICA client.
5. Nasdaq Clearing will determine the total obligation in relation to the ICA client:
    a) the market value of all positions (intraday positions included)
    b) whether there is any unsettled MtM
    c) whether there are any unsettled premiums
    d) whether there are any unsettled securities settlements
    e) whether there are any unsettled fees
    f) whether there are any unsettled final cash settlements

    The total ICA obligation is the sum of a – f.
6. Nasdaq Clearing determines if there is sufficient collateral to cover all ICA obligations based on information in steps 4 and 5.

PATENT
REEL: 037821 FRAME: 0073

7. Nasdaq Clearing contacts the back-up member with details of the account. The back-up member must take on all ICA obligations determined in step 5, there is no option for back-up members to only take on partial ICA positions.
    - The back-up member will have the opportunity to:
        + Accept the porting request, or
        + Contact client and call for additional collateral from the client and then accept the porting request.
    - Porting to back-up member:
        + Nasdaq Clearing will port positions to the back-up member. No close-out and re-open mechanism is needed.
        + Nasdaq Clearing will port collateral to the back-up member.
        + Porting of positions and collateral will be processed by Nasdaq Clearing on the business day following the day when Nasdaq Clearing receives the porting request from a backup member.
    - Reject the porting request:
        + Payment to ICA client
            1. Nasdaq Clearing will close the ICA account using close out netting.
            2. Nasdaq Clearing will use posted collateral to cover all obligations in relation to the ICA client.
            3. Nasdaq Clearing will pay out any excess value or excess collateral to ICA client.
8. Default fund:
    - Nasdaq Clearing calls for additional contributions from the back-up member if neceassary.

PATENT
REEL: 037821 FRAME: 0074

10.4 DEFAULT HISTORY

Since Nasdaq Clearing began its derivatives clearing operations, twelve (12) clearing participants have experienced financial difficulties resulting in their forced withdrawal from the clearing—and Nasdaq Clearing incurred, in 1989, the only financial loss due to a counterparty default in its history. These events are described in more detail below.

December 1989	A Swedish-based market maker member experienced liquidity problems due to trading losses. After all positions had been closed, the market maker had an unpaid settlement amount for options amounting to SEK 736,000, which was covered by Nasdaq's equity reserves.
January 1991	A Swedish-based sole market maker had insufficient capital due to losses in stock options. The posted collateral was seized to cover the closeout costs. Nasdaq did not incur any loss due to this default.
March 1993	The Swedish based brokerage firm Orion Fondkommission AB was placed into bankruptcy and Nasdaq Clearing's required margin covered all the costs associated with the closing of the counterparty's positions. Nasdaq did not incur any loss due to this default.
November 2001	UK based Enron Europe Trading Ltd, a member of the UKPX, experienced serious financial difficulties. The OMLX and Nasdaq Clearing acted early in the progression that led to the bankruptcy of Enron's parent company, Enron USA. When Enron was placed into default, costs of GBP 4,442 were incurred when the position was closed out. These costs, together with some miscellaneous items, were fully covered by the posted collateral. Neither Nasdaq nor OMLX incurred any loss due to this default.
November 2001	The Commodities Markets clearing member Enron Capital & Trade Resources International Corp (ECTRIC), a wholly owned subsidiary of Enron Corp. and incorporated under American legislation, experienced serious financial difficulties. Nasdaq Clearing acted early in the progression that led to the bankruptcy of Enron's parent company, Enron USA, and put ECTRIC in default due to ECTRIC not being able to meet an extraordinary margin call issued. Nasdaq Clearing initiated immediate closeout of the portfolio, which was closed by day end. The closeout cost was fully covered by the collateral posted by ECTRIC. Nasdaq did not incur any loss due to this default.
October 2002	A clearing member on the Commodities markets was declared in default after the company did not meet a daily margin requirement. As the clearing member was not in bankruptcy, the member was put into default administration—meaning the default was not communicated to the market and the clearing house let the clearing member close down their exposure under the clearing house's supervision. The clearing member was kept anonymous during the default process, the closeout cost was fully covered by the collateral pledged by the clearing member, and Nasdaq did not incur any loss due to this default. Later, the defaulted clearing member withdrew from the market.
November 2002	UK-based TXU Europe Energy Trading Ltd. was placed into default after the company filed for administration protection. Default proceedings were initiated; the member's positions were taken over by the clearing house and liquidated during the trading day. The amounts resulting from position liquidation totalled SEK 204,000. The full settlement amount was paid from excess cash. Neither Nasdaq Derivatives Markets nor OMLX incurred any loss due to this default.

PATENT
REEL: 037821 FRAME: 0075

January 2008	Two affiliated indirect pledging customers of a Finnish bank simultaneously failed to meet their margin requirement pertaining to positions in stock forwards, and were subsequently declared in default. The combined margin requirement was MEUR 121. The positions were liquidated within 24 hours at a cost of MEUR 98. Nasdaq did not incur any loss due to this default.
April 2008	A clearing member on the Commodities market was declared in default after the company did not meet its daily margin requirement. As the clearing member was not in bankruptcy, the member was put into default administration—meaning the default was not communicated to the market and the clearing house let the clearing member close down their exposure under its supervision. The clearing member was kept anonymous during the default process, the closeout cost was fully covered by the collateral posted by the clearing member, and Nasdaq did not incur any loss due to this default. Later, the defaulted clearing member withdrew from the market.
October 2008	A direct pledging customer filed for suspension of payments and was subsequently declared in default. The customer's stock options portfolio, with a margin requirement of MSEK 9, was liquidated within one hour at a cost of MSEK 7. Nasdaq did not incur any loss due to this default.
March 2009	Clearing member Weavering Capital AB failed to comply with the minimum financial criteria for clearing members and was declared to be in default. Weavering Capital AB administered approximately 20 indirect pledging customers but had no proprietary trading book. Before the end of the day of the default, all clients had been successfully transferred to other clearing members. Nasdaq did not incur any loss due to this default.
August 2010	HQ Bank had its banking and trading license revoked by the Swedish Financial Supervisory Authorithy and was declared in default. Nasdaq Clearing actively traded out of the proprietary positions and transferred (or, where necessary, liquidated) customer accounts. Nasdaq did not incur any loss due to this default process.
September 2011	MF Global UK Ltd, clearing member of both the financial and commodities markets, went into special administration due to insolvency and was declared to be in default. MF Global only had open positions on behalf of clients on the financial markets and the remaining position was closed out in one day without any losses.

PATENT
REEL: 037821 FRAME: 0076

CHAPTER 11

MARGIN METHODOLOGY

To enable a trustworthy clearing operation, reasonably conservative margins are required to avoid the risk of the clearing house incurring a loss in a default. This section describes the Nasdaq Clearing's margin methodologies and systems.

The margin requirement should theoretically be the market value of the account. However, under normal conditions an account cannot be closed at the instant a participant defaults at the prevailing market prices. It typically takes time to neutralize the account and the value of the account can change during this period, which must be catered for in the margining methodology.

Nasdaq Clearing uses a risk system called Genium Risk. The purpose of a margin requirement system is to calculate accurate risk-based margin requirements for each counterparty account. The margin methodologies are customized and designed specifically for the different asset classes in question to generate accurate valuation and capital efficient calculations to optimize the use of members' collateral.

11.1 CALCULATION OF RISK PARAMETERS

Since neutralizing an account in a default situation can take time, there is a lead-time from the moment a default occurs to the time at which Nasdaq Clearing is able to close the participant's positions and when necessary, liquidate the collateral that has been pledged (so called liquidation period). For most financial products it is assumed that it takes two days on average, but up to five days for more illiquid products, to close a counterparty's positions and liquidate related collateral in the event of a default. For commodity products the liquidation period ranges between 2-5 days. Hence, the margin parameters are calculated with considerations taken to the assumed liquidation period.

Historical price movements are in many cases not normally distributed. This could cause concern as knowledge of the distribution could enable an estimation of accurate confidence intervals for the parameters in the margin calculation. Thus, in order to avoid issues assuming normal distribution, Nasdaq Clearing instead uses a numerical method to calculate its risk parameters. An additional buffer of 25% (procyclicality buffer) is added unless the lock-back period is 10 years. The confidence level when determining the risk parameters ranges from 99.2% to 99.5% depending on product.

Prices on commodities derivatives' markets possess the same general properties as other financial instruments, including "heavy tails" and high excess. For margin calculations Nasdaq Clearing applies contemporary statistical methods with use of stable distributions as a model for the tails of relative price increments distribution. Major part of parameters is estimated within one year data horizon. Parameters of the margining model guarantee that possible losses will be covered by the member's margin with 99.2-99.5 percent confidence.

PATENT
REEL: 037821 FRAME: 0077

11.2 GENIUM RISK - THE MARGINING SUBSYSTEM

Genium Risk is a subsystem integrated within the Genium INET clearing system, which is used to generate the daily counterparty margin requirements and intraday counterparty margin calculations. In the Genium INET Clearing system Nasdaq Clearing achieves full integration of the Commodity and Financial markets. Genium Risk is a multi asset risk management system that integrates OTC and standardized products, hence generating risk offsets and efficiency for members of the clearing house. Risk models and risk parameters are customized for different types of asset classes and credit risks. The following sections describe the margin methodologies used for Equities, Fixed Income and Commodities.

11.3 OMS-II – EQUITY DERIVATIVES MARGINING

OMS-II examines the portfolio as a whole to see how an adverse movement in the value of an underlying instrument would affect the value of the entire portfolio of a given counterparty. It uses a range of inputs in the margin calculation, some of which are specified below.

11.3.1 MARKET PRICE MODELS FOR OPTION CONTRACTS

The market value of an option contract at each valuation point is calculated using industry standard valuation models such as Black-Scholes, binomial method and Black-76.

11.3.2 VALUATION INTERVAL

Different values for the account must be calculated since the market often moves after collateral is pledged until

Nasdaq Clearing can close a position in the event of a default situation. To do this, OMS-II varies the price for the underlying security for each series to calculate the neutralization cost. In this way, OMS-II creates a "valuation interval" for each underlying security. The size of the valuation interval depends on the length of the liquidation period (liquidation period) and the size of the historic fluctuations in the price over this liquidation period.

11.3.3 VALUATION POINTS

The upper and lower limits of the valuation points represent the worst expected movement (during the liquidation period) for the margin calculation. However, the worst-case scenario for a portfolio with different options and forwards/futures based on the same underlying instrument can occur anywhere in the valuation interval. In order to reflect this, the valuation interval is divided into a number of valuation points (currently 31).

OMS-II calculates the neutralization cost for each series with the same underlying security in each valuation point; the actual margin requirement is then based on the valuation point that rendered the highest margins, i.e. the worst-case scenario. This means that a portfolio which contains a series for which margins normally would be calculated at different ends of the valuation interval is calculated in the same valuation point. This methodology is justified since the market can only go in one direction at a time (see section 11.6).

11.3.4 IMPLIED VOLATILITY AND VOLATILITY SHIFTS

When calculating implied volatility for exchange-traded options, there are two opposing forces to consider: flexibility and stability. Using the individual implied volatility for each series theoretically allows the clearing organization to cover "smile" effects in volatility; however, the problem with obtaining accurate pricing for out-of-the-money and in-the-money series makes this method unstable.

PATENT
REEL: 037821 FRAME: 0078

For the most liquid underlying instruments, OMS-II calibrates a volatility surface used as input for the margin calculations. For less liquid instruments, OMS-II calculates an arithmetic average for the three closest "at-the-money" series for each expiration and underlying instrument. This is then used as market volatility. This method does not consider smile effects, but is extremely stable.

The risk for a change in volatility is taken into account by calculating the neutralization cost of an account by a higher and lower volatility than the current volatility. This ensures that the neutralization cost is calculated at each of the valuation points for three different volatility levels; low, current and high. A typical valuation interval therefore consists of 3x31 valuation points.

11.3.5 VECTOR FILES

OMS-II produces a vector file for each contract cleared. A vector file consists of a data series that is shared by all positions in the series. There are primarily two reasons to produce a vector file. The first is to achieve computational efficiency and the second is that the vector files can be distributed externally so that members can replicate the margin calculations in their own systems.

11.4 CFM - FIXED INCOME DERIVATIVES MARGINING

Desirable properties of a margin methodology are that it should mirror realistic circumstances, and at the same time be capital efficient. When margining fixed income derivatives it appears natural to utilize the correlation between different maturities along a yield curve. CFM (short for Cash Flow Margin) is a yield curve based margin methodology that captures this correlation of fixed income instruments priced against the same curve. Instead of stressing each instrument's individual price, yield curves are stressed using their first three principal components. All instruments in an account are then evaluated against each stressed yield curve and the margin requirement is given as the combined value of these instruments calculated with the worst of the stressed yield curves. Each principal component (PC) explains part of the historical changes in yield curves.

PC1 is a parallel shift of the yield curve; PC2 is a change in slope; PC3 is a change in curvature. The main steps of the margin model are:

- Calculate a market yield curve for each currency
- Bootstrap individual credit curves from prices of selected instruments
- Change the whole yield curve to simulate future possible movements of the curve
- Use the three first principal components (PC) as three independent changes to the yield curve
- A total number of 125 future yield curves are constructed
- For each curve the market value of a portfolio is calculated
- The curve that leads to the lowest market value for a portfolio is the "margin curve" for that portfolio
- Forward contracts based on Swedish fixed income instruments which are cleared by Nasdaq Cleairng are hybrid futures/forward contracts. The hybrid style arises from the fact that the contract is not settled daily; instead, monthly cash settlement is carried out. This means that margin calculations for fixed income forwards must consider the bought forward price or the previous fixing value depending on whether the trade was carried out during the month or previous to the last monthly cash settlement.

For further information on Nasdaq Clearing's margin methodologies, please visit this website: http://www.nasdaqomx.com/transactions/posttrade/clearing/europeanclearing/risk-management/margining-methodology.

PATENT
REEL: 037821 FRAME: 0079

11.5 SPAN - COMMODITIES DERIVATIVES MARGINING

The Commodities derivatives margin model represents a modification of SPAN[2] and takes into account special properties of traded commodities and features of delivery procedures.

11.5.1 VOLATILITY CURVES

Price volatilities on the Commodities derivatives markets are crucially dependent on time to delivery. The volatility structure is formalized as a volatility curve which consists of calculated volatilities as a function of time to delivery for a given market. The volatility of a contract with a given time to delivery and delivery period is then presented as an integral of a volatility curve over the corresponding time period. Volatility curves for the commodity markets are presented on Nasdaq Clearing's web-site and are published in a parameter file (SPAN-file) on a daily basis.

11.5.2 SCENARIO ANALYSIS

The margin model possesses major properties of the generic SPAN model and uses a scenario approach to determine margin levels sufficient to cover correspondent portfolio risks. The model takes into account possible price movements as well as changes in volatility, which are formalized in 16 standard scenarios. Features of the commodities derivatives markets and physical properties of delivery procedures suppose special features for portfolio netting and provide dependencies between market prices which have required special modification of the margining system.

[2] SPAN is a registered trademark of Chicago Mercantile Exchange, Inc. and used herein under licence. Chicago Mercantile Exchange, Inc. assumes no liability in connection with the use of SPAN by any person or entity.

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11.6 CORRELATION BETWEEN INSTRUMENTS

Equities (OMS-II)

For different instruments that show a high correlation to each other, there is a need for a method that takes this into consideration with respect to margining calculations. The method used by Nasdaq Clearing is called the "window method". In this method, the scanning range limits the individual movement for each series, but there is a maximum allowed difference between the scanning points of the two series. This range can be represented as a window, hence the name. The size of this window is estimated roughly by the same method that is used to estimate scanning ranges. Daily differences between the movements of the series are calculated using one year of data. These values are then used to build a numerical cumulative distribution from which 99.2 % confidence interval is applied.

Based on a given covariance, the window can display a spread demonstrating the maximum allowable difference in price variation between two different underlying securities. In a narrow window, prices cannot vary as much as in a broad one. As a result, high covariance causes a narrow window, and vice versa.

Fixed Income (CFM)

Yield curves with different credit risks can show a historical relationship. Calculations of allowed correlation between two or more yield curves are based on the strength of the historical relationship between the different yield curves. Each historical curve change can be represented in terms of movements in PC1, PC2 and PC3 by applying a method of least squares solution. The method gives historical time series in terms of movements in PC1, PC2 and PC3. From each curve there will be a daily change in each Principal Components. The window size between each Principal Component is based on the maximum anticipated amount that the Principal Components can deviate from each other in terms of the number of valuation points in the valuation interval. Each day the maximum difference of the changes will be calculated and the result will end up in a spread vector. The same numerical statistical approach as when calculating the risk parameters is then applied to this vector, i.e. the estimated window size is based on a 99.2% (or 99.5%) confidence interval. Instruments exposed to the same yield curve will have a logical correlation due to the fact that only one stressed curve per margin account may be chosen in the margin calculations.

Commodities

Due to economic and physical reasons many commodities derivatives are dependent and show high statistical dependence in price dynamics. This dependence can decrease portfolio risks, which should result in lower margin requirements. The commodities derivatives margin model takes into account dependencies between prices on derivatives with the same underlying (contract spread or time spread) as well as dependencies between different groups of products (inter commodity spread).

Dependence between price increments on the derivatives with the same underlying can be estimated based on statistical properties of price processes and features of delivery procedures. The latter defines additional restrictions on the price dynamics of commodities derivatives and provides correlation coefficient to be a major factor for the estimation of the rate of dependence between correspondent price increments. The resulting decrease in margin is defined by the "window method" (see above), where the number of steps aside from the main scenario if defined by the correlation coefficient between price increments for correspondent derivatives (the higher correlation, the lower deviation from the main scenario). Correlation tables for each risk group are published in the parameter file (SPAN-file) on a daily basis.

PATENT
REEL: 037821 FRAME: 0081

11.7 MARGIN SIMULATION

In the Genium INET Clearing back office application and over the open API a margin simulation facility is provided. Members can use this facility to get an indicative margin requirement on existing or fictive positions. The margin simulation calculations are based on the same methodology and parameters as the official evening margin calculations. It is however important to note that the margin simulation is based on current real time prices and simulating the same position several times may thus give different results as market prices change. The result of the simulation should be seen as an indication of the official margin requirement.

11.8 MARGIN BACK-TESTING

Comprehensive, automated margin back-testing is a key element of the validation process. Back-testing in general aims at verifying and validating that a model or method meets the requirements that were intended. The aim of Nasdaq Clearing's automated margining back-testing functionality is to verify that the margining methodologies that Nasdaq Clearing relies upon are adequate, or in other words, that the margining results are in line with what the margining methodologies are designed to achieve.

Margin requirements are calculated each day by Nasdaq Clearing's risk margining system Genium Risk. These calculations are based on a number of assumptions, and it is therefore of interest to investigate how well these assumptions hold up to real market events. From a risk management perspective it is crucial to verify that the margin requirements are not too low. The principle for Nasdaq Clearing's margin back testing is therefore that for each account and margin date the market value of the account is calculated on the position from the margin date but using actual market prices over the assumed liquidation period following the margin date.

These calculations are done automatically every day for a one-year reference period for all counterparty accounts and all instruments. If the back-tested market value of an account following the margin date is less than the margin requirement, a margin breach is understood to have occurred. It should be noted that given the confidence level which Nasdaq Clearing applies in calculating risk interval parameters, margin breaches of counterparty portfolios are theoretically expected. But since risk interval parameters are calculated per underlying instrument, the diversity factor of a portfolio will determine if a margin breach occurs when a risk interval parameter is breached (a risk interval parameter breach occurs when an underlying price movement is larger than what the approved risk interval parameter accounts for). The margin back testing data that is produced is analysed on a monthly basis by Nasdaq Clearing and the result is reported to the Risk Committee and the Swedish Financial Supervisory Authorithy.

In addition, Nasdaq Clearing performs daily back testing and monitoring of risk parameters. Actual price movements of underlying instruments are compared each day to their corresponding margin parameters. Again, breaches are expected to happen. All breaches are logged and the reason behind the breach is noted. Based on the scale and number of breaches and the underlying reason, Risk Management decides if the risk parameter needs to be recalculated or not.

Nasdaq Clearing also performs regular model and sensitivity testing of its margin and stress test models. The purpose of such testing is to detect any weaknesses in the models even if any actual margin coverage breaches have occurred. Such model and sensitivity testing provides Nasdaq Clearing with indication if the models needs to be adjusted or if the risk management department needs to monitor certain exposures more closely.

PATENT
REEL: 037821 FRAME: 0082

CHAPTER 12

CCAR

A clearing organization is required to have financial resources as a consequence of the risks assumed in the clearing activities. This section describes CCaR, a proprietary methodology and system developed by Nasdaq Clearing to estimate the required clearing capital.

Nasdaq Clearing relies on a proprietary capital-at-risk calculation model and system, CCaR, as the main driver for establishing an appropriate level of clearing capital. The methodology is approved by the Swedish Financial Supervisory Authorithy and complies with the Committee on Payment and Settlement Systems (CPSS), the Technical Committee of the International Organization of Securities Commissions (IOSCO) and EMIR.

A clearing house has counterparty risk in each position that it clears. To cover that risk, the clearing house requires that all counterparties post margins. The purpose of the CCaR measure is to estimate the risk that posted collateral may be insufficient to cover the costs of closing out the positions of a defaulted counterparty. The system generates implied loss given default calculations based on assumptions on extreme price movements and levels of simultaneously defaulting counterparties. The two main differences between the assumptions in CCaR and the ones applied in the margining methodology are the following:

- Market movements in margin calculations are described as "sufficient to cover a majority of normal trading days", while the movements applied in CCaR are designed to be "extreme but plausible", in order to comply with IOSCO regulations on capital adequacy.
- Margins are applied to all accounts, but the CCaR value is calculated as the aggregated loss for a predefined number of simultaneously defaulting accounts in the worst extreme scenario applicable that day.

For each individual account and extreme scenario, a stressed market value is calculated and compared to the margin requirement applied to the corresponding account. The difference between the greatest stressed market value and the margin requirement is the CCaR value for that account. The CCaR value reflects the amount of Nasdaq Clearing capital that is at risk for that scenario, if that counterparty were to default.

12.1 CALCULATING CCAR PARAMETERS

CCaR parameters set the stressed market values, on each product set, which drive clearing capital in the CCaR system. Nasdaq Clearing follows a systematic and homogeneous procedure to calculate CCaR parameters for each product line and asset class. The purpose of following an objective methodology is to measure capital contributions fairly, such that stress levels neither penalize nor favor any particular market or product. The extreme but plausible scenarios generated by these CCaR parameters are based on the long-term historical tail risk of each product and asset class with 99.9% confidence. The stressed market values for each product set are completely independent (i.e. fully decoupled) from the level of margins.

PATENT
REEL: 037821 FRAME: 0083

CHAPTER 13

FINANCIAL RESOURCES



The first protection layer to ensure that Nasdaq Clearing can fulfill its obligation is its conservative margining methodology, its collateral requirements, and its pro-active risk management.

The second protection layer is its risk-bearing capital, which is its dedicated capital resources specifically designed to cover counterparty losses, i.e. to handle extreme situations where the defaulting member's pledged collateral and other resources are insufficient. The buffer capital to cover for such a scenario is referred to as the Clearing Capital. This is made up of several tranches.

The first tranche in the Clearing Capital, which would be utilized first in the event of a counterparty default, is Nasdaq Clearing's own funded capital. This means that Nasdaq Clearing's own risk-bearing capital is at risk. Thus, Nasdaq Clearing has a fully vested interest in ensuring that risk management routines are applied at all times to provide for the accurate measurement, reasonable control and satisfactory protection against risks arising within the clearing organization. A certain amount of this tranche is allocated to each market (refer to 13.2 – Clearing Capital).

The second tranche of the Clearing Capital consists of member contributed default funds, one for the cleared instruments within the financial market, one for the cleared instruments within the commodity market and one for the cleared instruments in the seafood market. The member contributed default funds ensure that the clearing house and its members are aligned and share the same interest of protecting the clearing house from counterparty losses.

The third tranche of the Clearing Capital is another layer of capital provided by Nasdaq Clearing and can be utilized for defaults in all markets.

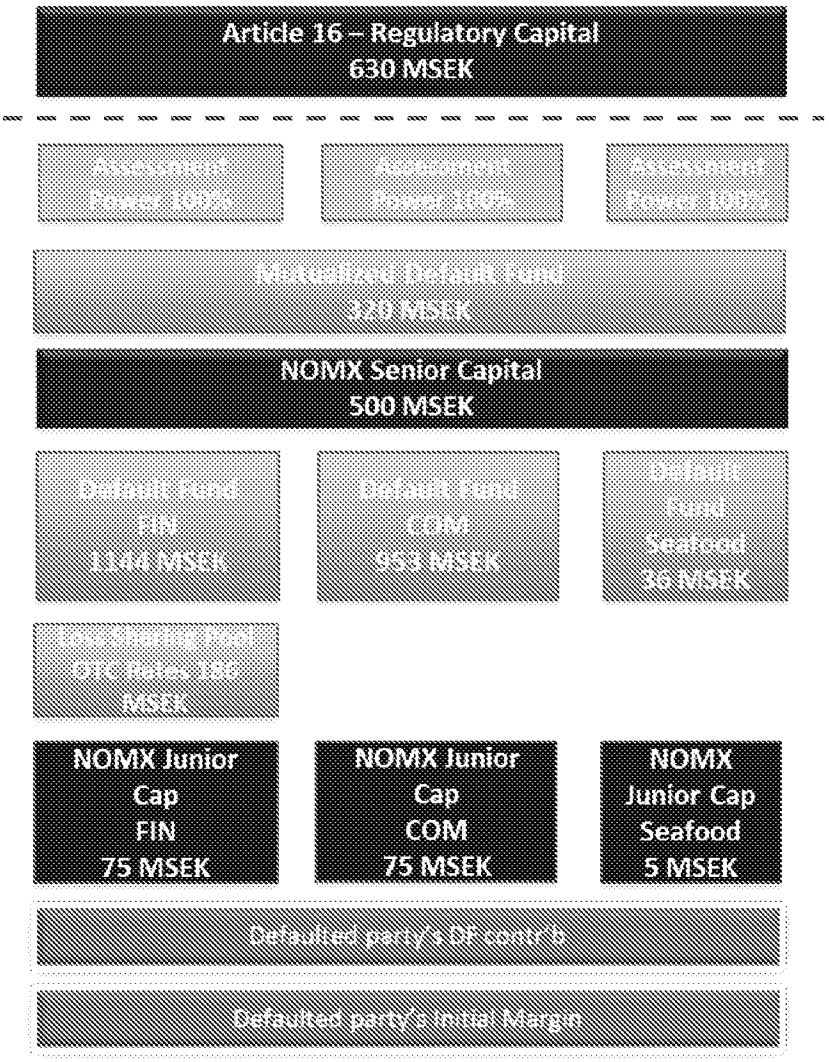
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The fourth tranche of the Clearing Capital is the Mutualized Default fund, an additional layer which is provided by members, as a percentage of their contributions to the default funds for each market. This Mutualized Default fund can be utilized for defaults in all markets.

Further, the fifth tranche of the Clearing Capital is the Assessment Power, which consist of guaranteed commitments provided by the Default fund participants.

In addition to the Clearing Capital, Nasdaq Clearing holds regulatory capital to cover for other types of risks (Operational and legal risk, Investment risk and Business risk) as well as additional capital to ensure an orderly wind-down.

- CLEARING CAPITAL AS OF APRIL 7, 2015



The Commodities Default Fund is denominated in EUR. EUR amounts are converted to SEK at a rate of 9,34

The Seafood Default Fund is denominated in NOK. NOK amounts are converted to SEK at a rate of 1,07

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13.2 CLEARING CAPITAL

- **Nasdaq Junior Capital.** In the event of a counterparty default where the defaulting counterparty's posted margin and default fund contribution is not sufficient to cover the cost of closing out the portfolio, Nasdaq Clearing will absorb the first layer of loss. The Junior Capital is divided between Junior Capital for the Financial Markets, Junior Capital for the Commodities Markets and Junior Capital for the Seafood Markets.
- The **Financial Market Default Fund** will function as the second layer in the event of a counterparty default where the loss has arisen in the financial market. The size of the Financial Market Default Fund is calculated to withstand a default of either the largest, or of the second and third largest counterparties combined, in an extreme but plausible scenario. Contributions to the Financial Market Default Fund are only available to cover default losses in the financial market.
- The **Commodities Default Fund,** will function as the second layer in the event of a counterparty default where the loss has arisen in the commodities market. The size of the Commodities Default Fund is calculated to withstand a default of either the largest, or of the second and third largest counterparty combined, in an extreme but plausible scenario. Contributions to the Commodities Default Fund are only available to cover default losses in the commodities market.
- The **Seafood Markets Default Fund** will function as the second layer in the event of a counterparty default where the loss has arisen in the seafood market. The size of the Seafood Markets Default fund is calculated to withstand a default of either the largest, or of the second and third largest counterparties combined, in an extreme but plausible scenario. Contributions to the Seafood Default Fund are only available to cover default losses in the seafood market.
- In the event of a counterparty default, **Nasdaq Senior Capital** would be used as a third layer. The size of this third layer is calculated to be sufficiently large to ensure that, when aggregated with the Junior Capital, Default Funds and Mutualized Default Fund, Nasdaq Clearing will withstand a default of the two largest counterparties, regardless of market, under an extreme but plausible scenario.
- In the waterfall structure, the **Mutualized (combined) Default Fund**, is a buffer provided by the clearing members from both the commodities market, the financial market and the seafood market. This fourth layer would be used in the event of a default in the commodities market and/or in the financial market and/or the seafood market. In other words, it is mutualized between the three markets. The contribution is limited to 15% of each clearing member's contributions to the Commodities, Financial and Seafood Default Funds.
- Nasdaq Clearing holds **Assessment Power** as a final layer in the waterfall. This ultimate layer strengthens the clearing house's contingent financial resources by committing clearing members to contribute additional capital in the event that prior levels of protection have not been sufficient to cover counterparty default(s). The commitment equals an obligation to provide additional funds up to an amount equal to 100% of each clearing member's contribution to the Financial Default Fund, the Commodities Default Fund and the Seafood Default Fund (i.e. not including the contribution to the Mutualized Default Fund). Commitments based on the default fund contributions to the financial market are only available to cover default losses in the financial market. Commitments based on the default fund contributions to the commodities market are only available to cover default losses in the commodities market. Commitments based on the default fund contributions to the seafood market are only available to cover default losses in the seafood markets.

PATENT
REEL: 037821 FRAME: 0086

- Nasdaq´s offering of clearing of OTC-traded interest rate derivatives requires an incentive for clearing members involved in such clearing to support the clearing house in a default involving such instruments. The incentive to support the clearing house is achieved through a member-sponsored pre-funded collateral pool only exposed to default losses from OTC-traded interest rate derivatives – the **Loss Sharing Pool**. The Loss Sharing Pool is in addition to, and without changes to, the existing regular waterfall. The Loss Sharing Pool does not for example influence the size of the default fund. In the event of a default including OTC-traded interest rate derivatives, default losses from such derivatives and other related fixed income contracts remaining after the junior capital has been exhausted shall be covered by the Loss Sharing Pool. If the Loss Sharing Pool is exhausted in a default, remaining default losses from OTC-traded interest rate derivatives will be covered by the regular waterfall (Financial Default Fund, senior capital, etc.). The Loss Sharing Pool is not subject to any assessment power or similar.

13.3 OTHER REGULATORY CAPITAL

In addition to capital held to withstand counterparty defaults, Nasdaq Clearing will also hold capital to ensure that it is adequately protected from Operational and legal risk, Investment risk and Business risk . In addition to the funds described to cover these risks, Nasdaq Clearing will hold sufficient capital to ensure an orderly winding-down or restructuring.

13.4 THE DEFAULT FUND CONTRIBUTION PROCESS

All clearing participants of Nasdaq Financial Markets, Nasdaq Commodities and Nasdaq Seafood markets contribute to the member sponsored default funds.

The operation of the Nasdaq Default Fund is part of the collateral management service. The management of collateral to cover Default Fund requirements and margin requirements is performed in the same way, but is held in separate custody accounts. For more information on CMS, please see Chapter 6.

Payments of accrued interest and coupons

Any amounts that arise due to capitalized interest and coupon payments on the Participant's Default Fund Custody Account will be paid to the Participant according to the Standing Settlement Instruction for cash call back. Capitalized interest and coupon payments are not added to held collateral.

Interest is capitalized on the Participant's Default Fund Custody Account on a monthly basis and coupon payments are paid to the Participant in connection with the coupon payment date of the held security.

PATENT
REEL: 037821 FRAME: 0087

FURTHER INFORMATION

For more information about Nasdaq Clearing as well as news and upcoming mandatory changes, please visit: http://www.nasdaqomx.com/europeanclearing.

For updated amounts and more information regarding the capital and financial resources of the clearing house, please refer to the document "NASDAQ OMX Clearing AB's Capital Resources" at: http://www.nasdaqomx.com/transactions/posttrade/clearing/europeanclearing/risk-management/default-fund/waterfall.

For more information regarding the member contributed default fund, please visit: http://www.nasdaqomx.com/transactions/posttrade/clearing/europeanclearing/risk-management/default-fund.

To contact the Clearing Operations team cal +46 8 405 7360 or send an e-mail to clearing@nasdaq.com.

To contact Collateral Management team call +46 8 405 6266 or send an email to cms@nasdaq.com.

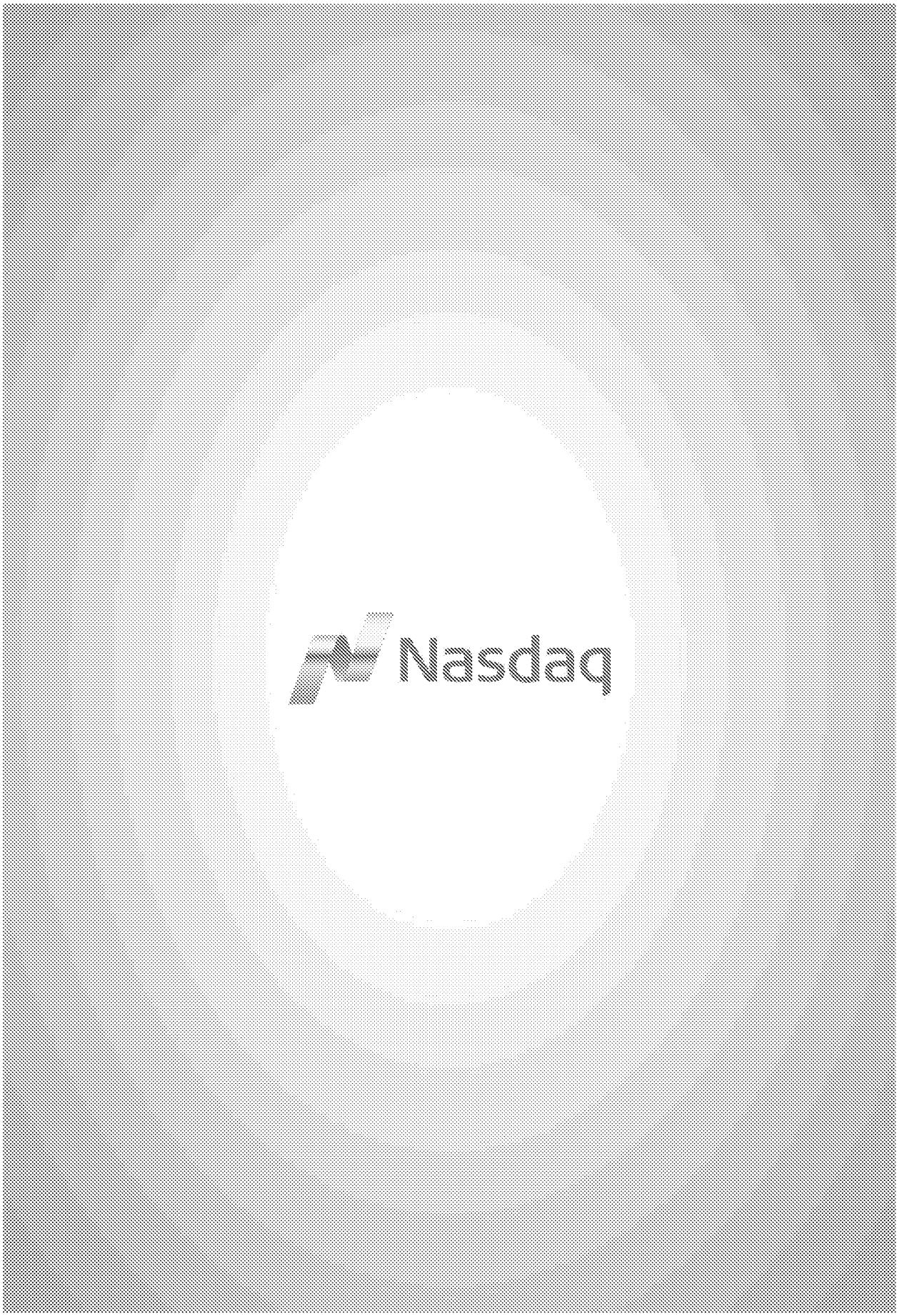
For risk management inquiries contact the Risk Management department; risk.management@nasdaq.com (for the Financial markets) or clearing.risk@nasdaq.com (for the Commodities market) or call +46 8 405 6000.

Information meeting Nasdaq Clearing's disclosure obligations under EMIR article 39(7) is found at http://www.nasdaqomx.com/europeanclearing/accounts under "Investor Risks".

The information herein, as well as descriptions and references to derivatives rules, are based on the best information available at the time of publication (April 2015, see also Legal Disclaimer above). The most recent version of the Rules of Nasdaq Clearing is found at http://www.nasdaqomx.com/nordicrules and additional information about derivatives markets and trading statistics can be found at http://nordic.nasdaqomxtrader.com.

Any information herein is of general information purpose only. More detailed information on Nasdaq Clearing is provided in the Rules, each applicable membership agreement, custody account agreement and other applicable agreements and terms applicable from time to time and available on Nasdaq's web site and/or upon request.

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Nasdaq



Computer–to-Computer Interface (CTCI)
For Risk Management
Programming Specifications

May 25, 2006

version 2006-01

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Table of Contents

1 Introduction 5
1.1 Document Overview 5
1.2 CTCI Overview 6
1.3 Allowable Subscriber Entry Times (All times Eastern) 7
1.4 NASDAQ Customer Support Information 8
1.5 Communication Protocols 9
2 Standard Input Messages 10
2.1 General Message Format 11
2.1.1 Message Header Format 11
2.1.2 Message Body Format 11
2.1.3 Message Trailer Format 12
2.2 Application Messages 14
2.2.1 Message Header Format 14
2.2.2 Message Body Format 15
2.2.3 Message Trailer Format 15
2.3 Admin Messages 17
2.3.1 Message Header Format 17
2.3.2 Message Body Format 18
2.3.3 Message Trailer Format 18
2.4 SUPER Messages 20
2.4.1 Message Header Format 20
2.4.2 Message Body Format 20
2.4.3 Message Trailer Format 23
3 Standard Output Messages 24
3.1 General Message Format 24
3.1.1 Message Header Format 24
3.1.2 Message Body Format 26
3.1.3 Message Trailer Format 26
3.1.4 Message Numbers 27
3.2 SUPER Messages 29
3.2.1 Message Acknowledgment 29
3.2.1.1 Acknowledgement Message Body Format #1 29
3.2.1.2 Acknowledgement Message Body Format #2 29
3.2.2 Number Gap Message 30
3.3 Reject Messages 32
3.3.1 Switch Reject Messages 32
3.3.2 Application Reject Messages 33
4 Risk Management Messages 35
4.1 Risk Management Input Messages 35
4.1.1 Risk Management Information 35
4.1.2 Risk Management Query and Update (Function K) 39
4.1.3 Clearing Firm Inhibit/Allow Blockbuster and Sizable Trade (Function I) 41
4.1.4 Enhanced Risk Management Query and Update (Function J) 42
4.2 Risk Management Output Messages 45
4.2.1 Risk Management Query Update Response (TCAK) 45
4.2.2 Enhanced Risk Management Query Update Response (TTAJ) 47
4.2.3 Blockbuster Trade Notification (TCBT) 49
4.2.4 Sizable Trade Notification (TCST) 51
4.2.5 Net Trade Threshold Notification (TTNT/TTNP) 52
4.2.6 Net Trade Threshold Fallback Notification (TTFB/TTFP) 56

PATENT
REEL: 037821 FRAME: 0092

4.3 Reject Message Format 60
5 Appendix A: TCP/IP Connection 65
6 Appendix B: IBM WebSphere MQ 81

PATENT
REEL: 037821 FRAME: 0093

1 Introduction

1.1 Document Overview

This document contains the subscriber requirements for using NASDAQ's Computer-to-Computer Interface (CTCI) to access the NASDAQ market center[1]. The document outlines only the messages transmitted via CTCI and not via other entry points to NASDAQ.

This document should be used by NASDAQ member firms acting on their own behalf and by third party software vendors/service bureaus acting on behalf of a NASDAQ participant.

The document contains these sections:

- Standard input messages;
- Standard output messages;
- ACES;
- NASDAQ market center trading;
- Appendix A: TCP/IP Connection;
- Appendix B: IBM WebSphere MQ; and

The standard input and output sections detail the formats for messages to and from the NASDAQ Switch. The other sections detail the input and output messages that are specific to a particular application. Appendix A describes how a subscriber can submit and receive messages to and from the CTCI using the TCP/IP protocol. Appendix B provides a link to *CTCI WebSphere MQ V1.1 Subscriber Intercommunication Specification.*

These conventions are used throughout the document:

- Fields defined as required must be present in the message.
- Fields defined as alphabetic can only hold A-Z (no spaces or numbers).
- Fields defined as numeric can only hold 0-9 (no spaces or alpha characters).
- Embedded spaces cannot be entered in alphabetic or numeric fields.
- Messages are limited to 1024 characters (including the header and trailer).
- Lines within messages are limited to 253 characters, including the end-of-line delimiter.
- All lines are terminated by a CR/LF pair.
- Fields within square brackets are optional.
- Multiple fields within brackets must all be present if any are.

[1]MFQS and TRACE specifications are in separate documents.
http://www.nasdaqtrader.com/asp/ctcidisclaim4.asp#MFQS
http://www.nasd.com/mkt_sys/trace_techspec.asp

PATENT
REEL: 037821 FRAME: 0094

1.2 CTCI Overview

NASDAQ provides a CTCI facility that allows subscribers to record and to report NASDAQ securities transactions from their computer systems to NASDAQ's computer systems via the NASDAQ Message Switch (Switch) using a two-way communications link over dedicated point-to-point circuits. ACES and NASDAQ market center trading are available via the CTCI.

There are nearly 500 circuits in production, handling more than 2 million transactions a day. CTCI uses a Transmission Control Protocol/Internet Protocol (TCP/IP) interface connection that allows incremental bandwidth.

NASDAQ supports IBM WebSphere MQ over the CTCI TCP/IP interface connection. IBM WebSphere MQ, a message queue middleware that extends business applications and enables them to communicate with one another, offers customers the ability to incorporate different systems a common messaging infrastructure. CTCI TCP/IP customers may implement WebSphere MQ software to facilitate interaction between their computer-to-computer-interface and other internal systems. See Appendix B: IBM WebSphere MQ.

CTCI Frequently Asked Questions can be found on the NASDAQ Trader website at: http://www.nasdaqtrader.com/trader/tradingservices/productservices/productdescriptions/ctcifaqs.stm.

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REEL: 037821 FRAME: 0095

1.3 Allowable Subscriber Entry Times (All times Eastern)

Entry of	Start time	End time
ACES Orders	7:00, but will not be delivered until 8:00	18:30, but cancel and cancel/replace are accepted until the switch is taken down
ADMIN or SUPER Messages	Anytime switch is up. These are not orders but admin messages or retransmission requests.	Until switch taken down
Money Market Prices	9:00	17:55 cutoff for newspaper dissemination; can be entered until 19:00 for level one dissemination
Mutual Fund Prices	9:00	17:55 cutoff for newspaper dissemination; can be entered until 19:00 for level one dissemination
NASDAQ Market Center Trading Orders	7:30	16:00

PATENT
REEL: 037821 FRAME: 0096

1.4 NASDAQ Customer Support Information

NASDAQ Technical Help Desk (techhelpdesk@nasdaq.com): 800.243.4284

PATENT
REEL: 037821 FRAME: 0097

1.5 Communication Protocols

Computerized firms that elect to use the CTCI will conform to the TCP/IP protocol detailed in Appendix A.

The subscriber is responsible for all line and equipment costs required for the use of the CTCI. In the TCP/IP environment, the system will support bandwidth from 56 kbps up to full T1 rates. A subscriber may order a redundant line(s) for backup.

CTCI permits a firm acting as a Service Bureau to interface with NASDAQ applications on behalf of multiple firms. Two station configuration methods for this Service Bureau capability are available:

1. One or more stations can be defined for each Service Bureau client. Since each client station will be configured and used just as if it were a direct link to the actual client, *no* Service Bureau-specific message formatting rules contained herein apply to this type of configuration.

2. Multiple clients can be associated to one or more Service Bureau stations. Since the Service Bureau station will be configured and used on behalf of multiple clients, *all* Service Bureau-specific message formatting rules contained herein apply to this type of configuration.

PATENT
REEL: 037821 FRAME: 0098

2 Standard Input Messages

The NASDAQ Message Switch supports three types of input messages:

- Application (section 2.2);
- ADMIN (section 2.3); and
- SUPER (section 2.4).

Application messages carry application-specific data in the message body to the NASDAQ application system designated in the message header. For example, an order entry message is an application message.

ADMIN messages are text messages sent to and logged in the Switch as communication checks.

SUPER messages are used to communicate with the NASDAQ Message Switch itself. These messages are used to notify the switch of the status of the user station, to turn sequence number checking on or off, to reset the sequence numbers, and to initiate retransmission of missed or lost CTCI output messages.

PATENT
REEL: 037821 FRAME: 0099

2.1 General Message Format

Input messages consist of:

- a message header that defines the message origin, category, and destination;
- a message body that consists of one or more lines of text; and
- an optional message trailer that consists of one line of text carrying the message sequence number.

Message headers, body, and trailers are constructed from lines of text. Each line consists of one or more data fields. All lines except the last line must be terminated with an end-of-line delimiter, which is either a Carriage Return/Line Feed pair <CR/LF> or a single Line Feed <LF> (for the sake of uniformity only the <CR/LF> pair will be used throughout this document to represent the end-of-line delimiter). Some of the data fields may be optional depending on the message category or destination. When an optional field is omitted and the result is a blank line the required end-of-line delimiter must still be provided.

Messages delivered to the NASDAQ Message Switch via TCP/IP are enclosed within a message envelope consisting of a 13-byte header and a 2-byte sentinel ("UU"). These 15 bytes are in addition to the header, body, and trailer described here. Transmission of blocked messages is not permitted, that is, each 15 byte "message envelope" must contain only one message, regardless of the message destination. Please see Appendix A: TCP/IP Connection for more details.

2.1.1 Message Header Format

Line 0:	[Origin]	**<CR/ LF>**
Line 1:	[Data]	**<CR/ LF>**
Line 1A:	[Category] **space** [Destination]	**<CR/ LF>**
Blank Line:		**<CR/ LF>**

The header consists of four lines. The first line is line 0 and contains the origin of the message. The second line is line 1 and contains the data. The third line is line 1a and contains the category and destination of the message. The fourth line is always a blank line.

2.1.2 Message Body Format

Line 2:	[first line of message body]	**<CR/ LF>**
Line 3:	[possible 2nd line]	**<CR/ LF>**
Line n:	[possible additional lines]	**<CR/ LF>**

The body consists of one or more lines. The first line is always line 2. For application messages, the content of the message body varies according to the destination application and the function being specified. For ADMIN messages, the body consists of one or more lines of user-defined text. For SUPER messages, the body consists of one or more lines of Switch-defined text.

PATENT
REEL: 037821 FRAME: 0100

2.1.3 Message Trailer Format

Trailer 1: [trailer data]

The trailer consists of a single line carrying the message sequence number. If the user elects to provide message sequence numbers for validation by the Switch, the message trailer line is required for all input messages. If the user elects not to provide message sequence numbers for validation by the Switch, the message trailer line can be omitted from ADMIN and application input messages. It cannot be omitted for SUPER messages. The message trailer is the last line of a message and is, therefore, never terminated with a <CR/LF>.

The NASDAQ Switch supports four input message trailer formats:

Format	Description	Examples
Format 1	A fixed 4-digit, zero-filled sequence number.	0034
Format 2	A hyphen (-), followed by a 1-4 digit sequence number.	-34
Format 3	The letters "OL" followed by an optional third alphabetic character and/or a space followed by a 1-4 digit sequence number. The sequence number can be zero-filled if desired. This sequence can appear anywhere on the last line. A space is used to separate the sequence number from any following user-defined data.	OL34 OLX 0034 [user-defined data]OLX 0034[*space*user-defined data]
Format 4	A 1-4 digit sequence number at the beginning of the line, followed by a space and a user-defined character string starting with a *non-numeric* character. The sequence number can be zero-filled if desired.	34*space*AXD 0034*space*/200008041717

If a user elects to provide message sequence numbers for validation by the Switch, the following should be kept in mind:

1. The allowed range for sequence numbers is 0001 to 9999.
2. Once 9999 is reached, the number rolls over to 0001 (not 0000), and any currently outstanding gaps for the station will be erased.
3. Each station requires its own unique sequence number series.
   For example:
   - The first message from Station 1 will be number 0001.
   - The second message from Station 1 will be number 0002.
   - If the next message is from Station 2, it will be number 0001, starting a new series specifically for Station 2.

PATENT
REEL: 037821 FRAME: 0101

4. The Switch will issue a NUMBER GAP message to any station where a gap in the provided message sequence numbers has been detected. The user is strongly urged to fill any gap (by retransmitting the missed message including the original i.e., missing, sequence number) as soon as possible, as the Switch allows only 16 outstanding gaps per station.
5. The sequence number in the required trailer of SUPER messages can have any value because this message type is never used to detect or fill a gap.
6. The station input sequence number, maintained by the Switch:
    - has value of the next expected sequence number from the user without exception;
    - has a start-of-day value of 0001;
    - can be altered programmatically with SUPER messages;
    - can be altered manually by NASDAQ Tandem Operations staff;
    - all input messages, including SUPER messages, "consume" a station input sequence number. For example, if two non-SUPER messages are sent with the legitimate sequence numbers 0041 and 0042, then two SYSTEM CHECK (SUPER) messages are sent with sequence number values of 0001 and 0100, and then another non-SUPER message is sent, then the SUPER message sequence numbers will not be flagged as out of the ordinary in any way. The non-SUPER message sent must contain the input sequence number 0045 because the two SUPER messages "consumed" the input sequence numbers 0043 and 0044.
7. The subscriber may retransmit a SUPER message, but the message will not fill a gap reported by any NUMBER GAP message. A self-addressed ADMIN message should be sent to fill a gap caused by a missed SUPER message.
8. A SUPER message should never be the first message sent to a station when a session is restored after a communication outage. If messages were in-flight when the session was lost, any SUPER message sent to stations as the first message following session reestablishment will adversely affect input gap detection, and one or more missing messages from the previous session will not be reported with a NUMBER GAP message. It is recommended that a self-addressed ADMIN message be the first message sent to stations when a session is re-established.

To read more about ADMIN messages, see section 2.3. To read more about SUPER messages, see section 3.2. Number Gap Messages are explained in section 3.2.2.

PATENT
REEL: 037821 FRAME: 0102

2.2 Application Messages

Application messages carry application-specific data in the message body to the NASDAQ application system designated in the message header.

2.2.1 Message Header Format

Input Application Message Header Format

Line 0: [Entry Originator] **<CR/LF>**
Line 1: [Branch Office] **space** [Branch Office Seq. #] **<CR/LF>**
Line 1A: **Category space Destination <CR/LF>**
Blank Line: **<CR/LF>**

Examples for line 1:

ABCD**space**1234**<CRLF>**

A**space**7**<CRLF>**

DR 2850/120601**<CRLF>** (optional format for ACES only)

Line	Field	Description	Req'd
0	Entry Originator	1 to 6 characters For service bureaus, the field must contain the 4-character MMID (as specified by the NASD) of the firm represented by the transaction. The NASDAQ Switch will populate the field if it is not supplied.	Y for firms acting as a service bureau & when either "PMXR" or "PMXN" is used in the destination field, even if the user is not a service bureau N for firms not acting as a service bureau
	<CR/LF>	line delimiter	Y even if the Entry Originator field is not entered
1	Branch Office*	1 to 4 alpha characters. Used to denote the firm's branch office.	Y for ACES
	Branch Office Seq. #	1 to 4 numeric characters	Y for ACES and NASDAQ market center
	Optional Entry date (ACES only)		N
	<CR/LF>	line delimiter	Y

PATENT
REEL: 037821 FRAME: 0103

Line	Field	Description	Req'd
1A**	Category	"ORDER" or "OTHER" For NNMS and NASDAQ market center, this field must contain the string "ORDER". For all other NASDAQ applications this field must contain the string "OTHER".	Y
	space	field separator	Y if destination is filled in
	Destination	For **ACES**: Must contain one of the following: A lower case "c", or "ACES" followed by a space and the MMID of the ACES market maker. If the MMID is included in the message body it can be omitted from this line. "ACESP" for messages from an ACES market maker that are to be "passed through" to the order entry firm.	Y
	<CR/LF>	line delimiter	Y
blank line	<CR/LF>	line delimiter used to separate the message header from the message body	Y

** Line 1A is required for all new CTCI users. When omitted, the destination of the message is determined by the content of the SECID field in the message body. New CTCI users should always populate the destination field as omission of the destination may cause incorrect routing. Current CTCI users are encouraged to do this as well.

2.2.2 Message Body Format

ADMIN message body format is discussed in section 2.3.2. SUPER message body format is discussed in sections 3.2.1.1 and 3.2.1.2.

The body of each application message (versus SUPER or ADMIN) sent from the user to the Switch is application-specific. Please refer to one of the following sections for information about the format of the application message body:

- ACES messages are described in Section **Error! Reference source not found.**.
- NASDAQ market center trading messages are described in Section **Error! Reference source not found.**.

2.2.3 Message Trailer Format

PATENT
REEL: 037821 FRAME: 0104

Trailer 1: [trailer data]

The NASDAQ Switch supports four input message trailer formats:

Format	Description	Examples
Format 1	A fixed 4-digit, zero-filled sequence number.	0034
Format 2	A hyphen (-), followed by a 1-4 digit sequence number.	-34
Format 3	The letters "OL" followed by an optional third alphabetic character and/or a space followed by a 1-4 digit sequence number. The sequence number can be zero-filled if desired. This sequence can appear anywhere on the last line. A space is used to separate the sequence number from any following user-defined data.	OL34 OLX 0034 [user-defined data]OLX 0034[spaceuser-defined data]
Format 4	A 1-4 digit sequence number at the beginning of the line, followed by a space and a user-defined character string starting with a *non-numeric* character. The sequence number can be zero-filled if desired.	34spaceAXD 0034space/200008041717

PATENT
REEL: 037821 FRAME: 0105

2.3 Admin Messages

Input Admin messages should be used in the following recovery situations.

- A self-addressed ADMIN message should be sent in place of a SUPER message when the Switch sends the user a NUMBER GAP message (see Section 4) and the gap corresponds to a missed SUPER message; the sequence number of the missing SUPER message must be used by this ADMIN message in order to remove the gap created by the missed SUPER message. If necessary, the SUPER message can be resent after the gap has been filled by the ADMIN message.
- When a session is restored after a communications problem, an ADMIN message should be the first message sent to a station, so that the input gap detection by the Switch is accurate. An application message may also be used for this purpose.

When an ADMIN message is used as described above, it is recommended that the destination field on Line 1A be populated with a value that will cause the message to be routed back to the originator; the user can obtain the "address" for this specific purpose from the output message trailer `<DestId>` field, described in section 3.1.3. Such a self-addressed message not only handles the situations described above, but also proves to the user that data can flow in both directions.

2.3.1 Message Header Format

Input Admin Message Header Format

Line 0: <Originator>**<CR/LF>**
Line 1: **<CR/LF>**
Line 1A: <Category>**space**<Destination>**<CR/LF>**
Blank Line: **<CR/LF>**

Line	Field	Description	Req'd
0	Entry Originator	1 to 6 characters The NASDAQ Switch will populate the field if it is not supplied.	N for firms not acting as a service bureau
	<CR/LF>	line delimiter	Y even if the Entry Originator field is not entered
1	Variable Data	0 to 253 characters Field that the CTCI subscriber may use to enter any data.	N
	<CR/LF>	line delimiter	Y
1a	Category	"ADMIN" Identifies the message category. This field must contain the string "ADMIN".	Y

PATENT
REEL: 037821 FRAME: 0106

Line	Field	Description	Req'd
	space	field separator	Y
	Destination	1 to 6 character address code Holds the address of the message destination. It is recommended that this field be populated with an address that will route it back to the originator (a "self-addressed" message). The NASDAQ Customer Subscriber Test group (CST) can provide the user with the appropriate destination code for use in sending themselves self-addressed Admin messages.	Y
	<CR/LF>	line delimiter	Y
blank	<CR/LF>	Blank line used to separate the message header from the message body.	Y

2.3.2 Message Body Format

Input Admin Message Body Format

Line 2: [Variable Data] **<CR/LF>**
Line 3 ...: [Additional Data] **<CR/LF>**

Line	Field	Description	Req'd
2	Variable Data	This is a free format message containing information destined for the individual address identified in the Destination field of the message header.	Y
	<CR/LF>	line delimiter	Y
3	Additional Data	Free form additional lines of message text. Each line requires a <CR/LF> to separate it from the following line.	N

2.3.3 Message Trailer Format

Trailer 1: [trailer data]

The NASDAQ Switch supports four input message trailer formats:

Format	Description	Examples
Format 1	A fixed 4-digit, zero-filled sequence number.	0034
Format 2	A hyphen (-), followed by a 1-4 digit sequence number.	-34

PATENT
REEL: 037821 FRAME: 0107

Format	Description	Examples
Format 3	The letters "OL" followed by an optional third alphabetic character and/or a space followed by a 1-4 digit sequence number. The sequence number can be zero-filled if desired. This sequence can appear anywhere on the last line. A space is used to separate the sequence number from any following user-defined data.	OL34 OLX 0034 [user-defined data]OLX 0034[*space*user-defined data]
Format 4	A 1-4 digit sequence number at the beginning of the line, followed by a space and a user-defined character string starting with a *non-numeric* character. The sequence number can be zero-filled if desired.	34*space*AXD 0034*space*/200008041717

PATENT
REEL: 037821 FRAME: 0108

2.4 SUPER Messages

Input SUPER messages are used to communicate with the NASDAQ Message Switch. These messages are used to notify the switch of the status of the user station, to turn sequence number checking on or off, to reset the sequence numbers, and to initiate retransmission of missed or lost CTCI output messages.

2.4.1 Message Header Format

Line 0: [Entry Originator] **<CR/LF>**
Line 1: [Variable Data] **<CR/LF>**
Line 1A: [Category] **<CR/LF>**
Blank Line: **<CR/LF>**

Line	Field	Description	Req'd
0	Entry Originator	1 to 6 characters For service bureaus, the field must contain the 4-character MMID (as specified by the NASD) of the firm represented by the transaction. The NASDAQ Switch will populate the field if it is not supplied.	Y for firms acting as a service bureau N for firms not acting as a service bureau
	<CR/LF>	line delimiter	Y even if the Entry Originator field is not entered
1	Variable Data	0-253 characters Field which the CTCI subscriber may use to enter any data.	N
	<CR/LF>	line delimiter	Y
1a	Category	"SUPER" Identifies the message category. This field must contain the string "SUPER". SUPER messages do not have a destination field.	Y
	<CR/LF>	line delimiter	Y
blank	<CR/LF>	blank line used to separate the message header from the message body.	Y

2.4.2 Message Body Format

In order to be processed automatically by the Switch, the message body portion of a SUPER Message must match one of the expected SUPER message formats. If the text does not conform to one of the specified formats, the message will be rejected.

Line 2: **[Function Text]**
Line 3-n: **[Additional Lines of Text as required]**

PATENT
REEL: 037821 FRAME: 0109

Line	Field	Description	Req'd
2	Function Text	See the following table for the supported SUPER message functions. In some cases, the Function Text may consist of multiple lines, with a <CR/LF> between each one. The last line does not require a <CR/LF> as a terminator.	Y

SUPER Message Functions

SUPER Function Text	Processing
GOOD MORNING	Indicates the subscriber is ready to begin receiving messages from the Switch.
GOOD NIGHT	Indicates the subscriber has no further traffic to send and is no longer prepared to receive traffic. This command will cause the station output queue to be drained.
SUSPEND SEQ CHECK	Instructs the Switch to suspend input sequence number checking for this subscriber station. This command is only valid if sequence checking was previously instituted.
ALLOW SEQ CHECK	Instructs the Switch to resume input sequence number checking from the next received input sequence number. This command is only valid if suspension of sequence checking was previously instituted.
SYSTEM CHECK	A test message allowing a subscriber to check its ability to communicate with the Switch.
RESET ORDER SEQ<CR/LF> nnnn or RESET ORDER SEQ<CR/LF> ANY	Instructs the Switch to expect a new input sequence number. Two options are provided: nnnn - Numeric string specifying the sequence number provided with the next input message. ANY - Literal indicating that sequence number checking is to commence from the sequence number of the next input message. Either form of this message will erase all previously created number gaps.
REVERT TO SEQ 1	Instructs the Switch to reset to start-of-day numbering in both directions (input and output). This message will erase all previously created number gaps.
RESTART LAST RCVD<CR/LF> nnnn	Instructs the Switch that a subscriber switching facility has been restored after a failure.

PATENT
REEL: 037821 FRAME: 0110

SUPER Function Text	Processing
	The Switch will reset the next output sequence number to nnnn + 1, where nnnn is typically the last message sequence number that had been received by the subscriber.
RTVL LAST OUT [mm] or RTVL OUT nnnnn mm Other options: ROUTE=[ADDR] ID=[SID]	Permits a subscriber to request a resend of messages previously transmitted by the Switch. The optional field mm is the number of messages to be retrieved and must be between 1 and 15 (default is 1). If more than 15 messages are requested then multiple SUPER messages must be used. LAST OUT mm instructs the Switch to resend the most recent mm messages. OUT nnnnn mm instructs the Switch to resend mm messages starting with the message which had output retrieval number nnnnn. Valid values for nnnnn are 1 through 65535. Retrieval of INPUT messages is no longer supported. If the "ROUTE=" option is used, the retrieved messages will be sent to <ADDR>. If the "ID=" option is used, the retrieved messages will be messages belonging to the station defined by <SID>. A station may only use the ROUTE= and ID= options if it has been granted those privileges. NOTE: The previous specification showed <CR/LF> after the RTVL. This is still a valid input format. However, the response to this command echoes this information as a single line, i.e., no <CR/LF> after RTVL. While both formats are acceptable, we choose to represent it in this spec with a single line in an attempt to avoid confusion.
NUMBER GAP nnnnn or NUMBER GAP nnnnn nnnnn Other options: ROUTE=[ADDR] ID=[SID]	As input to the Switch: Indicates that a subscriber has detected a gap in the Switch assigned output sequence number and is requesting the resend of the message originally sent with retrieval number nnnnn. The Switch will resend the related message with a new output sequence number; the optional second trailer line in the output message will indicate the retrieval number previously assigned to the message i.e., nnnnn. Up to two messages can be retrieved by a single NUMBER GAP message (nnnnn nnnnn denotes 2 distinct retrieval numbers, not a range). Valid values for nnnnn are 1 through 65535 only.

PATENT
REEL: 037821 FRAME: 0111

SUPER Function Text	Processing
	See the discussion of the RTVL command for info about the optional ROUTE= and ID= fields. NOTE: The previous specification showed <CR/LF> after the NUMBER GAP. This is still a valid input format. However, the response to this command echoes this information as a single line, i.e., no <CR/LF> after NUMBER GAP. While both formats are acceptable, we choose to represent it in this spec with a single line in an attempt to avoid confusion.

Because the station output queue is a first-in-first-out (FIFO) queue, the subscriber CTCI design must take into account the fact that SUPER message rejects and acknowledgements are always appended to the existing (and potentially deep) queue. There is currently no way to push output messages onto the top of an output queue.

2.4.3 Message Trailer Format

Trailer 1: [trailer data]

The NASDAQ Switch supports four input message trailer formats:

Format	Description	Examples
Format 1	A fixed 4-digit, zero-filled sequence number.	0034
Format 2	A hyphen (-), followed by a 1-4 digit sequence number.	-34
Format 3	The letters "OL" followed by an optional third alphabetic character and/or a space followed by a 1-4 digit sequence number. The sequence number can be zero-filled if desired. This sequence can appear anywhere on the last line. A space is used to separate the sequence number from any following user-defined data.	OL34 OLX 0034 [user-defined data]OLX 0034[*space*user-defined data]
Format 4	A 1-4 digit sequence number at the beginning of the line, followed by a space and a user-defined character string starting with a *non-numeric* character. The sequence number can be zero-filled if desired.	34*space*AXD 0034*space*/200008041717

PATENT
REEL: 037821 FRAME: 0112

3 Standard Output Messages

3.1 General Message Format

Output messages consist of:

- a message header that defines the start of the message, its origin, its destination, its output sequence number, and the message type;
- a message body that consists of one or more lines of text; and
- an optional message trailer that carries the date and time, the message retrieval number, and other information.

Messages sent from the NASDAQ Message Switch via TCP/IP are enclosed within a message envelope consisting of a 13-byte header and a 2-byte sentinel ("UU"). These 15 bytes are in addition to the header, body, and trailer described here. Please see Appendix A for more details.

Message headers and trailers are constructed from lines of text. Each line consists of one or more data fields and is terminated by a Carriage Return/Line Feed pair <CR/LF>.

An output message header consists of up to 4 fields with a user defined field separator between each field. The separator defaults to space if the user has not specified something else. The user can select which fields they would like to receive and can specify the order in which the fields should be placed in the header.

Assuming that the user has elected to receive all fields in the default order, the format is as follows:

3.1.1 Message Header Format

The message header format is one line containing four fields. The field separators can, however, be <CR/LF>, which makes the message header four lines.

Line 1:	[Destination Code]	[field separator]
	[Originator Code]	[field separator]
	[Sequence Number]	[field separator]
	[Message Type]	**<CR/LF>**

Line	Field	Description
1	Destination Code	The Destination Code is a 1-6 character identifier that defaults to the Station ID of the user. The user may specify a custom code. Custom codes may also be specified for each message. See field 4. The user may elect not to receive this field.
	Field Separator	The field separator is defined by the user (**space**, **<CR/LF>**, **<LF>**, etc.). If the user does not specify a separator, a **space** is used by default.

PATENT
REEL: 037821 FRAME: 0113

Line	Field	Description
	Originator Code	The Originator Code is a 1-6 character identifier that defaults to the Station ID of the originator of the message. The user may specify custom Originator Codes for each message type. See field 4. The user may elect not to receive this field.
	Field Separator	The field separator is defined by the user (**space**, **<CR/ LF>**, **<LF>**, etc.). If the user does not specify a separator, a **space** is used by default.
	Sequence Number	4 numeric characters. Output message sequence number. The number is in the range 0001 to 9999. When 9999 is reached, the number wraps to 0001 (0000 is not used). The "REVERT TO SEQ 1" Super Message resets this field. The user may elect not to receive this field.
	Field Separator	The user defines the field separator (**space**, **<CR/ LF>**, **<LF>**, etc.). If the user does not specify a separator, a **space** is used by default.
	Message Type	The message type is a 1-character code that specifies the nature of the message. The user may select the user's own codes. If custom codes are not used, the defaults are as follows: R = Report A = Admin S = Status P = Super T = Other The type of an application output message is determined by the Category Field of Input Header Line 1A of the message input to the switch by the application. It does not indicate which application produced the message. Standard Input information is in section three of this document. The user may elect not to receive this field.
	<CR/LF>	Line delimiter. A **<CR/ LF>** is used to separate the output message header from the message body. It is present even if the user elects not to receive any of the fields defined above.

As part of NASDAQ's on-going effort to maximize Switch performance and capacity, NASDAQ will require that the last three characters of the six-character Common Message Switch (CMS) output header Originator Code be reserved for NASDAQ's use. If you, therefore, plan to code your firm's internal systems to use the Originator Code to identify system of origin, you should compare the first three characters of the Originator Code.

Below are the three-letter codes that should be used to identify the system of origin:

System of Origin	(Mnemonic)
ACES Pass-Thru[SM]	ACE
NASDAQ Market Center	HSW
ITS	ITS

PATENT
REEL: 037821 FRAME: 0114

NASDAQ reserves the right to change an application mnemonic at any time.

3.1.2 Message Body Format

An output message body consists of one or more lines, with the first line referred to as Line 1. The number of lines and their content varies with the class of the message.

Line 1:	[first line of message body]	**<CR/ LF>**
Line 2:	[possible 2nd line]	**<CR/ LF>**
Line n:	[possible additional lines]	**<CR/ LF>**

See Sections 3.1.4 - 3.3.2 for format information specific to each message class.

3.1.3 Message Trailer Format

An output message trailer consists of either one or two lines depending upon the type of message. Each line in the trailer is optional and the user may elect to not receive either one. If present, the format is as follows:

Trailer 1: [Date/Time]**space**[Dest ID]**slash**[Rtvl #]**<CR/ LF>**
Trailer 2: [Resend]**space**[Alt Route]**space**[Poss Dup]

Line	Field	Description
Trailer 1	Date/Time	12 character numeric field. The format of the Date/Time field is HHMMSSDDMMYY (hours, minutes, seconds, day, month, year).
	space	Field separator.
	DestID	1-6 character Destination Station ID. This is identical to the default Destination Code found in the output message header. It is not affected if the user chooses to have a custom Destination Code.
	slash	Field separator (/).
	Rtvl #	4 or 6 character numeric field. The switch maintains a 6-digit retrieval number (RN) from 000001 to 065535. When 065535 is reached, the number wraps to 000001. A user will receive the default 4-digit RN or can choose to receive the 6-digit RN (recommended). The 4-digit RN is merely the rightmost 4 digits of the number maintained by the switch. The 4-digit wrapping sequence is [00]0001 to [00]9999, [01]0000 to [01]9999, [02]..., [06]0000 to [06]5535, [00]0001 to [00]9999 and so on.
	<CR/LF>	Line delimiter. The **<CR/ LF>** is only present if the trailer includes Trailer Line 2.

PATENT
REEL: 037821 FRAME: 0115

Line	Field	Description
Trailer 2*	Resend	An optional **"RSND"** followed by **[destID] / [Rtvl#].** Used when the switch resends a message (due to an input Super RTVL or Super Number Gap message). The switch places the character string "RSND" in this field, followed by a 1-6 character Destination Id, a **slash**, and the 4 or 6 character retrieval number of the original message. Optional.
	space	Field separator. A **space** will be present if another field follows the Resend field
	Alt Route	Holds the 1-6 character Destination ID of the original location the message was addressed to when the message has been rerouted. Optional.
	space	Field separator. A **space** will be present if another field follows the Alt Route field.
	Poss Dup	An optional "**PD**". Holds the string value "PD" if the switch needs to indicate that this message may possibly be a duplicate of an earlier attempt to deliver the message. Optional.

* Trailer Line 2 is present only when the Switch must indicate unusual situations to the user (message resend, alternate routing, and possible duplicate message). If the line is present, it will consist of one, two, or all three of the fields, with a **space** between each one.

A message that successfully passes the Switch validation and safestore procedures is forwarded to the specified application, which performs additional validation on the text of the message. If an error is detected, the user will receive a reject message explaining why the original message could not be processed. All reject messages sent from applications will be forwarded to the subscriber via the Switch and will be contained in a Standard Switch Output Message.

If the text from an application is too large, the Switch will replace the text with the character string "-->" so that the message does not exceed 1024 characters. This string replaces the entire echo.

See section 3.3.2 for additional reject information.

3.1.4 Message Numbers

Each output message delivered by the Switch is assigned two numbers:

1. A Message Sequence Number located in the output header.
2. A Message Retrieval Number located in the output trailer.

The Message Sequence and Message Retrieval numbers are independently maintained for each station and will normally be sequential.

The user detects missing messages by monitoring the Message Sequence Number for gaps, but must request message retrievals by using the Message Retrieval Number. The Message Sequence Number may wrap, be set back to 0001 via a REVERT TO SEQ 1 (SUPER) Message, or be manually altered by the Tandem Operations Staff, at any time so the Message Retrieval Number is necessary to uniquely identify all transmitted messages.

PATENT
REEL: 037821 FRAME: 0116

The Retrieval Number wraps to 0 after 65,535. Only the most recently output 65,535 messages are ever retrievable, so if output message counts for a particular station are expected to exceed 65,535 during the trading day the user may opt to configure multiple stations and employ the Switch's Balanced Delivery feature.

"Balanced Delivery" is a Message Switch configuration feature that allows subscriber-bound messages to be queued in round robin fashion to more than one output queue. This technique spreads like-addressed output messages over many output stations, effectively reducing the number of messages transmitted per station while increasing overall throughput.

This feature requires that multiple stations be configured for the firm and that any addresses used to direct messages to the 'prime' station queue be added to our Balanced Delivery Configuration (BDFILE) file. Configuration must be coordinated and tested with the NASDAQ Testing Facility (NTF).

PATENT
REEL: 037821 FRAME: 0117

3.2 SUPER Messages

3.2.1 Message Acknowledgment

Super Messages received by the Switch are subject to message validation, except that the Switch does not validate the value of the message sequence number contained in the trailer of a message. If the Switch rejects the message, a reject message is sent to the user. If the Switch accepts the message, a response is sent to the user to indicate the disposition of the Super Message. The format of the Super Message Acknowledgment is the Standard Switch Output Message format, as described in Section 3.1. The Super Message Acknowledgment message is a STATUS message.

If the Super message was processed successfully, the body of the Super Acknowledgement message is formatted as follows:

3.2.1.1 Acknowledgement Message Body Format # 1

Line 1: [message category] **< CR/ LF>**
Line 2: [message text] **< CR/ LF>**

Line	Field	Description
1	message category	"STATUS". This field identifies the message category and will contain "**STATUS**".
	< CR/LF>	Line delimiter
2	message text	"SUPER MSG PROCESSED". This field contains the string "SUPER MSG PROCESSED", indicating that the function requested in the Super message has been performed.

If the message could not be processed due to an error in content or formatting or it could not be processed immediately, the body will contain:

3.2.1.2 Acknowledgement Message Body Format # 2

Line 1: [message category] **< CR/ LF>**
Line 2: [message text] **< CR/ LF>**
Line 3: [additional clarification] **< CR/ LF>**
Line 4-n: [input msg echo] **< CR/ LF>**

Line	Field	Description
1	message category	"STATUS". This field identifies the message category and will contain "**STATUS**".
	< CR/LF>	Line delimiter
2	message text	"SUPER MSG RECEIVED". This field contains the string "SUPER MSG RECEIVED", indicating that the switch received the Super message.
	< CR/LF>	Line delimiter

PATENT
REEL: 037821 FRAME: 0118

Line	Field	Description
3	additional clarification	Variable text.
	<CR/LF>	Line delimiter
4-n	input msg echo	Copy of the super message. These lines are a copy of the entire input Super message, including the header.
	<CR/LF>	Line delimiter

3.2.2 Number Gap Message

If input message sequence checking is enabled and the Switch receives a message with a sequence number other than the number expected, the Switch will generate either a Number Gap status message or a Sequence Number Reject message. This message will be formatted as a separate output message in the Standard Switch Output Message format, as described in Section 3.1. Number Gap messages are SUPER messages.

The body of the Number Gap message is formatted as follows:

Line 1: [message category] **<CR/ LF>**
Line 2: [message type] **<CR/ LF>**
Lines 3 - 6: [nnnn] [nnnn] [nnnn] [nnnn] **<CR/ LF>**

Line	Field	Description
1	message category	"STATUS". This field identifies the message category and will contain "**STATUS**".
	<CR/LF>	Line delimiter.
2	message type	"NUMBER GAP". This field contains the string "NUMBER GAP", indicating that this is a Number Gap message from the switch.
	<CR/LF>	Line delimiter.
3-6	nnnn nnnn nnnn nnnn	Up to 4 sets of 4 numeric characters. A number gap message can report up to 16 gaps, with up to 4 **space** separated sequence numbers on each line. The value **nnnn** represents the input sequence number of a missed message.
	<CR/LF>	Line delimiter

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REEL: 037821 FRAME: 0119

When 16 gaps become outstanding then all subsequent input will be rejected (reason: REJ-INVALID MSG SEQ NO) until one of the following occurs:

- one or more missing messages are resent with the original sequence number;
- one or more gaps are filled with the "self-addressed" ADMIN message (see Section 3.3);
- the station gap table is erased upon receipt of either the REVERT TO SEQ 1 or RESET ORDER SEQUENCE (SUPER) message;
- The Tandem Operations Staff manually sets the next expected input sequence number, which also erases the station gap table.

PATENT
REEL: 037821 FRAME: 0120

3.3 Reject Messages

3.3.1 Switch Reject Messages

The Switch rejects a message received from a CTCI subscriber when the message fails to pass one of the Switch validation tests. The subscriber will receive a reject message in the Standard Switch Output Message format, as described in Section 3.1. All reject messages are STATUS messages.

The body of a reject message is formatted as follows:

Line 1:	[message category]		**<CR/ LF>**
Line 2:	[message type]	[reason]	**<CR/ LF>**
Lines 3 - n:	[input msg Echo]		**<CR/ LF>**

Line	Field	Description
1	message category	"STATUS" This field identifies the message category and will contain "STATUS".
	<CR/LF>	Line delimiter
2	message type	"REJ-" This field contains the string "REJ-", indicating that this is a Reject message from the switch.
	Reason	Fixed text. This field indicates the reason for the rejection. If there was a problem with the input message, the following text may be reported in the reason field: • MSG EXCEEDS MAX SIZE, message is greater than 1024 chars • INVALID FIRM, origin code is invalid • INVALID BRID/SEQ NO, branch office identifier is invalid • INVALID CATEGORY, category is invalid • DESTINATION INVALID, destination code is invalid • FORMAT ERROR, message is not in the proper format • INVALID MSG SEQ NO, message sequence number is missing, badly formatted, equal to zero, or the maximum number of gaps (16) was exceeded • SEQ NO REPEATED, sequence number duplicates the number of an earlier message. The message will not be accepted. • TOO MANY DESTINATIONS, Admin Message contains too many destination codes. • NOT ACCEPTING INPUTS, input station has been closed by the System Operator or the User. • UNKNOWN STATION, MMID entered on Line 0 by a Service Bureau firm does not equal the first four characters of the station associated with the select address. • REJspace-spaceSYSTEM UNAVAILABLE, The destination

PATENT
REEL: 037821 FRAME: 0121

Line	Field	Description
		application/system is unavailable.
3-n	input msg echo	This is a copy of the entire rejected message, including the header and trailer.
	<CR/LF>	line delimiter

3.3.2 Application Reject Messages

A message that successfully passes the Switch validation and safestore procedures is forwarded to the specified application, which performs additional validation on the text of the message. If an error is detected, the user will receive a reject message explaining why the original message could not be processed. All reject messages sent from NASDAQ applications will be forwarded to the subscriber via the Switch and will be contained in General Output Message format, as described in Section 3.1. All reject messages are STATUS messages.

If the application cannot process a message received from the user it will generate a Status Message that will indicate why the message was rejected. The format of an application reject message body is as follows:

Application Reject Message Body

Line 1: [optional MMID] **<CR/ LF>**
Line 2: [message category] **<CR/ LF>**
Line 3: [reason] **<CR/ LF>**
Line 4-n: [echo] **<CR/ LF>**

Line	Field	Description
1	optional MMID	4 characters (if present). Contains the 4-character MMID of the entering firm or the MMID of the firm the Service Bureau is acting for. If this option is utilized for multi-station lines, it will equal the 4-character MMID associated with the station.
	<CR/LF>	Line delimiter
2	message category	"STATUS". This field identifies the message category and will contain "STATUS".
	<CR/LF>	Line delimiter
3	reason	This field contains the text explaining why the application rejected the message.
	<CR/LF>	Line delimiter
4-n	Echo	These lines are a copy of the entire input Application message, including the header and trailer.
	<CR/LF>	Line delimiter

PATENT
REEL: 037821 FRAME: 0122

Because the Switch may change the category destination to "OTHER m" on inbound messages to NASDAQ market center, "OTHER m" is a valid Category/Destination combination for reject messages sent from NASDAQ Market Center to Users (Line 4-n echo of original message). The destination code "m" is, however, not valid for inbound messages (user to NASDAQ market center). While NASDAQ market center does echo back the original message, the echo may contain "m" because the destination code was changed to "m" before NASDAQ market center received the message.

PATENT
REEL: 037821 FRAME: 0123

4 Risk Management Messages

In addition to Trade Reporting and Trade Comparison/Clearing functions, NASDAQ also provides a Risk Management function to clearing firms. Risk Management enables clearing firms to monitor their correspondent (execution brokers) firms' buy and sell trading activities, set and reset buy/sell thresholds for individual correspondent, allow or inhibit Blockbuster and Sizable trades, suspend or restore or delete clearing relationships, reset Super Cap Marker for their correspondents, receive pre-alert, alert, and other Risk Management related broadcast messages, access a real time data base of correspondent trading information. Clearing firms can choose between the standard risk management functions or the enhanced functionality that allows a clearing firm to define limits based on the security market class (i.e. NNM, SC, OTCBB, CQS) and define blockbuster and sizable amounts. Clearing firms can elect to receive all their correspondents' trade messages. These Risk Management capabilities are provided through the CTCI as well as NASDAQ Workstation.

In 2003, NASDAQ introduced enhancements to the Risk Management function. The enhancements allow the clearing firm to customize the settings the risk management limits based on each individual correspondent. NASDAQ has created two additional CTCI messages to support the Enhanced Risk Management Functions, Function J and TCAJ, which are similar to Function K and TCAK.

4.1 Risk Management Input Messages

4.1.1 Risk Management Information

The following Risk Management information and capabilities are provided to clearing firms on-line by the trade reporting service. All CTCI UM messages are described in section 4.2 of the CTCI Trade Reporting Programming Specification, and their respective exhibits are referenced here.

(1) Buy/Sell Thresholds/SuperCaps
Clearing firms can assign Buy/Sell Thresholds/SuperCaps (limits) in dollar amount for each of their execution brokers or correspondents. Based on these clearing firms' assigned thresholds, NASDAQ will issue or disseminate various pre-alert and alert messages to the clearing firms and the trading community. Therefore, a clearing firm can manage its risks and liabilities through the assignment of these thresholds. A clearing firm can exempt an execution broker from the Risk Management process by assigning all 9's (unlimited credits) to these thresholds. Operations assigns all 9's to these thresholds for all self-clearing execution brokers.

(2) Buy/Sell Trade Amount
NASDAQ continuously calculates, accumulates, and compares the Buy/Sell Trade Amount against the clearing firm assigned Buy/Sell Thresholds for the respective execution broker as trades are entered into ACT.

(3) Buy/Sell Compared Amount
NASDAQ continuously calculates and accumulates the Buy/Sell Compared Amount for the respective execution broker as trades are locked-in (compared) in Trade Reporting. They are used to determine the Buy/Sell Super Cap Limits and the setting and broadcasting of the Super Cap Marker.

(4) Buy/Sell SuperCap Limits

PATENT
REEL: 037821 FRAME: 0124

The SuperCap limits have been combined with the trading thresholds. Please refer to bullet 1 for more information.

(5) SuperCap Marker
For a correspondent, when either it's Buy/Sell Compared Amount is exceeded its corresponding Buy/Sell Super Cap Limit, a Super Cap Marker (set the RMI Field from "A" to "M" in the TCPI message, section 4.2.13 in the CTCI Trade Reporting Programming Specification) pertaining to the correspondent will be broadcast to the entire trading community and the Marker ("*" next to its MMID) will be displayed on every security that the correspondent makes a market. In the system, this Marker will have a value of "C" during the current trade date. The clearing firm can reset this Marker by increase the specified correspondent's Buy/Sell SuperCap Limits using the CTCI "K" Function (section 4.1.2), Function J (section 4.1.4) or using the NWII Risk Management Scan. If the clearing firm does not reset the Marker during the current trading date, the Marker will carry into the next trading date with the value of "P". The clearing firm may delete the previous date Marker by update the field to "*". The Marker resetting event will be broadcasted to trading community by the same media as above.

(6) Risk Management State
A clearing firm may delete (by using the CTCI "K" or "J" Functions or the NWII Risk Management Scan Function by updating RMS Field to "D") a clearing relationship with anyone of its correspondents and cease its liability to clear that correspondent's trades. This deletion event will be broadcasted to the trading community through the TCPI message by setting the respective correspondent's RMI to "D" and a "MMID Clearing Delete" Workstation message (where MMID is the correspondent ID).

(7) Blockbuster Trade
A Blockbuster Trade (BBT) message (TCBT, section 4.2.3) will be sent to the specified executing correspondents and their clearing firms when a correspondent trade meets the BBT conditions. NASDAQ will hold (i.e., assign a "H" Status) the BBT from normal trade comparison processing for a pre-determined time period (currently set at 15 minutes) pending clearing firms' actions. Clearing firms may inhibit or allow (section 4.1.3) the BBT during this time period. When this time period is expired and the clearing firms have not taken actions, the BBT will be accepted as normal trade (i.e., assign an "U" or "O" Status and process accordingly). If the firm is using the enhanced functionality NASDAQ will use the default Blockbuster action (allow or inhibit) defined by the clearing firm after the 15 minute held period is over and the user has not taken action on the trade.

(8) Sizable Trade
A Sizable Trade message (TCST, section 4.2.4) will be sent to the specified executing correspondents and their clearing firms when a correspondent trade meets the Sizable Trade conditions. NASDAQ will hold (i.e., assign a "H" Status) the Sizable Trade from normal trade comparison processing for a pre-determined time period (currently set at 15 minutes) pending clearing firms' actions. Clearing firms may inhibit or allow (section 4.1.3) the Sizable Trade during this time period. When this time period is expired and the clearing firms have not taken actions, the Sizable Trade will be killed by NASDAQ (i.e., assign a "K" Status).

9) Net Amount Traded Pre-Alert Message
If a correspondent's Buy/Sell Net Amount Traded (NAT) is reaching 70% of the clearing firm assigned Buy/Sell SuperCap, a NAT Pre-Alert message (TTNP, section

PATENT
REEL: 037821 FRAME: 0125

4.2.5) will be sent to the specified executing correspondents and their clearing firms. This message will contain the trade that reached the Pre-Alert SuperCap Limit.

(10) Net Amount Traded Alert Message
If a correspondent's Buy/Sell Net Amount Traded (NAT) is reaching 100% of the clearing firm assigned Buy/Sell SuperCap, a NAT Alert message (TTNT, section 4.2.5) will be sent to the specified executing correspondents and their clearing firms. This message will contain the trade that reached the Alert SuperCap Limit.

(11) Net Amount Compared Pre-Alert Fallback Message
When a correspondent's Net Amount Compared (NAT) falls back to lower than the 70% of the clearing firm assigned Buy/Sell SuperCap due to trade cancellations or corrections, a NAT Pre-Alert Fallback message (TTFP, section 4.2.6) will be sent to the specified executing correspondents and their clearing firms. This message will contain the trade that caused the fallback of the Pre-Alert SuperCap Limit.

(12) Net Amount Traded Alert Fallback Message
When a correspondent's Buy/Sell Net Amount Compared (NAT) falls back to lower than 100% of the clearing firm assigned Buy/Sell SuperCap due to trade cancellations or corrections, a NAT Alert Fallback message (TTFB, section 4.2.6) will be sent to the specified executing correspondents and their clearing firms. This message will contain the trade that reached the Pre-Alert SuperCap Limit.

(13) Participant Indicators Message
In addition to the opening broadcast, a Participant Indicator message (TCPI, refer to section 4.2.13 in the CTCI Trade Reporting Programming Specification) pertaining to a specific participant will be broadcast to the trading community if such participant's Super Cap Marker, Risk Management or clearing relationship state is changed during the trading date.

14) Correspondent Trade Messages Available To Clearing Firm
The following correspondent trade messages are available to clearing firms. To receive these correspondent trade messages, with the exception of TCBT and TCST that a clearing firm always receives, a clearing firm has to indicate its election to NASDAQ Operations to set up the Firm Profile record for such election. With these correspondent trade messages, it is possible for a clearing firm to build an image trade file for all its correspondents to meet its internal business requirements. In conjunction with the above Risk Management messages, a clearing firm also able to design a Risk Management System to meet its own Risk Management requirements.

Message Type (Exec. Broker)	Message Title	Message Type (Clr. Broker)
TTEN	Trade Entry	CTEN
TTAL	Alleged Trade	CTAL
TTUD	Trade Update	CTUD
TCLK	Locked-In Trade	CCLK
TCBK	Break Trade Notice	CCBK
TCER	Error Trade Notice	CCER

PATENT
REEL: 037821 FRAME: 0126

Message Type (Exec. Broker)	Message Title	Message Type (Clr. Broker)
TCAN	Cancel Trade Notice	CCAN
TTNW	No/Was Trade Notice	CCNW
TCDE	Decline Trade	CCDE
TCBT	Blockbuster Trade	CCBT, TCBT
TCST	Sizable Trade	CCST, TCST

The data content of the clearing firm messages is identical to that of the Executing Broker, except Memo and Reference Number fields will be spaced filled in the clearing firm messages. However, if the trade's origin is an external system, the mnemonic of that system will appear in the Reference Number field.

PATENT
REEL: 037821 FRAME: 0127

4.1.2 Risk Management Query and Update (Function K)

A clearing firm may enter this K Function message to query its correspondents' Risk Management information or update a correspondent's Buy/Sell Thresholds, reset the Super Cap Marker or change the RM State. A correspondent execution broker may use this message to query (only) its own risk management information. An acceptance of this message will result in a Risk Management Query/Update Response message (TCAK, refer to section 4.2.1) forwarded to the entering subscriber's CTCI.

The header Destination Code on Line 1A for this message must be ACTR.

Message Format

Field Names	Position	Format	Description
Function Code	1-1	X(1)	Function Code = K
Action Code	2-2	X(1)	Q = Query U = Update (for clearing firms only)
Clearing Broker	3-6	X(4)	Clearing firm ID.
Executing Broker	7-10	X(4)	Executing broker ID.
Buy-side Threshold	11-20	9(10)	For U = enter the clearing firm's assigned Buy Threshold in dollar value for the specified EXID. The entry is right-justified in the range of 0-9999999999 (unlimited). For Q = blank
Sell-side Threshold	21-30	9(10)	For U = enter the clearing firm's assigned Sell Threshold in dollar value for the specified EXID. The entry is right-justified in the range of 0-9999999999 (unlimited). For Q = blank
Super-Cap Marker	31-31	X(1)	For Q = blank For U = * for reset, or blank, "P" carried over from previous day.
Risk Management State	32-32	X(1)	For Q: blank For U: D = Delete A = Authorize/Activate clearing relation with EXID, correspondent firm cannot enter As-of T+2 to T+N trades (except self-clearing) Y = Authorize/Activate clearing relation with EXID, correspondent firm can enter As-of T+2 to T+N trades (except self-clearing) blank-no change

PATENT
REEL: 037821 FRAME: 0128

The CLID and EXID (CLID = EXID = self clearing) are required for query and update. For self-clearing execution brokers, there is no need to use this function because NASDAQ does not perform RM for them. For query, all other fields may leave blank filled.

The same day Marker (= "C") will be reset automatically if the respective Buy/Sell Thresholds are updated so that the related Super Cap Limits are no longer exceeded by the amount of compared trades on each side. If a marker is not caused to be reset on the day it was set, it carries over to the following business day, and it must then be reset by a clearing firm entry of " * " in the Super Cap Marker field. For an entry to be effective in resetting a marker that was carried over from a prior day, the reset must be entered at a time that the amount of compared trades is less than the respective Buy/Sell Super Cap Limits.

PATENT
REEL: 037821 FRAME: 0129

4.1.3 Clearing Firm Inhibit/ Allow Blockbuster and Sizable Trade (Function I)

A clearing firm may inhibit or allow a Held Blockbuster (BBT) or Sizable trade via its CTCI facility by entering an I (inhibit) function message to the system within the Held Trade time period (currently set for 15 minutes). If the I function update action resulted in a change of the held trade status, an appropriate TCBT, CCBT, TCST, or CCST will be forwarded to the concerned execution brokers and clearing firms. This message will work the same way as the Workstation AI Function.

The header Destination Code on Line 1A for this message must be ACTB.

Message Format

Field Name	Position	Format	Description
Function Code	1-1	X(1)	Function Code = I
Reference Number	2-7	9(6)	Optional entry of clearing firm's reference number.
Control Number	8-17	X(10)	The system assigned control number of the BBT or Sizable trade.
Action Code	18-18	X(1)	Valid values: I = Inhibit A = Allow

PATENT
REEL: 037821 FRAME: 0130

4.1.4 Enhanced Risk Management Query and Update (Function J)

A clearing firm may enter this message to query a correspondent's Risk Management information or update the correspondent's Buy/Sell SuperCap, Blockbuster and Sizeable Amounts for the individual Mkt (Security Type) or ALL. The message is also used to reset the Super-Cap Marker or change the RM State. An execution broker may also use this message to query (only) its own Risk Management information. An acceptance of this message will result in a TTAJ Risk Management Query/Update Response message (TTAJ, section 4.2.2) to the entering subscriber's CTCI. Note: if multiple Markets have to be changed, a separate Function J Message is required for each market.

The header Destination Code on Line 1A for this message must be ACTR.

The CLID and EXID (CLID = EXID = self clearing) are required for query and update. For self-clearing execution brokers, there is no need to use this function because NASDAQ does not perform RM for them. For query, all other fields may leave blank filled.

The same day Marker (="C") will be reset automatically if the respective Buy/Sell Thresholds are updated so that the related Super Cap Limits are no longer exceeded by the amount of compared trades on each side. If a marker is not caused to be reset on the day it was set, it carries over to the following business day, and it must then be reset by a clearing firm entry of " * " in the Super Cap Marker field. For an entry to be effective in resetting a marker that was carried over from a prior day, the reset must be entered at a time that the amount of compared trades is less than the respective Buy/Sell Super Cap Limits.

Message Format

Field Names	Position	Format	Description
Function Code	1-1	X(1)	Function Code = J
Action Code	2-2	X(1)	Q = Query U = Update (for clearing firms only, not available to correspondent's query)
Clearing Broker	3-6	X(4)	Clearing firm ID.
Executing Broker	7-10	X(4)	Correspondent executing broker ID.
Market Type	11-11	X(1)	A clearing firm may set limits for the following market types: A = All N = NNM S = NASDAQ Capital Market O = OTCBB C = CQS All is an overall limit for a correspondent. Covers all clearing eligible securities. Required for each correspondent.
Super Cap Marker	12-12	X(1)	For update, enter the only allowable " * " to reset Marker = "P" carried over from previous day.

PATENT
REEL: 037821 FRAME: 0131

Field Names	Position	Format	Description
Risk Management State	32-32	X(1)	Blank = Query D = Delete clearing relation with EXID; A = Authorize/Activate clearing relation with EXID, correspondent firm cannot enter As-of T+2 to T+N trades (except self-clearing); Y = Authorize/Activate clearing relation with EXID, correspondent firm can enter As-of T+2 to T+N trades (except self-clearing)
Buy SuperCap			The clearing firm's assigned Buy Supercap/Threshold in dollar value for the specified EXID. The entry is right-justified in the range of 0-999999999999 (unlimited). blank = query
Sell SuperCap			The clearing firm's assigned Sell SuperCap/threshold in dollar value for the specified EXID. The entry is right-justified in the range of 0-999999999999 (unlimited). blank = query
Blockbuster Amount			Clearing firms may set a single trade dollar amount threshold for each of the market types. 0 – 999999999999 for this market type blank = query
Blockbuster Default Action			A clearing firm may define the default action to be taken on a held transaction after the 15-minute review period has ended without the clearing firm taking action on the trade. A = Allow trade I = Inhibit Trade
Sizable Amount			Clearing firms may set a single trade dollar amount threshold for each of the market types when the market has reached its SuperCap limit. 0 – 999999999999 for this market type blank = query
Sizable Default Action			A clearing firm may define the default action to be taken on a held transaction after the 15-minute review period has ended without the clearing firm taking action on the trade. A = Allow trade I = Inhibit Trade
Summarization Indicator		X(1)	Valid values: P = price point A = average price blank = none

PATENT
REEL: 037821 FRAME: 0132

Field Names	Position	Format	Description
Make Default			A clearing firm may use Function J to update limits for intraday use or for permanent limit update. N = the entered limits are for intraday use only and will not be carried to the next business day Y = the entered limits will be used as the default and will be carried to the next business day

PATENT
REEL: 037821 FRAME: 0133

4.2 Risk Management Output Messages

4.2.1 Risk Management Query Update Response (TCAK)

This message is transmitted to the executing broker and the corresponding clearing firm. The message includes the current or updated levels of the buy and sell side thresholds, amounts traded, Super-caps and compared amounts. Included as well, are the current status of the marker, the state of the clearing arrangement, and the date and time of the read-out.

Line 1: Other MMID cr lf
Line 2: TCAK cr lf
Line 3: (Action) (Clrg ID) (EXID) BT BAT BSC BCA ST SAT SSC SCA
(Marker)(State)(Date)(Time)

Message Format

Field Name	Position	Format	Description
Action Code	1-1	X(1)	Valid values: Action Codes: Q = Query U = Update
Clearing ID	2-5	X(4)	Clearing firm MMID
Executing MMID	6-9	X(4)	Correspondents MMID
Buy Threshold	10-19	9(10)	Buy side Threshold level entered by clearing firm
Buy Amount Traded	20-29	9(10)	Current dollar amount of reported Buy side trades of EXID
Buy Super-Cap	30-39	9(10)	
Buy Compared Amt	40-49	9(10)	Current dollar amount of compared Buy side trades of EXID
Sell Threshold	50-59	910)	Sell side Threshold level entered by clearing firm
Sell Amount Traded	60-69	9(10)	Current dollar amount of reported Sell side trades of EXID
Sell Super-Cap	70-79	9(10)	
Sell Compared Amt	80-89	9(10)	Current dollar amount of compared Sell side trades of EXID
Super-Cap Marker	90-90	X(1)	Current Status of Marker. Valid values: C = Marker set current day P = Marker set prior day, blank = no Marker set
State of Clearing	91-91	X(1)	State of Clearing arrangement. Valid values: A = Active no SuperCap Marker M = Active with SuperCap Marker D = Deleted

PATENT
REEL: 037821 FRAME: 0134

Field Name	Position	Format	Description
Date	92-97	9(6)	MMDDYY - current date
Time	98-103	9(6)	HHMMSS - current time of the record data

PATENT
REEL: 037821 FRAME: 0135

4.2.2 Enhanced Risk Management Query Update Response (TTAJ)

This message is transmitted to the executing broker and the corresponding clearing firm. For each accepted Risk Management query/update entry via the J Function, NASDAQ will respond with the current updated RM information for the specified EXID and forward to the requesting subscriber. One message will be sent for each security market type changed. The message will be generated when any of the modifiable fields below are changed.

Line 1: Other MMID cr lf
Line 2: TTAJ cr lf

Message Format

Field Name	Position	Format	Description
Action Code	1-1	X(1)	Valid values: Q = Query U = Update
Clearing ID	2-5	X(4)	Clearing firm MMID
Executing MMID	6-9	X(4)	Executing Firm's MPID
Risk Management State	91-91	X(1)	State of Clearing arrangement. Valid values: A= Active (No Super-Cap Marker) M= Active (With Super-Cap Marker) D = Deleted A = Authorize/Activate clearing relation with EXID, correspondent firm cannot enter As-of T+2 to T+N trades (except self-clearing) Y = Authorize/Activate clearing relation with EXID, correspondent firm can enter As-of T+2 to T+N trades (except self-clearing) blank-no change
Market Type	11-11	X(1)	A clearing firm may set limits for the following market types: A = All. This is an overall limit for a correspondent. Covers all clearing eligible securities. Required for each correspondent. N = Limit for NNM securities R = Limit for Small Cap securities P = OTCBB C = CQS S = NASDAQ Capital Market O = OTCBB
Buy Amount Traded	20-29	9(10)	Buy net amount traded by EXID
Buy Super-Cap	30-39	9(10)	Buy Super-Cap set by clearing firm

PATENT
REEL: 037821 FRAME: 0136

Field Name	Position	Format	Description
Buy Compared Amt	40-49	9(10)	Current dollar amount of compared Buy side trades of EXID
Sell Amount Traded	60-69	9(10)	Sell net amount traded by EXID
Sell Super-Cap	70-79	9(10)	
Sell Compared Amt	80-89	9(10)	Current dollar amount of compared Sell side trades of EXID.
Super-Cap Marker	90-90	X(1)	Current Status of Marker. Valid values: C = Marker set current day P = Marker set prior day, blank = no Marker set
Blockbuster Amount			0 – 999999999999 for this market type Clearing firms may set a single trade dollar amount threshold for each of the market types.
Blockbuster Default Action			A clearing firm may define the default action to be taken on a held transaction after the 15-minute review period has ended without the clearing firm taking action on the trade. Valid values: A = Allow. The trade is eligible for further trade reporting processing I = inhibit
Sizable Amount			0 – 999999999999 for this market type Clearing firms may set a single trade dollar amount threshold for each of the market types when the market has reached its SuperCap limit.
Sizable Default Action			A clearing firm may define the default action to be taken on a held transaction after the 15-minute review period has ended without the clearing firm taking action on the trade. Valid values: A = Allow. The trade is eligible for further trade reporting processing I = inhibit
Summarization Indicator		X(1)	Valid values: P = price point A = average price blank = none
Date			MMDDYY current date
Time			Time: HHMMSS

PATENT
REEL: 037821 FRAME: 0137

4.2.3 Blockbuster Trade Notification (TCBT)

A Blockbuster-Trade (BBT) is a correspondent trade with a Contract Amount equal to or greater than the Blockbuster Trade Dollar Volume set by NASD (currently set at one million dollars) or the blockbuster amount set by the clearing firms using NASDAQ's Enhanced Risk Management.

The following types of trades are not subject to blockbuster validation:

- Trades submitted with the .B or .SB modifier
- Trades submitted to NASDAQ by one of NASDAQ's execution systems
- QSR entries
- Trade Report Only transactions (no clearing)

Clearing firms will be notified of Blockbuster trades and the trades will not be eligible for matching until the clearing firm ALLOWS the trade or the 15-minute HELD period is over. If the correspondent's risk management capmark is on the trade will not be subjected to Blockbuster validation but will be subjected to SIZABLE validation.

Line 1: OTHER MMID cr lf
Line 2: TCBT cr lf
Line 3: (Ctrl Number)(Status)(ITI)(Time) cr lf

Message Format

Field Name	Position	Format	Description
Reference Number	1-6	9(6)	User assigned reference number
Control Number	7-16	X(10)	ACT System assigned number associated with the trade reporting record
Trade Status	17-17	X(1)	Valid values: H = Held (ACT automatically set "H" for 15 minutes pending clearing broker action) I = Inhibited (if clearing broker inhibited the BBT) U = Unanswered MM Entry (ACT set the MM entry to "U" after "H" period expired or if allowed by clearing firm) O = OE Entry trade (NASDAQ set the OE entry to "O" after "H" period expired or allowed by clearing firm) K = Killed
Inhibit Trade Indicator	18-18	X(1)	Valid values: B = Buy side Clearing firm inhibited the trade S = Sell side Clearing firm inhibited the trade blank = Neither clearing firm has inhibited the trade A = One or both Clearing firms have "allowed" the trade, as required.

PATENT
REEL: 037821 FRAME: 0138

Field Name	Position	Format	Description
Start Time	19-24	9(6)	HHMMSS Entry time of the BBT
Action Time	25-30	9(6)	HHMMSS Time of receipt of Action input or expiration of review period

PATENT
REEL: 037821 FRAME: 0139

4.2.4 Sizable Trade Notification (TCST)

A Sizable Trade is a correspondent trade with a Contract Amount equal to or greater than the Sizable Trade Dollar Volume set by NASD (currently set at two hundred thousand dollars) or by the sizable set by clearing firms using the NASDAQ's Enhanced Risk Management, and at least one of the executing broker has the Risk Management Capmark set.

Trades submitted to NASDAQ by one of NASDAQ's execution systems, QSR or Trade Report Only reports are not subject to Sizable validation. Clearing firms will be notified of Sizable trades and the trades will not be eligible for matching until the clearing firm ALLOWS the trade or the 15 minute HELD period is over. If the clearing firm does not ALLOW the trade within 15 minutes, NASDAQ will INHIBIT the transaction and it will not be eligible for NASDAQ's matching process. Clearing firms using NASDAQ's Enhanced Risk Management may set the default action to ALLOW for trades if no response has been received after the 15 minute HELD period.

Line 1: OTHER MMID cr lf
Line 2: TCST cr lf
Line 3: (Ref Number)(Ctrl Number)(Status)(I/A TI)(Time)(Action Time) cr lf

Message Format

Field Name	Position	Format	Description
Reference Number	1-1	9(6)	User assigned reference number
Control Number	2-11	X(10)	ACT System assigned number associated with the trade reporting record
Trade Status	12-12	X(1)	Valid values: H = Held (ACT automatically set "H" for 15 minutes pending clearing broker action) I = Inhibited (if clearing broker inhibited the Sizable transaction) K = Killed (ACT set the entry to "K" after "H" period expired) U = Unanswered MM entry O = OE Entry
Inhibit Trade Indicator	13-13	X(1)	Valid values: B = Buy side Clearing firm inhibited the trade S = Sell side Clearing firm inhibited the trade blank = Neither clearing firm has inhibited the trade A = One or both Clearing firms have "allowed" the trade, as required
Start Time	14-19	9(6)	HHMMSS Entry time of the Sizable Trade
Action Time	20-25	9(6)	HHMMSS-Time of receipt of Action input or review period expiration time

PATENT
REEL: 037821 FRAME: 0140

4.2.5 Net Trade Threshold Notification (TTNT/ TTNP)

Denotes that the dollar value of this trade has contributed to the cumulative Net Amount Traded (NAT) such that the resulting NAT exceeds one or both of the trading party's (i.e. the executing broker as MM, OE, MMGU, or OEGU) Net Trade Threshold (NTT). This threshold alert message shall be forwarded to each party of the trade whose NTT is exceeded and to its clearing firm if any.

Line 1: OTHER MMID cr lf
Line 2: TTNT cr lf
Line 3: (NTL Control Number) (Trade Text) cr lf
Line 3A: (NTL Control Number) (Trade Text plus 14 character TMTR symbol) cr lf

The trade text field contains an echo of the MM original Session or As-Of Session and shall be formatted as a MM Trade Entry Message (section 4.1.3 in the CTCI Trade Reporting Programming Specification).

Note 1: If the trade was in a CQS security, the 5-character CQS symbol will appear in the "Trade Text"; the 14-character TMTR symbol will be appended at the end of the message.

Note 2: If a firm's NAT is caused to exceed its NTT as the result of an update to its NTT, ""EXID" NTT UPDATED" will appear instead of the above fields, i.e. NTL Indicator, Control Number and Trade Text; where EXID is the MMID of the firm whose NTT was updated. (Will not be included in the initial phase implementation.)

Note 3: A Pre-Alert Trade Threshold message for correspondents and their clearing firms (TTNP) which is identical to TTNT, will be transmitted if the dollar value of trades exceeds the trade threshold percent established by the NASD.

Message Format

Field Name	Position	Format	Description
NTL Indicator	1-1	X(1)	Contains "M" when the dollar amount of this trade contributes to the MM's Net Amount Traded (NAT) so as to exceed the MM's Net Trade Limit (NTL), or "O" when the dollar amount of this trade contributes to the OE's NAT so as to exceed the OE's NTL. M = exceeds MM Trade Limit O = exceeds OE Trade Limit
Control Number	2-11	X(10)	Control number that the system had assigned to the transaction when it was originally received from the subscriber. The control number is required to uniquely identify the trade reporting record in the trade reporting File Control Number associated with the trade reporting record
As-of	12-12	X(1)	Valid values: Y = As-of (T+1 to T+n) space = Original (T Day entry)

PATENT
REEL: 037821 FRAME: 0141

Field Name	Position	Format	Description
Security Class	13-13	X(1)	Valid U.S. market values: N = National Market P = Non-NASDAQ OTC R = NASDAQ Capital Market
B/S/X	14-14	X(1)	Valid values: B = Bought S = Sold X = Crossed Z = Dealer Sold Short E = Dealer Sold Short Exempt C = Selling Customer Sold Short K = Selling Customer sold Short Exempt P = Contra side sold short A = Contra sold short exempt
Reference Number	15-20	X(6)	User assigned reference number
Volume	21-28	9(8)	Number of shares
Symbol	29-33	X(5)	NASDAQ SECID
Price:			This field includes dollar, numerator, and trade digit.
Dollar	34-37	9(4)	N/A
Numerator	38-40	9(3)	N/A
Trade Digit	41-41	X(1)	A = Decimal Unit Price B = Contract Amount
Trade Modifier	42-44	X(3)	Valid values: SLD = Late B = Bunched SB = Late Bunched SNN = Seller's Option C = Cash ND = Next Day T = .T PRP = Prior Reference Price space = Regular W = Average Price TS = T appended by system SLS = SLD appended by system If submitting a Clearing only transaction for matching of ex-clearing transactions (i.e. C, ND or Snn) the field will be redefined to: Trade modifier: X(1), space-filled Days: 9(2), 00 for Cash, 01 for ND, 02, 04-60 for Snn, space for normal 3 day settlement

PATENT
REEL: 037821 FRAME: 0142

Field Name	Position	Format	Description
Price Override	45-45	X(1)	Valid values: O = Override space = No override
OEID	46-49	X(4)	MMID of the OE side
OEGU	50-53	X(4)	MMID of give up on the OE side
OE Clear Number	54-57	9(4)	space = Major clear Number
MMID	58-61	X(4)	Required MMID of the MM side
MMGU	62-65	X(4)	MMID of give up on the MM side
MM Clear Number	66-69	9(4)	space = Major clear Number
MM PA Indicator	70-70	X(1)	Valid values: P or space = Principal A = agent R = Riskless Principal
Trade Report Flag	71-71	X(1)	space = Report by rules N = No Report On StepOut transactions, if the Trade Report Flag is set to space NASDAQ will make adjustments to the Section 31 fee for the transaction, if the Trade Report Flag is set to "N" no Section 31 fee adjustment will take place, and the Clearing Flag must be set to space or G.
Clearing Flag	72-72	X(1)	Valid values: space = clear G = Automatic Give-up Lock-in N = no clear Q = QSR no clear Z = QSR clear L = Ext. Sys. Locked-in (The "L" value is output for NASDAQ ESI executions) On StepOut transactions, if the Trade Report Flag is set to space NASDAQ will make adjustments to the Section 31 fee for the transaction, if the Trade Report Flag is set to "N" no Section 31 fee adjustment will take place, and the Clearing Flag must be set to space or G.
Special Trade Indicator	73-73	X(1)	Valid values: Y = Special trade S = Step-out trade X = Special and Step-out trade F = fee transfer for a trade that occurred on NASDAQ O = fee transfer for a trade that occurred off

PATENT
REEL: 037821 FRAME: 0143

Field Name	Position	Format	Description
			NASDAQ space = Not Special Trade (none of the above) On Step-Out transactions, if the Trade Report Flag is set to space NASDAQ will make adjustments to the Section 31 fee for the transaction, if the Trade Report Flag is set to "N" no Section 31 fee adjustment will take place, and the Clearing Flag must be set to space or G.
Execution Time	74-79	9(6)	Required Military HHMMSS E.T.
Memo	80-89	X(10)	User Memo
Decimal Price	90-101	9(12)	Unit Price = 999999V999999 for Trade Digit "A" Contract Price = 0999999999V99 for Trade Digit "B"
Contra Branch Sequence	102-109	X(8)	Required by OATS for MM QSR or AGU trade only.
Trade Date	110-117	9(8)	Must be entered for T+2 or older, mmddyyyy format.
Reversal Indicator	118-118	X(1)	Valid values: space = not a Reversal R = Reversal of NASDAQ exchange trade (allowed only for as-of trades) K = Reversal of NASD (ACT reported) trade
OE P/A Indicator	119	X(1)	
Filler	120-125	X(6)	space-filled (reserve for future use)
Clearing Price	126-137	X(12)	Price inclusive of commissions. This field will be included only for firms who select this option in their firm profiles.
TMTR Symbol		X(14)	The TMTR Symbol if CQS security. This field is included in the message if the Security Class is either C or Z. If not, the field is not sent.

PATENT
REEL: 037821 FRAME: 0144

4.2.6 Net Trade Threshold Fallback Notification (TTFB/ TTFP)

Denotes that the dollar value of this trade has contributed to the cumulative NAT such that the resulting NAT has fallen back below one or both of the party's NTT. This threshold fallback message shall be forwarded to the party(s) of the trade whose NAT was now within its NTT limit and to its clearing firm, if the firm is not self-clearing.

This message is identical to the TTNT message except the NTL Indicator will refer to the party whose NAT has Fallen Back below the NTT.

If a firm's NAT is caused to be less than its NTT as the result of an update to its NTT, "EXID NTT UPDATED" will appear instead of the above fields, i.e. NTL Indicator, Control Number and Trade Text; where EXID is the MMID of the firm whose NTT was updated.

A Pre-Alert Fall-back message for correspondents and their clearing firms (TTFP) that is identical to TTFB will be transmitted if the dollar value of trades exceeding the trade threshold percent established by the NASD decreases (due to a trade correction or threshold adjustment).

In the event that one trade exceeds the threshold percentage both the TTNP and the TTFB message will be transmitted.

Line 1: OTHER MMID cr lf
Line 2: TTFB cr lf
Line 3: (NTL Control Number) (Trade Text) cr lf
Line 3A: (NTL Control Number) (Trade Text, plus 14 character TMTR symbol) cr lf

Message Format

Field Name	Position	Format	Description
NTL Indicator	1-1	X(1)	Valid values: M = exceeds MM Trade Limit O = exceeds OE Trade Limit
Control Number	2-11	X(10)	Control Number associated with the trade reporting record
As-of	12-12	X(1)	Valid values: Y = As-of (T+1 to T+n) space = Original (T Day entry)
Security Class	13-13	X(1)	U. S. Market: Valid values: N = National Market P = Non-NASDAQ OTC R = NASDAQ Capital Market
B/S/X	14-14	X(1)	Valid values: B = Bought S = Sold X = Crossed Z = Dealer Sold Short

PATENT
REEL: 037821 FRAME: 0145

Field Name	Position	Format	Description
			E = Dealer Sold Short Exempt C = Selling Customer Sold Short K = Selling Customer Sold Short Exempt P = Contra Side Sold short A = Contra Sold Short exempt
Reference Number	15-20	X(6)	User assigned reference number
Volume	21-28	9(8)	Number of shares
Symbol	29-33	X(5)	NASDAQ SECID
Price:			This field includes dollar, numerator, and trade digit.
Dollar	34-37	9(4)	Dollar portion of the price
Numerator	38-40	9(3)	Numerator portion of the price
Trade Digit	41-41	X(1)	1 – 9 A = Decimal Unit Price B = Contract Amount
Trade Modifier	42-44	X(3)	Valid values: SLD = Late B = Bunched SB = Late Bunched SNN = Seller's Option C = Cash ND = Next Day T = .T PRP = Prior Reference Price space = Regular W = Average Price TS = T appended by system SLS = SLD appended by system If submitting a Clearing only transaction for matching of ex-clearing transactions (i.e. C, ND or Snn) the field will be redefined to: Trade modifier: X(1), space-filled Days: 9(2), 00 for Cash, 01 for ND, 02, 04-60 for Snn, space for normal 3-day settlement
Price Override	45-45	X(1)	Valid values: O = Override space = No override
OEID	46-49	X(4)	MMID of the OE side
OEGU	50-53	X(4)	MMID of give up on the OE side
OE Clear Number	54-57	9(4)	space = Major clear Number
MMID	58-61	X(4)	Required MMID of the MM side
MMGU	62-65	X(4)	MMID of give up on the MM side

PATENT
REEL: 037821 FRAME: 0146

Field Name	Position	Format	Description
MM Clear Number	66-69	9(4)	space = Major clear Number
MM PA Indicator	70-70	X(1)	Valid values: P or space = Principal A = agent R = Riskless Principal
Trade Report Flag	71-71	X(1)	Valid values: space = Report by rules N = No Report On StepOut transactions, if the Trade Report Flag is set to space NASDAQ will make adjustments to the Section 31 fee for the transaction, if the Trade Report Flag is set to "N" no Section 31 fee adjustment will take place, and the Clearing Flag must be set to space or G.
Clearing Flag	72-72	X(1)	Valid values: space = clear G = Automatic Give-up Lock-in N = no clear Q = QSR no clear Z = QSR clear L = Ext. Sys. Locked-in (The "L" value is output through TTEN/TTAL messages only for NASDAQ ESI executions.) On StepOut transactions, if the Trade Report Flag is set to space NASDAQ will make adjustments to the Section 31 fee for the transaction, if the Trade Report Flag is set to "N" no Section 31 fee adjustment will take place, and the Clearing Flag must be set to space or G.
Special Trade Indicator	73-73	X(1)	Valid values: Y = Special trade S = Step-out trade X = Special and Step-out trade F = fee transfer for a trade that occurred on NASDAQ O = fee transfer for a trade that occurred off NASDAQ space = Not Special Trade (none of the above) On Step-Out transactions, if the Trade Report Flag is set to space NASDAQ will make adjustments to the Section 31 fee for the transaction, if the Trade Report Flag is set to "N" no Section 31 fee adjustment will take place, and the Clearing Flag must be set to

PATENT
REEL: 037821 FRAME: 0147

Field Name	Position	Format	Description
			space or G.
Execution Time	74-79	9(6)	Required HHMMSS
Memo	80-89	X(10)	User Memo
Decimal Price	90-101	9(12)	Unit Price = 999999V999999 for Trade Digit "A" Contract Price = 0999999999V99 for Trade Digit "B"
Contra Branch Sequence	102-109	X(8)	Required by OATS for MM QSR or AGU trade only.
Trade Date	110-117	9(8)	Must be entered for T+2 or older, mmddyyyy format.
Reversal Indicator	118-118	X(1)	Valid values: space = not a Reversal R = Reversal of NASDAQ exchange trade (allowed only for as-of trades) K = Reversal of NASD (ACT reported) trade
OE P/A Indicator	119	X(1)	
Filler	120-125	X(6)	Space Filled (reserve for future use)
Clearing Price	126-137	X(12)	Price inclusive of commissions. This field will be included only for firms who select this option in their firm profiles.
TMTR Symbol		X(14)	The TMTR Symbol if CQS security. The TMTR Symbol field is included in the message if the Security Class is either C or Z. If not, the field is not sent.

PATENT
REEL: 037821 FRAME: 0148

4.3 Reject Message Format

If the application cannot process a message received from the subscriber, it will generate a Status Message for the originator that indicates why the message was rejected. The Status Message will be received by the originator as the text portion of a Standard Switch Output Message.

Line 1: MMID <*CR/LF*>
Line 2: 'STATUS' <*CR/LF*>
Line 3: 'REJ' - Reject Reason <*CR/LF*>
Line 4: BRID SQNO HH:MM:SS <*CR/LF*>
Line 5: Text of original input message <*CR/LF*>

Line	Field	Description	Req'd
1	Originator MMID	This is an optional line that may contain the 4-character MMID of the entering firm, or the MMID of the firm the Service Bureau is acting for. If this option is utilized for multi-station lines, it will equal the 4-character MMID associated with the station (select/poll address).	N
	CR LF	Required line delimiter.	Y
2	Category	This field identifies the message category and will contain "STATUS".	Y
	CR LF	Required line delimiter.	Y
3	'REJ'	This line contains ("REJ - Reason for Rejection"). See following table.	Y
	CR LF	Required line delimiter.	Y
4	Branch Office	1-8 character alphanumeric (A-Z, a-z, 0-9, embedded spaces, left justified, pad with trailing spaces)	Y
	CR LF	Required line delimiter.	Y
5		This line contains an echo of the original input message being rejected.	Y
	CR LF	Required line delimiter.	Y

PATENT
REEL: 037821 FRAME: 0149

Risk Management Reject Messages

Message	Description
ALL BLOCKBUSTER LESS THAN DEFAULT MKT BLOCKBUSTER	Enhanced risk mgmt message. The ALL category blockbuster amount cannot be less than the amount setup by NASDAQ.
ALL BLOCKBUSTER LESS THAN MKT BLOCKBUSTER	Enhanced risk mgmt message. The ALL category blockbuster amount cannot be less than any of the individual markets.
ALL SIZEABLE LESS THAN DEFAULT MKT SIZEABLE	Enhanced risk mgmt message. The ALL category sizable amount cannot be less than the amount setup by NASDAQ.
ALL SIZEABLE LESS THAN MKT SIZEABLE	Enhanced risk mgmt message. The ALL category sizable amount cannot be less than any of the individual markets.
ALL SUPERCAP LESS THAN DEFAULT MKT SUPERCAP	Enhanced risk mgmt message. The ALL category supercap amount cannot be less than the amount setup by NASDAQ.
ALL SUPERCAP LESS THAN MKT SUPERCAP	Enhanced risk mgmt message. The ALL category supercap amount cannot be less than any of the individual markets.
BLOCKBUSTER BELOW MINIMUM AMOUNT	Enhanced risk mgmt message. The ALL category blockbuster amount cannot be less than the amount setup by NASDAQ.

PATENT
REEL: 037821 FRAME: 0150

Other Reject Messages

Message
ACCEPT
ACCEPT - CONTRA NOT READY
ACCEPT - NOT CLEARING ELIGIBLE
BLOCKBUSTER EXCEEDS DEFAULT MKT SUPERCAP Blank – may be used
BLOCKBUSTER EXCEEDS MKT SUPERCAP
BLOCKBUSTER LESS THAN SIZEABLE AMT
BRANCH SEQ# REQUIRED
ENTRY REQUIRED
EXCEEDS MAXIMUM CONTRACT AMOUNT
EXECUTION TIME GREATER THAN TRADE REPORT TIME
EXECUTION TIME REQUIRED
FIRM NOT AUTHORIZED
FIRM REQUIRED
INTERNAL ERROR
INVALID ACT ENTRY
INVALID AMOUNT
INVALID B/A INDICATOR
INVALID BLOCKBUSTER ACTION
INVALID BLOCKBUSTER AMOUNT
INVALID CAP MARK
INVALID CLEARING ACCT #
INVALID CONTRA BRANCH SEQUENCE
INVALID CONTRA PARTY
INVALID CONTROL NUMBER
INVALID DATE
INVALID ENTRY
INVALID FIRM
INVALID FORMAT
INVALID FUNCTION CODE
INVALID GIVEUP CODE
INVALID MAKE DEF VALUE
INVALID MARKET ID
INVALID MARKET TYPE
INVALID MEMO FIELD
INVALID OEID
INVALID PRICE/CONTRACT INDICATOR

PATENT
REEL: 037821 FRAME: 0151

Message
INVALID REFERENCE NUMBER
INVALID RISK MANAGEMENT
INVALID SECURITY CLASS
INVALID SELECTION
INVALID SHORT SALE INDICATOR
INVALID SIZEABLE ACTION
INVALID SIZEABLE AMOUNT
INVALID SPECIAL TRADE IND
INVALID STATUS ENTRY
INVALID SUPERCAP AMOUNT
INVALID SYSTEM DESIGNATION
INVALID TIME COMBINATION
INVALID TRADE REPORT FLAG
INVALID TRADE TYPE
INVALID TYPE
INVALID UPDATE
ISSUE NOT ACT AUTHORIZED
LAST SALE OK - CLEARING REJECT
LAST SALE OK - NOT CLEARING ELIGIBLE
LAST SALE OK -NO CLEARING
MEMO FIELD CANNOT BE CHANGED
MKT BLOCKBUSTER EXCEEDS ALL BLOCKBUSTER
MKT BLOCKBUSTER EXCEEDS DEFAULT ALL BLOCKBUSTER
MKT SIZEABLE EXCEEDS ALL SIZEABLE
MKT SIZEABLE EXCEEDS DEFAULT ALL SIZEABLE
MMCLR NOT ACT AUTHORIZED
MMGU NOT ACT AUTHORIZED
MOD SLD REQUIRED
MOD T NOT ALLOWED
MOD T REQUIRED
NO CLEARING RELATION WITH THIS EXECUTION BROKER
NO ENTRY DATA WAS UPDATED
NO MORE DATA FOR SELECTION CRITERIA
NO MORE RECORDS
NO MORE RECORDS FOR CLEARING FIRM
NO NEW DATA ENTERED
NO NO/WAS FOR MOD T TRADES

PATENT
REEL: 037821 FRAME: 0152

Message
NO NO/WAS FOR NON-MEDIA TRADES
NO OTHER UPDATE WHEN STATE IS D
NO RECORDS FOUND
NO STATISTICS AVAILABLE
NO UPDATES AFTER LAST SALE END TIME
NOT A REPORTABLE OPEN TRADE
NOT AUTHORIZED
OECLR NOT ACT AUTHORIZED
OEGU NOT ACT AUTHORIZED
POTENTIAL VOL ERR
POTENTIAL VOLUME ERROR
REVERSAL NOT ALLOWED
SIZEABLE BELOW MINIMUM AMOUNT
SIZEABLE EXCEEDS DEFAULT MKT BLOCKBUSTER AMT
SIZEABLE EXCEEDS MKT BLOCKBUSTER AMT
SUPER CAP STILL EXCEEDED
SUPERCAP EXCEEDS ALL VALUE
SUPERCAP EXCEEDS DEFAULT ALL VALUE
SUPERCAP LESS THAN BLOCKBUSTER
SUPERCAP LESS THAN DEFAULT BLOCKBUSTER
TERMINAL NOT AUTHORIZED
TRADE ALREADY CANCELLED, ERRORED, OR CORRECTED
TRADE ALREADY LOCKED-IN
TRADE STATUS INVALID FOR ACTION
TRDE HELD
UPDATE OF FIELD REQUIRED

PATENT
REEL: 037821 FRAME: 0153

5 Appendix A: TCP/IP Connection

This appendix describes how a subscriber can submit and receive messages to and from The NASDAQ Stock Market's Computer-to-Computer Interface (CTCI) using the TCP/IP protocol.

The information contained in this appendix is presented in a step-by-step sequence that describes what must be done to setup and to configure a TCP/IP connection with NASDAQ, how to establish a TCP/IP connection, what control messages and associated protocol must be supported for CTCI TCP/IP session management, and ultimately how to send and receive CTCI messages over a TCP/IP connection.

The document is organized as follows:

- The business of contacting NASDAQ and configuring how the subscriber will access NASDAQ through TCP/IP is discussed first under Setup and Testing.
- The basics of establishing a TCP/IP connection with NASDAQ are discussed in Establishing a TCP/IP Connection.
- The format of the CTCI TCP/IP Message is presented next in the CTCI TCP/IP Message Format. This format is used for sending and receiving the CTCI message itself and also for sending and receiving control messages necessary for session management.
- A discussion of session management follows in CTCI TCP/IP Session Management, followed by detailed descriptions and examples of each control message in Control Messages.
- Finally, the method and format for sending and receiving CTCI messages is described in Sending a CTCI Message, Receiving a CTCI Message, and CTCI Message Sequence Verification.
- Appendix A contains the Glossary. While it is sometimes redundant, it should read also, as it does contain some information that does not appear anywhere else in the document.

The subscriber should read this appendix in its entirety to ensure that the rules of the protocol and what the subscriber is required to do to use it are clearly understood prior to contacting NASDAQ for Setup.

Setup

Before attempting to establish a connection over TCP/IP, the subscriber must first contact NASDAQ to configure the connection. If necessary, more than one TCP/IP connection can be configured for the same subscriber. For each connection, NASDAQ will provide the subscriber with two pairs of IP Addresses and a Well Known Port to connect to. The same port is used for all four addresses. At the same time, the subscriber must provide NASDAQ with the IP Address that they will be connecting from when they establish the connection.

Please note that the four IP Addresses consist of a Primary address and an Alternate address for use in connecting to NASDAQ and a backup address pair for use in connecting to the NASDAQ Disaster Recovery (D.R.) site. Please see the section Retrying failed connection attempts for more details.

PATENT
REEL: 037821 FRAME: 0154

For each TCP/IP connection, a client profile must be established. This process involves assigning an agreed upon ten-character logon identifier and assigning meaning to the "logical channels" that the subscriber will use to exchange CTCI messages with NASDAQ. *Note: A method of encryption will be introduced in a future release.*

The logon identifier will be associated with the client's IP Address and the IP Addresses and Well Known Port the client should be connecting to. This information will be verified when the client establishes the connection and sends a Logon control message to NASDAQ.

Over one TCP/IP connection, a subscriber can submit and receive CTCI messages on behalf of up to 63 different users and/or device locations. Messages for each user or device location are kept separated from each other by assigning them each to their own logical channel. Together with NASDAQ, the subscriber assigns a logical channel number from 1 to 63 to each of the users or device locations that the subscriber will be submitting and receiving CTCI messages on behalf of.

Use of a logical channel is up to the subscriber. A logical channel may be used for sending-only, receiving-only or both. This is solely under control of the subscriber.

Please note that a subscriber may establish multiple TCP sessions with NASDAQ over a single line if they choose to use Network Address Translation (NAT). NASDAQ will assign a unique Well Known Port for each session.

Testing

The Customer Subscriber Test System will be available, but the subscriber will have to connect to a different IP Address and Well Known Port from production. The subscriber should contact NASDAQ to obtain an IP Address and Well Known Port to connect to for testing. This means the subscriber must maintain the ability to dynamically connect to different sockets.

Establishing a TCP/IP Connection

The client (the subscriber) establishes a TCP/IP connection with the server (NASDAQ) by connecting to an IP Address and Well Known Port provided by NASDAQ, from the IP Address that the subscriber told NASDAQ they would be connecting from.

Note: The NASDAQ server follows the *Berkley Model* for establishing a socket connection.

PATENT
REEL: 037821 FRAME: 0155

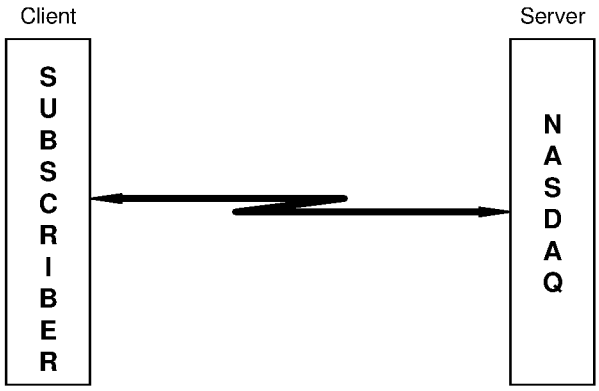


Figure Appendix A- 1 Client-Server TCP/IP Connection

Retrying failed connection attempts

The initial attempt to establish a TCP/IP connection should be to the NASDAQ Primary Address. If this attempt fails, the subscriber should delay briefly (3 seconds is recommended) and then try the NASDAQ Alternate Address. Subsequent attempts should alternate between the Primary and Alternate addresses until at least 30 seconds have elapsed. At that point the subscriber should make one attempt using the Disaster Recovery Primary Address, followed by one attempt to the Disaster Recovery Alternate Address. If a session still cannot be established, the entire cycle should begin again, starting with the NASDAQ Primary Address.

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REEL: 037821 FRAME: 0156

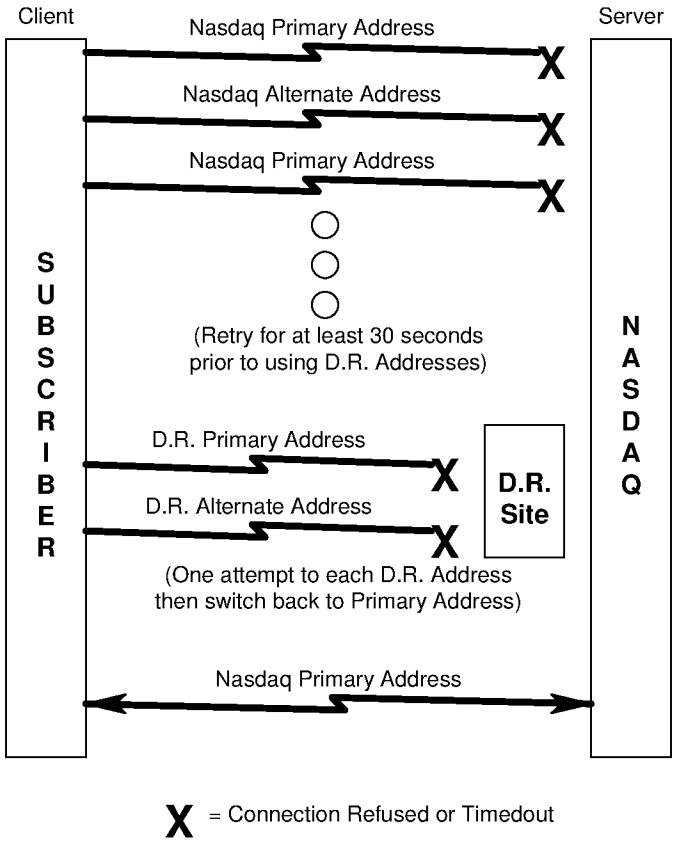


Figure Appendix A- 2 Connection Attempts

CTCI TCP/IP Message Format

The CTCI TCP/IP Message is used for sending and receiving CTCI messages, as well as session management control messages. The CTCI TCP/IP Message consists of a message "envelope" and the CTCI or control message data.

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When the CTCI TCP/IP Message contains CTCI message data it is referred to as a CTCI message, and when it contains a control message it is referred to by the name of the control message (Logon, Heartbeat Query, etc.). The format of the CTCI TCP/IP Message is as follows:

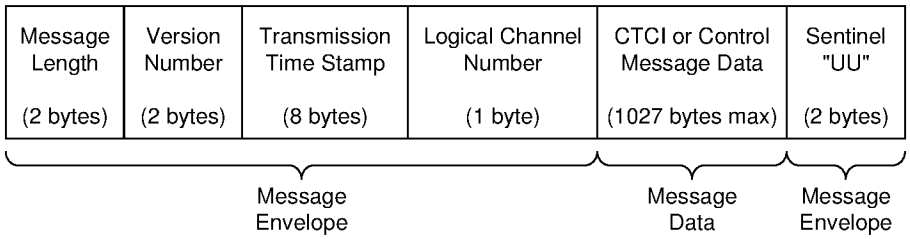


Figure Appendix A- 3 CTCI TCP/IP Message Format

The *Message Length* is a binary field that contains the total length (bytes) of the CTCI TCP/IP Message including the Message Length field at the beginning and the Sentinel field at the end. It is an unsigned integer in network byte order (NBO). Network byte order (NBO), also known as "big endian," is one standard form for transmitting binary values (including integers) in a network message. Since it is used in all TCP/IP headers uniformly, without regard to originating or receiving platform, it is also adopted for use in the CTCI TCP/IP message protocol. Technically, the most arithmetically significant bit of each byte is transmitted first, followed in order of descending significance by the remaining bits; the most significant byte of each multi-byte binary field is transmitted first, followed in order of descending significance by the remaining bytes. If a 32-bit number is to be transmitted, and the bits are numbered 0-31 in order, left to right, where the 0^{th} bit represents 2^{31}, and the 31^{st} bit represents the least significant binary digit, i.e., 0 or 1.

Currently, the largest message that can be sent is 1042 bytes. The Message Length field is the “sentinel boundary” of the message. Data flow must begin on a sentinel boundary whenever a connection is established.

The *Version Number* contains a two-character ASCII string. The first character contains the integer portion of the version number and the second character contains the decimal portion of the version number. This is version 1.0 of the interface, so the value in the first byte will be one and the value in the second byte will be zero.

The *Transmission Time Stamp* is an ASCII numeric field containing the time the CTCI TCP/IP Message was transmitted in HHMMSSCC (see Glossary) format.

The *Logical Channel Number* is a binary field that contains a value from zero through 63. If the logical channel number is zero, the CTCI TCP/IP Message is a control message. If the logical channel number is one through 63, the message is a CTCI message, and the logical channel number indicates which user or device location that the CTCI message belongs to.

CTCI or Control Message Data contains the CTCI or control message data. When the logical channel number is one through 63 it contains CTCI message data. When the logical channel number is zero, CTCI or Control Message Data contains the fields of one of the control messages described in the following pages.

PATENT
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The *Sentinel* is an ASCII field that always contains a constant of "UU".

CTCI TCP/IP Session Management

The control messages – Logon, Logon Response, Heartbeat Query, Heartbeat Response, Flow Control, Logical Channel State Query, and Logical Channel State Response – are used for session management and will be sent over logical channel zero exclusively. The format, content, and further details about how each control message should be used is described in the pages that follow the session management discussion.

Once a socket connection is established, the very first thing the client must do is send a Logon control message to the server. The Logon Identifier field tells the server who the client is, the Logical Channel State fields tell the server on which logical channels the client is ready to receive CTCI messages. If the Logon fails, NASDAQ will break the connection. If the Logon is successful the server will send a Logon Response control message back to the client.

On the Logon Response control message the Logical Channel State fields tell the client on which logical channels the server is ready to receive CTCI messages. The client must not send CTCI messages to the server over any logical channel that is in not in a "ready to receive" state. If a logical channel is not in a "ready to receive" state, and the client sends CTCI messages over it to the server, the messages will be discarded.

Note: It is not necessary to verify that logical channel zero is ready to receive. This logical channel must always be in a "ready to receive" state, as there must always be a dedicated path open for control message exchange.

The client can now send CTCI messages over any logical channel that the server has indicated is ready to receive. If the client has no CTCI or control messages to be sent over any logical channel on a connection, or there are no logical channels (1-63) that server is ready to receive them on, the client must send a Heartbeat Query control message on logical channel zero every 10 seconds.

For logical channels that the server has indicated are not ready to receive, the client must wait until the server changes the logical channel state to ready to receive. The server will do this by sending the client a Flow Control message on logical channel zero.

In the event that the volume of CTCI message traffic over a logical channel becomes too much for a message receiver (client or server) to buffer and process, the message receiver can instruct the sender to suspend transmission on the logical channel by sending a Flow Control control message that places the logical channel in a "not ready to receive" state. When the receiver is ready to resume receiving messages on the logical channel again, the receiver sends a Flow Control control message that returns the logical channel to a "ready to receive" state.

At any time during the session, the client (or server) may request the state of a logical channel by sending a Logical Channel State Query Request to the server (or client). The server (or client) must respond with a Logical Channel State Query Response that informs the receiver whether the logical channel is in a "ready to receive", "not ready to receive" or "not configured" state.

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The last two bytes of *every* CTCI TCP/IP Message received should always be checked for the sentinel character string of "UU". If the last two bytes are not equal to the sentinel, the TCP/IP connection is considered no longer reliable and should be terminated.

Control Messages

Logon and Logon Response

Once a socket connection is established, the client must first send a Logon control message to the server.

If the server does not recognize the Logon Identifier as being associated with the IP Address the client has connected from or does not recognize the Logon Identifier as being associated the IP Address and Well Known Port the client is connected to, it will terminate the connection. If the Logon is successful a Logon Response control message will be returned.

Here is an example of a *Logon* control message sent on logical channel zero at 9:30 a.m.:

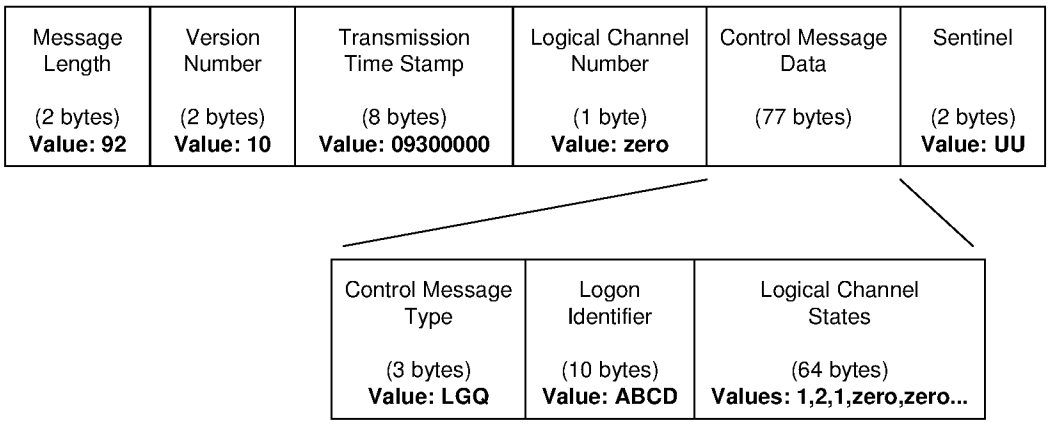


Figure Appendix A- 4 Logon control message, channel zero, 9:30 a.m.

In this example, the *Logical Channel Number* contains a value of zero, indicating the message is a control message.

The *Control Message Type* is an ASCII field that appears in every control message that indicates which control message is being sent. In this case "LGQ" represents Logon.

The *Logon Identifier* field is an ASCII field that must contain the logon identifier assigned during setup for use with the IP Address and Well Known Port. The value ABCD is shown just as an example.

In the *Logical Channel States* field, each byte contains a binary value that represents the state of a logical channel. The first byte contains the state of logical channel zero, the second the state of logical channel one, the third the state of logical channel three, up to the 64th byte that contains the state of logical channel 63. If the logical channel is ready to

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REEL: 037821 FRAME: 0160

receive the value will be one. If it is not ready to receive the value will be 2. If the logical channel was not configured during Setup, the value will be zero.

In this example the value of the state of logical channel zero and two is one. The value of the state of logical channel one is two. The value of the state of logical channels three through 63 is zero. This means the client is ready to receive control messages on logical channel zero (always the case), not ready to receive CTCI messages on logical channel one, ready to receive CTCI messages on logical channel two, and the remaining logical channels are not configured.

Here is an example of a *Logon Response* control message sent on logical channel zero at 2/100 of a second past 9:30 a.m.:

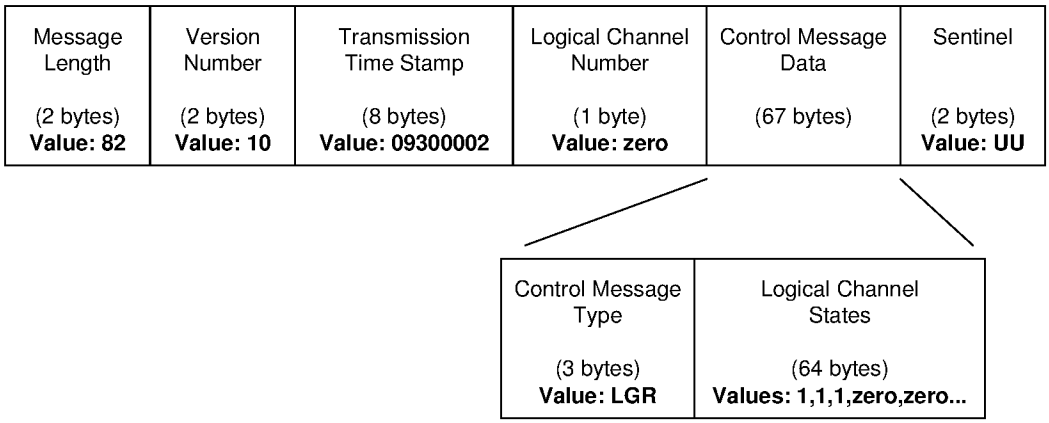


Figure Appendix A- 5 Logon Response control message

In this example, the *Logical Channel Number* contains a value of zero, indicating the message is a control message.

The *Control Message Type* is an ASCII field that appears in every control message that indicates which control message is being sent. In this case "LGR" represents Logon Response.

In the *Logical Channel States* field, each byte contains a binary value that represents the state of a logical channel. The first byte contains the state of logical channel zero, the second the state of logical channel one, the third the state of logical channel three, up to the 64th byte that contains the state of logical channel 63. If the logical channel is ready to receive the value will be one. If it is not ready to receive the value will be 2. If the logical channel was not configured during Setup, the value will be zero.

In this example the value of the state of logical channel zero is one. The value of the state of logical channel one and two is one. The value of the state of logical channels three through 63 is zero. This means the server is ready to receive control messages on logical channel zero (always the case) and CTCI messages on logical channels one and two. The remaining logical channels are not configured.

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Heartbeat Query and Response

The integrity of the data transfer connection must be constantly checked with the periodic exchange of client-issued Heartbeat Query and server-issued Heartbeat Response control messages.

If there are no other messages to be sent the client must send a Heartbeat Query every 10 seconds. The server does not require heartbeat queries during the 10-second interval if any properly formatted message has been received within the last 10 seconds, but will terminate the connection if no message is received for the duration of two, 10-second intervals.

Here is an example of a *Heartbeat Query* control message sent on logical channel zero at 2 seconds past 9:30 a.m.:

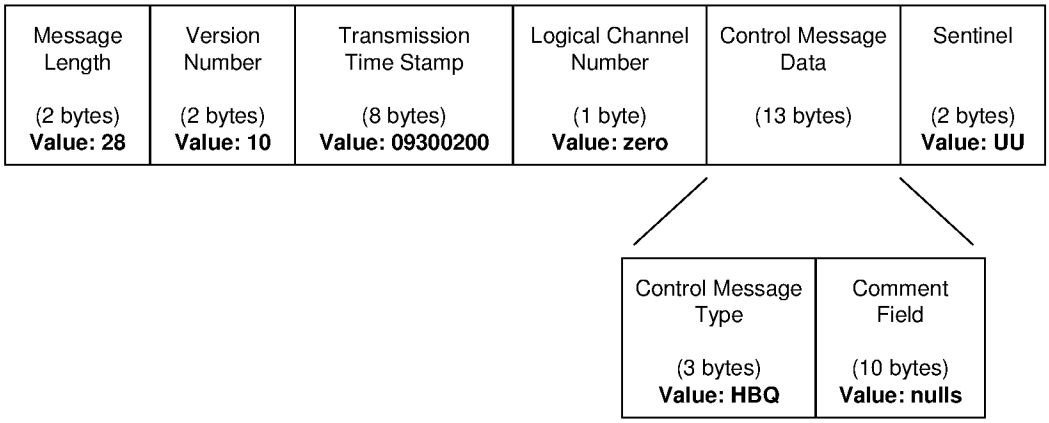


Figure Appendix A- 6 Heartbeat Query control message

In this example, the *Logical Channel Number* contains a value of zero, indicating the message is a control message.

The *Control Message Type* is an ASCII field that appears in every control message that indicates which control message is being sent. In this case "HBQ" represents Heartbeat Query.

The *Comment* field is an ASCII field that the client can use. Any data in it will be echoed back in the Comment field of the Heartbeat Response. The complete ASCII character set can be used. If the field is not used, it should be filled with ASCII nulls (binary zeros). In this example, there is no data in the Comment field, so it is filled with nulls.

PATENT
REEL: 037821 FRAME: 0162

Here is an example of a *Heartbeat Response* control message sent on logical channel zero at 2 and 2/100 seconds past 9:36 a.m.:

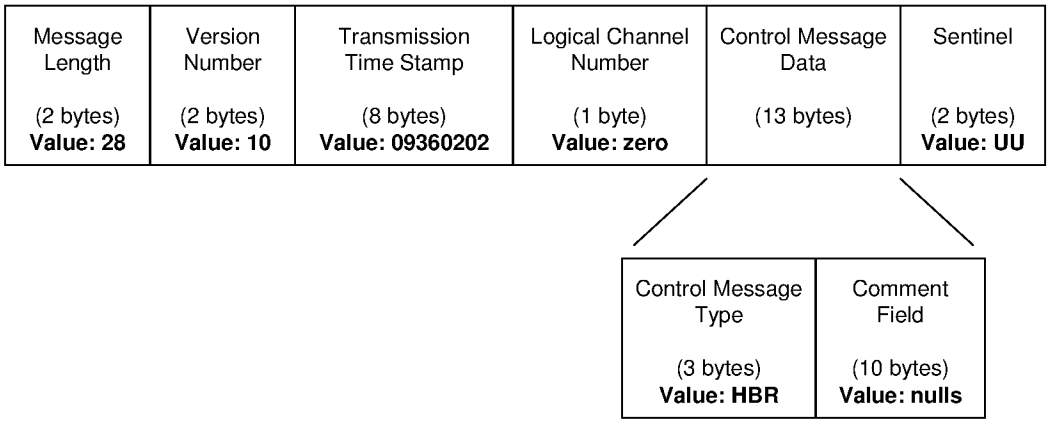


Figure Appendix A- 7 Heartbeat Response control message

In this example, the *Logical Channel Number* contains a value of zero, indicating the message is a control message.

The *Control Message Type* is an ASCII field that appears in every control message that indicates which control message is being sent. In this case "HBR" represents Heartbeat Response.

The *Comment* field is an ASCII field that contains the data sent by the client in the Comment field of the Heartbeat Query. In this example the field contains nulls, echoing this area of the input message.

Flow Control

In the event that the volume of CTCI message traffic over a logical channel becomes too much for a message receiver (client or server) to buffer and process, the message receiver can instruct the sender to suspend transmission on the logical channel by sending a Flow Control message that places the logical channel in a "not ready to receive" state. When the receiver is ready to resume receiving messages on the logical channel again, the receiver sends a Flow Control message that returns the logical channel to a "ready to receive" state.

Note: Flow control of logical channel zero is not allowed, as there must always be a dedicated path open for control message exchange. Client processing of flow control messages from the NASDAQ server is mandatory. It is not mandatory, but strongly advised, that the client be designed with a mechanism to initiate flow control commands. Under no circumstance should the client ever stop reading the connection with a NASDAQ server while at the same time continuing to transmit data to the NASDAQ server.

PATENT
REEL: 037821 FRAME: 0163

Here is an example of a *Flow Control* message sent on logical channel zero at 1:30 p.m. that places logical channel one in a "not ready to receive" state:

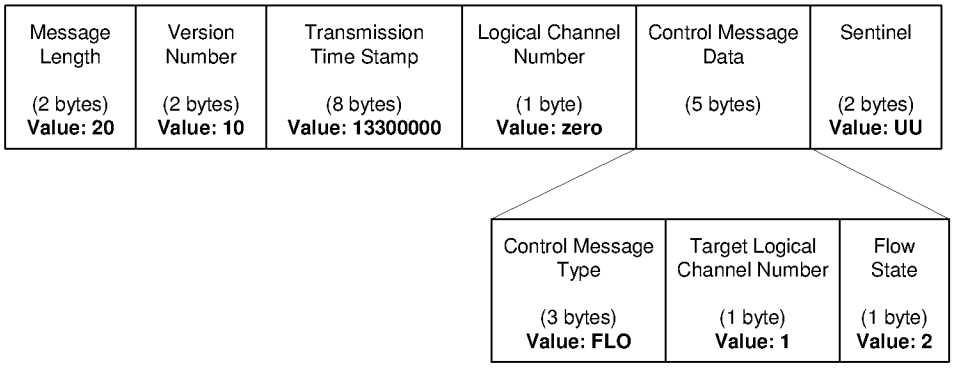


Figure Appendix A- 8 Flow Control message

In this example, the *Logical Channel Number* contains a value of zero, indicating the message is a control message.

The *Control Message Type* is an ASCII field that appears in every control message that indicates which control message is being sent. In this case "FLO" represents Flow Control.

The *Target Logical Channel Number* is a binary field that contains a value from one through 63 and indicates which logical channel should be affected. In this example, logical channel one is being affected.

The *Flow State* field is a binary field that changes the state of a logical channel to ready to receive or not ready to receive CTCI messages. A value of one changes the state to ready to receive. A value of two changes the state to not ready to receive. In this case the value is two, changing the state of the logical channel to "not ready to receive" CTCI messages.

Logical Channel State Query and Response

The client or server can request the state of a particular logical channel by sending a Logical Channel State Query control message over logical channel zero. A Logical Channel State Response must be sent back by the query recipient.

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REEL: 037821 FRAME: 0164

Here is an example of a *Logical Channel State Query* control message requesting the state of logical channel one, sent on logical channel zero at 23 and 85/100 seconds past 1:45 p.m.:

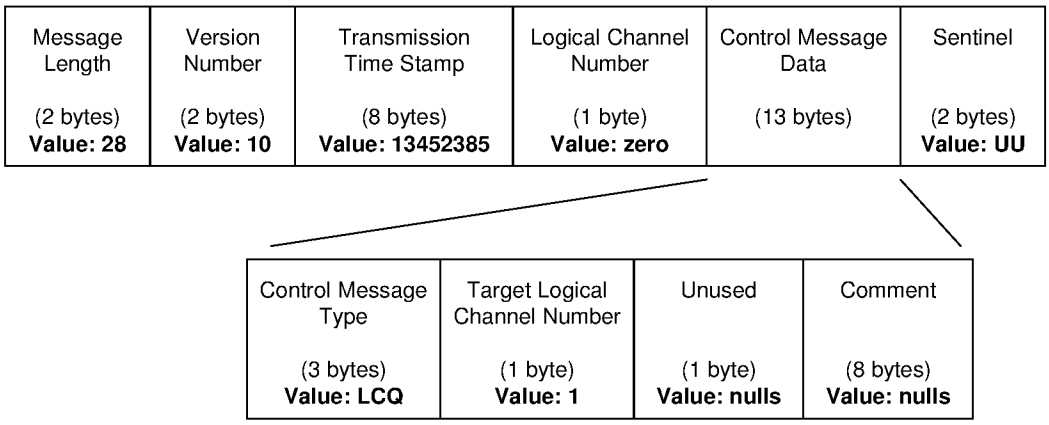


Figure Appendix A- 9 Logical Channel State Query control message

In this example, the *Logical Channel Number* contains a value of zero, indicating the message is a control message.

The *Control Message Type* is an ASCII field that appears in every control message that indicates which control message is being sent. In this case "LCQ" represents Logical Channel State Query.

The *Target Logical Channel Number* is a binary field that contains a value from one through 63 and indicates for which logical channel the state is being requested. In this example the state of logical channel one is being requested.

The *Unused* field is an ASCII field that should always be filled with ASCII nulls (binary zeros).

The *Comment* field is an ASCII field that the message initiator can use. Any data present must be echoed back in the Comment field of the Logical Channel State Response. The complete ASCII character set can be used. If the field is not used, it should be filled with ASCII nulls (binary zeros).

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Here is an example of a *Logical Channel State Response* control message returning the state of logical channel one, sent on logical channel zero at 24 seconds past 1:45 p.m.:

Message Length	Version Number	Transmission Time Stamp	Logical Channel Number	Control Message Data	Sentinel
(2 bytes) **Value: 28**	(2 bytes) **Value: 10**	(8 bytes) **Value: 13452400**	(1 byte) **Value: zero**	(13 bytes)	(2 bytes) **Value: UU**

Control Message Type	Target Logical Channel Number	Logical Channel State	Comment
(3 bytes) **Value: LCR**	(1 byte) **Value: 1**	(1 byte) **Value: 2**	(8 bytes) **Value: nulls**

Figure Appendix A- 10 Logical Channel State Response control message

In this example, the *Logical Channel Number* contains a value of zero, indicating the message is a control message.

The *Control Message Type* is an ASCII field that appears in every control message that indicates which control message is being sent. In this case "LCR" represents Logical Channel State Response.

The *Target Logical Channel Number* is a binary field that contains a value from one through 63 and indicates for which logical channel the state is being reported. In this example, the state of logical channel one is being reported.

The *Logical Channel State* is a binary field that contains a value that represents the state of the logical channel. If the logical channel is ready to receive, the value will be one. If it is not ready to receive, the value will be 2. If the logical channel was not configured during Setup, the value will be zero. In this example the value is two, indicating logical channel is "not ready to receive" CTCI messages.

The *Comment* field is an ASCII field that must always contain the data sent in the Comment field of the Logical Channel State Query. In this example the field contains nulls because that's what was sent in the query.

Sending a CTCI Message

The client should format a CTCI message as usual (refer to *Subscriber Requirements for Computer to Computer Interface Utilizing the NASDMS Switch*), but to deliver it over a TCP/IP connection it must be imbedded in a CTCI TCP/IP Message "envelope."

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Here is an example of a CTCI message 100 bytes long sent on logical channel 31 at 9:31 a.m.:

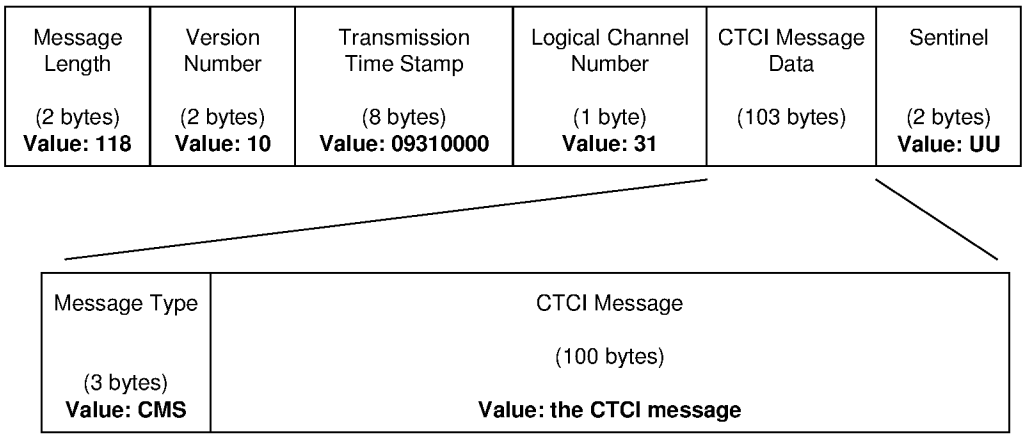


Figure Appendix A- 11 CTCI message

In this example, the *Logical Channel Number* contains a value of 31, in the range of one through 63, indicating that the message is a CTCI message.

The *Message Type* field is an ASCII field that should always have the value "CMS"..

CTCI Message is the actual CTCI message itself, beginning with line zero, line two, etc., as described in *Subscriber Requirements for Computer to Computer Interface Utilizing the NASDMS Switch*. Do not include any control characters other than those specific the composition of the CTCI message (i.e. carriage return and line feed).

Receiving a CTCI Message

NASDAQ will send CTCI messages to subscribers using the same format as described above in Sending a CTCI Message. The *CTCI Message* field will include any user-specified header line(s) followed by line zero, line two, etc., through any user-specified trailer line(s).

CTCI Message Sequence Verification

It is the responsibility of the client to detect and recover lost data by implementing CTCI message sequence number checking and message retrieval processing. It is also the responsibility of the client to respond to gap fill requests from the server for lost or discarded client to server messages. Refer to *Subscriber Requirements for Computer to Computer Interface Utilizing the NASDMS Switch* for a detailed description of these procedures. Message sequence numbers continue to be the last part of the *CTCI Message* in *CTCI Message Data*.

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Glossary

Client: The Subscriber side of the TCP/IP connection.

Connection: Transmission path (including all equipment) between a sender and receiver, ready and able to exchange data.

CTCI: Computer to Computer Interface; the protocol, message standards and underlying physical structure which allows subscribers to send and receive NASDAQ transactions from/to a subscriber host computer.

Flow Control: Mechanism by which the recipient of incoming data notifies the sender to stop or start transmitting data over a specified logical channel.

Flow State: The flow state changes the state of a logical channel to ready to receive or not ready to receive CTCI messages. A value of one changes the state to ready to receive (RR - Receiver Ready to receive). A value of two changes the state to not ready to receive (RNR - Receiver Not Ready).

HHMMSSCC: Method of formatting the time day in hours, minutes, seconds and hundredths of seconds. HH = Hours in military time (00-23), MM = Minutes (00-59), SS = Seconds (00-59) CC = hundredths of seconds (00-99). For example: 9AM is 09000000, 1:35PM is 13350000, 35 and 98/100 seconds past midnight is 00003598.

IP Address: The IP Address together with the Well Known Port, is used to establish a connection to NASDAQ in order to send and receive CTCI TCP/IP Messages. Will be assigned by NASDAQ.

Logical Channel: Over one TCP/IP connection, a subscriber can submit and receive CTCI messages on behalf of 63 different users or device locations. Each logical channel represents one user or device location. Logical channel zero is reserved for session management control messages.

Logical Channel Number: Number from zero through 63 assigned to a logical channel to uniquely identify it.

Logical Channel State: A logical channel can be in one of three states:

Ready to receive CTCI messages (RR - Receiver Ready to receive).
Not ready to receive CTCI messages (RNR - Receiver Not Ready).
Not assigned a user or device location during Setup (NC - Not Configured).

Nulls: The value of the lowest occurrence in the ASCII character set (Binary zero).

Session: Synonymous with Connection.

Sentinel: A character string constant used to verify that a complete CTCI TCP/IP Message has been received. The last two characters of every CTCI TCP/IP Message must be "UU".

Sentinel Boundary: Term used to indicate that the next data to be sent (or received) on a connection must begin with the Message Length field of a CTCI TCP/IP Message. Data flow must begin on a sentinel boundary whenever a connection is established.

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Server: The NASDAQ side of the TCP/IP connection.

TCP/IP: Transmission Control Process/Internet Protocol, a method that allows communications to take place between heterogeneous systems in a multinetwork environment (Internet).

Well Known Port: A signed 16 bit binary value combined with an IP Address to form a socket (connection) name. Will be assigned by NASDAQ.

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§ Appendix B: IBM WebSphere MQ

Formatted: Bullets and Numbering

The *CTCI WebSphere MQ V1.1 Subscriber Intercommunication Specification* describes how you can submit and receive CTCI messages using the NASDMS (Switch) through IBM WebSphere MQ Middleware using WebSphere MQ API calls over TCP/IP protocol. The document also describes the required CTCI-MQ intercommunication specifications. The CTCI-MQ Interface uses the WebSphere MQ Distributed Queuing technique.

To access the document, select this link:

http://www.nasdaqtrader.com/trader/tradingservices/specsinstallguides/CTCIMQSpecs.pdf

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PATENT
REEL: 037821 FRAME: 0171



NASDAQ FIX for Trade Reporting

Programming Specification

December 24, **2015**
Version 2015-07

PATENT
REEL: 037821 FRAME: 0172

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Contents

1 Overview 6
1.1 Related Documentation 6
1.2 NASDAQ Customer Support 6

2 NASDAQ FIX Trade Reporting 8
2.1 Trade Report Submission 8
2.2 M1 Matching 8
2.3 Short Sale Reporting 8
2.4 T-messages v. C-messages 12
2.5 Required Fields 12
2.6 Price fields 12
2.7 Message Type 12
2.8 Message Identification 15
2.9 Possible Duplicates and Resends 18
2.10 Processing Messages across Protocols 18
2.11 Explicit Fee 19

3 Session Details 20
3.1 Hours of Operation 20
3.1.1 Regular Trading Day 20
3.1.2 Early Close Trading Day 22
3.1.3 Submission of Messages on Non-trading Days 23
3.2 Connectivity 24
3.3 Architecture 25

4 Message Formats 26
4.1 Standard Message Formats 26
4.1.1 Inbound to NASDAQ Header Format 26
4.1.2 Inbound to NASDAQ Trailer Format 27
4.1.3 Outbound from NASDAQ Header Format 28
4.1.4 Outbound from NASDAQ Trailer Format 29
4.2 Administrative Messages 30
4.2.1 Heartbeat 30
4.2.2 Logon 30
4.2.3 Test Request 30
4.2.4 Resend Request 31

PATENT
REEL: 037821 FRAME: 0173

4.2.5 Sequence Reset 31
4.2.6 Logout 31
4.3 Application Messages 33
4.3.1 Inbound to NASDAQ 33
4.3.1.1 Entry 33
4.3.1.2 Accept, Break, Cancel, Decline, Error 47
4.3.1.3 No/Was 51
4.3.2 Outbound from NASDAQ 63
4.3.2.1 Trade Entry Notification Message Format TKEN/CKEN 64
4.3.2.2 Entry Notification to Alleged Firm Message Format TKAL/CKAL 75
4.3.2.3 Locked-in Notification TCLK/CCLK 87
4.3.2.4 Locked-in Notification TGLK/CGLK 91
4.3.2.5 Break Notification TCBK/CCBK 96
4.3.2.6 Cancel Notification TCAN/CCAN 99
4.3.2.7 Decline Notification TCDE/CCDE 101
4.3.2.8 Error Notification TCER/CCER 103
4.3.2.9 No/Was Notification Message Format TKNW/CKNW 105
4.3.2.10 Update Notification TTUD/CTUD 116
4.3.2.11 Update Notification TRUD/CRUD (previously called Reg NMS Message Format for TTUD/CTUD) 124
4.3.2.12 M2 Trade Match Notification TCM2/CCM2 132
4.3.2.13 Participant Authorization Indicator Message TCPI 133
4.3.2.14 Blockbuster or Sizable Trade Notification TCBT/CCBT/TCST/CCST 137
4.3.2.15 Net Trade Threshold Notification TTNT/TTNP 140
4.3.2.16 Net Trade Threshold Fallback Notification TTFB/TTFP 143

5 Reject Messages 147
5.1 Session 147
5.2 Business 148
5.3 Application 152

6 Appendix A: Message Flow Scenarios 160
6.1 Cross Trades 160
6.2 QSR Submitted Trades 161
6.3 AGU Submitted Trades 161
6.4 Clearing Broker Fails after NASDAQ Market Center-originated Trade Report 161
6.5 Trade Entry Accepted 162
6.6 Trade Entry Matched 162
6.7 Trade Entry Accepted then Broken by Contra Party 163
6.8 Trade Entry Cancelled by Executing Party 163

PATENT
REEL: 037821 FRAME: 0174

6.9 Locked-In Trade Entry Cancelled 164
6.10 Trade Entry Cancelled by Executing Party Clearing Firm 165
6.11 Trade Entry Declined 165
6.12 Trade Entry Errored 166
6.13 Trade Entry Reversed 166
6.14 (Scenario removed) 167
6.15 Trade Entry Updated (price) 167
6.16 Trade Entry Contra Broker Updated 168
6.17 Trade Entry Capacity/BrSeqNbr Updated 168
6.18 Trade Entry Clearing Firm Updated 169

7 Appendix B: Step Out/Step-in Matching Criteria 170

PATENT
REEL: 037821 FRAME: 0175

PATENT
REEL: 037821 FRAME: 0176

1 Overview

This document details the NASDAQ FIX trade reporting protocol and the user requirements for accessing that protocol for FINRA/Nasdaq TRF trade reporting and clearing, as well as NASDAQ Market Center clearing functions. This document also outlines the messages transmitted via FIX for trade reporting.

The trade reporting protocol facilitates the reporting of transactions executed otherwise than on an exchange in all NMS stocks as defined in Rule 600(b)(47) of SEC Regulation NMS. Members that use the FINRA/Nasdaq Trade Reporting Facility must comply with the Rule 6300A and 7200A Series, as well as all other applicable rules. It allows you to enter trades and have these trades made available for trade reporting, matching, and clearing. Trades are forwarded to the appropriate reporting agency, either NASDAQ or SIAC, and to the Depository Trust Clearing Corporation (DTCC) as applicable.

As new functionality becomes available, you will receive technical updates detailing that functionality. At the same time the technical update is distributed, this programming specification will be updated on the NASDAQ Trader web site at: http://www.nasdaqtrader.com/Trader.aspx?id=TradingSpecs

1.1 Related Documentation

Both the NASDAQ FIX for Orders Programming Specification for FIX 4.2 and the NASDAQ FIX for ACES Programming Specification can be found at:

http://www.nasdaqtrader.com/Trader.aspx?id=TradingSpecs

1.2 NASDAQ Customer Support

NASDAQ Support

☎	NASDAQ Technical Support:	212.231.5180
✉	Email:	tradingservices@nasdaqomx.com

FINRA Support

☎ FINRA Operations: 212.231.5180

✉ Email: Finraoperations@finra.org

PATENT
REEL: 037821 FRAME: 0177

PATENT
REEL: 037821 FRAME: 0178

2 NASDAQ FIX Trade Reporting

In the past, you may have communicated trade reports and associated messages to NASDAQ via CTCI. If so, you are familiar with CTCI message names, such as Function F and TRAL. These names have been carried over into our FIX implementation of trade reporting to ease the transition.

2.1 Trade Report Submission

FINRA Rule 6380A(b) prescribes which FINRA member has the trade reporting obligation and is deemed to be the Executing Party under FINRA rules. FINRA members and their reporting agents should refer to FINRA Rule 6380A(b) to determine who is obligated to report a trade.

In our specification, we refer to the party with the trade reporting obligation as the "Executing party" and other side as the "Contra party."

2.2 M1 Matching

Trade entries can be matched in two ways:

- M1 match process; and
- Alleged party acceptance.

Firm A sends in a trade entry message for 1000 shares of XYZ at $10 alleging Firm B. This entry initiates the M1 trade matching process, which compares trades one-to-one. The system attempts to match the Firm A trade entry with an identical Firm B trade entry. The system finds an identical Firm B trade entry for 1000 shares of XYZ at $10 and locks it in. See section 4.3.2.3.

Firm A sends in a trade entry message alleging Firm B. Firm B responds with an accept message (instead of entering in its own trade entry message). Through that acceptance, Firm B enters into a locked-in trade with Firm A. See sections 4.3.2.3.

2.3 Short Sale Reporting

Firms are obligated to include an indication of a short sale transaction as part of their trade entry. It is not possible for firms to use the Accept message to indicate a short sale. The short sale and short sale exempt information is included in tags 54 and 853 of the Trade Entry and No/Was input functions and the Acknowledgement, CTEN, TRAL/CRAL,

TRNW/CRNW, and TRUD/CRUD output response messages.

The table below defines the supported value combinations between tags 54 and 853. Value combinations not defined below will be rejected.

Sale Type	Tag 54 contains...	Tag 853 contains...	Comments
Buy	1	blank	
Sell	2	blank	
Cross	8	blank	
Dealer Sold Short	2	0	
Dealer Sold Short Exempt	2	1	
Selling Customer Sold Short	8	2	MPID must be present in tag 375
Selling Customer Sold Short Exempt	8	3	MPID must be present in tag 375
Contra Side Sold Short	1	4	ContraBroker must be present in tag 375
Contra Side Sold Short Exempt	1	5	ContraBroker must be present in tag 375
Selling Customer Sold Short	1	2	ContraBroker in tag 375 must be omitted
Selling Customer Sold Short Exempt	1	3	ContraBroker in tag 375 must be omitted

Because a short sale is proprietary information, it will be returned to the submitting firm only, unless the report is a QSR locked-in entry. The QSR firm will receive a TTEN and the contra short seller will receive a TTAL that contains the short sale side code.

For a NASDAQ Market Center-originated trade, the code is automatically entered when the Contra party side is being executed as a short seller. It will, therefore, be included as the side code in a TTAL message to the CP/contra party, while the standard buy side code is included in the TTEN acknowledgment message to the EP side.

PATENT
REEL: 037821 FRAME: 0179

PATENT
REEL: 037821 FRAME: 0180

These tables show what values you can expect on outgoing messages:

Trade Entry

Short Sale Scenario	MM Entry	OE Entry	TTEN	TTAL
EP Sold Short	54= 2 853=0		54= 2 853=0	54=2
EP Sold Short Exempt	54= 2 853=1		54= 2 853=1	54=2
CP Sold Short		54= 2 853=0	54= 2 853=0	54=2
CP Sold Short Exempt		54= 2 853=1	54=2 853=1	54=2
EP Cross Customer Sold Short	54= 8 853=2		54= 8 853=2	
EP Cross Customer Sold Short Exempt	54= 8 853=3		54= 8 853=3	
EP Buy CP Sold Short				
EP Buy CP Sold Short Exempt				
EP Buy CP Sold Short (QSR, AGU)	54= 1 853=4		54= 1 853=4	54= 1 853=4
EP Buy CP Sold Short Exempt (QSR, AGU)	54= 1 853=5		54= 1 853=5	54= 1 853=5
EP Buy Customer Sold Short	54= 1 853=2		54= 1 853=2	
EP Buy Customer Sold Short Exempt	54= 1 853=3		54= 1 853=3	

No/Was

Short Sale Scenario	No/Was	MM TTNW	OE TTNW
EP Sold Short	54= 2 853=0	54 = 2 853=0	54=2
EP Sold Short Exempt	54= 2 853=1	54 = 2 853=1	54=2
CP Sold Short			
CP Sold Short Exempt			
EP Cross Customer Sold Short	54 = 8 853=2	54 = 8 853=2	
EP Cross Customer Sold Short Exempt	54 = 8 853=3	54 = 8 853=3	
EP Buy OE Sold Short			
EP Buy CP Sold Short Exempt			
EP Buy CP Sold Short (QSR, AGU)	54 = 1 853=4	54 = 1 853=4	54 = 1 853=4
EP Buy CP Sold Short (QSR, AGU) Exempt	54 = 1 853=5	54 = 1 853=5	54 = 1 853=5
EP Buy Customer Sold Short	54= 1 853=2	54= 1 853=2	
EP Buy Customer Sold Short Exempt	54= 1 853=3	54= 1 853=3	

PATENT
REEL: 037821 FRAME: 0181

PATENT
REEL: 037821 FRAME: 0182

2.4 T-messages v. C-messages

Outgoing messages are identified by names such as TCER or CTER (for Error) and TTNW or CTNW (for No/Was). Messages with names that begin with "T" are sent to trade reporting firms and non-trade reporting firms. Messages with names that begin with "C" are sent to clearing firms. For example, when a firm is alleged, it receives a TTAL message. That firm's clearing firm receives a CTAL. These message names are included in tag 58 of all outbound messages. Please note that C-messages will not be part of our initial implementation.

2.5 Required Fields

Message format tables indicate which tags are required. Fields are required either by FIX (=Y), by NASDAQ (=Q), or by neither (=N).

2.6 Price fields

The trade price and contract amount are included in the same tag, AvgPx. Tag 423, PriceType, indicates whether tag 6 is the trade price or the contract amount. The formats of these values are, however, different. The price field is 12 characters in length. The trade price allows six digits for the whole number and six digits for the decimal portion. For example, $12.34 is 000012340000. The contact amount allows 10 digits for the whole number and two digits for the decimal portion. For example, $12.34 is 000000001234.

2.7 Message Type

NASDAQ FIX supports these message types for trade reporting:

Type	Message	Inbound, Outbound, or Both
A	Logon	B
0	Heartbeat	B
1	Test Request	B
2	Resend Request	B
3	Reject	O
4	Sequence Reset	B
5	Logout	B

8	Execution Report	B

Because `MsgType` = 8 is being used for all application messages, tag 856, TradeReportType, is used to identify the type of message.

Tag 856, TradeReportType:

0 = submit
1 = alleged
2 = accept
3 = decline
4 = addendum
5 = no/was
6 = trade report cancel
7 = locked-in trade break
8 = error
95 = participant indicator
96 = blockbuster
97 = sizable
98 = net trade threshold
99 = net trade threshold fallback

Incoming Message	856 =	Outgoing Message	856 =
Entry (Function V)	0	TTEN/CTEN/TREN/CREN/TGEN/CGEN	0
Accept (Function A)	2	TTAL/CTAL/TRAL/CRAL/TGAL/CGAL	1
Break (Function B)	7	TCLK/CCLK	2
Cancel (Function C)	6	TCBK/CCBK	7
Decline (Function D)	3	TCAN/CCAN	6
Error (Function E)	8	TCDE/CCDE	3
No/Was (Function X)	5	TCER/CCER	8
		TTNW/CTNW/TRNW/CRNW/TGNW/CGNW	5
		TTUD/CTUD	4
		TCPI	95

PATENT
REEL: 037821 FRAME: 0183

Incoming Message	856 =	Outgoing Message	856 =
		TCBT/CCBT	96
		TCST/CCST	97
		TTNT/TTNP	98
		TTFB/TTFP	99

Please see section 6 for scenarios.

PATENT
REEL: 037821 FRAME: 0184

PATENT
REEL: 037821 FRAME: 0185

2.8 Message Identification

The tables in this section highlight the ID and reference number tags that will be used in NASDAQ FIX trade reporting. They are not complete message formats. Please note that these descriptions apply to messages that you submit to NASDAQ.

All TRADE ENTRY messages from you to NASDAQ have these ID tags:

Tag	Name	Req'd	Description
11	ClOrdID	N	Your reference number. This tag is not required to be unique and is not validated in trade reporting.
17	ExecID	Y	Your reference number or 0 (zero). This tag is not required to be unique and is not validated in trade reporting.
37	OrderID	Y	Your reference number or 0 (zero). This tag is not required to be unique and is not validated in trade reporting.
571	TradeReportID	Y	Unique identifier of trade report. Must be unique per day per connector for your firm across all messages.

All other messages from you to NASDAQ have these ID tags:

Tag	Name	Req'd	Description
11	ClOrdID	N	Your reference number. This tag is not required to be unique and is not validated in trade reporting.
17	ExecID	Y	Your reference number or 0 (zero). This tag is not required to be unique and is not validated in trade reporting.
37	OrderID	Y	Your reference number or 0 (zero). This tag is not required to be unique and is not validated in trade reporting.
571	TradeReportID	Y	Unique identifier of message. Must be unique per day per connector for your firm across all messages.

Tag	Name	Req'd	Description
572	TradeReportRefID	N	Contains the value indicated in tag 571 in the original trade entry message.
880	TrdMatchID	Y	NASDAQ-assigned, unique alphanumeric control number. This is commonly known as the ACT Control Number.

Acknowledgement messages (ACKs) are sent in response to an inbound message and are sent to the firm that entered that message. Unsolicited messages (UMs) are sent in response to an inbound message and are sent to all non-trade reporting parties included on that inbound message.

All ACKNOWLEDGEMENT messages coming from NASDAQ have these tags:

Tag	Name	Req'd	Description
11	ClOrdID	N	Contains the value indicated in the inbound message, if any.
17	ExecID	Y	Contains the value indicated in the inbound message or 0 (zero).
37	OrderID	Y	Contains the value indicated in the inbound message or 0 (zero).
571	TradeReportID	Y	Contains the value indicated in the inbound message.
572	TradeReportRefID	N	Contains the first 6 characters of the value indicated in the inbound message, if any.
880	TrdMatchID	Y	NASDAQ assigns a unique alphanumeric control number to every transaction entered into the system. The number is composed of 3 leading digits (current date in Julian form) followed by 1-digit (0,2,4,6,8 = Buy; 1,3,5,7,9 = Sell) followed by a 6-digit alphanumeric relative record value. For example, for a buy entry that was entered on June 29 and assigned a relative record value of A19, the Control Number would be 1810000a19. This is commonly known as the ACT Control Number.

PATENT
REEL: 037821 FRAME: 0186

All UNSOLICITED messages coming from NASDAQ have these tags:

Tag	Name	Req'd	Description
571	TradeReportID	Y	Contains a NASDAQ-defined, unique identification number for this message.
880	TrdMatchID	Y	NASDAQ-assigned, unique alphanumeric control number. This is commonly known as the ACT Control Number.

PATENT
REEL: 037821 FRAME: 0187

PATENT
REEL: 037821 FRAME: 0188

2.9 Possible Duplicates and Resends

You should set tag 43, PossDupFlag, if you are sending a message with a sequence number that was already used. This tag is required for retransmissions. NASDAQ will process as follows:

If tag 43 =	& Seq # is a dup	then, NASDAQ will...
Y	Y	Ignore the message.
Y	N	Process the message normally.
N	Y	Drop the connection.
N	N	Process the message normally.

You should set tag 97, PossResend, if you are sending a message that may be a duplicate of another message. NASDAQ will process as follows:

If tag 97 =	& tag 571 is a dup	then, NASDAQ will...
Y	Y	Send you an acknowledgement, and if this is the first time we are receiving this message, then we will send appropriate responses to all parties involved.
N	Y	Reject the message.
Y	N	Process the message normally.
N	N	Process the message normally.

2.10 Processing Messages across Protocols

As you transition from one protocol to another (for example, from CTCI to FIX), you will have to decide via which protocol messages will come back to you. It may be the case that different desks within your firm will use different protocols. You'll be able to route particular messages to specific protocols.

You will consider three types of messages:

For NASDAQ Market Center-originated trades, you will choose to receive TTENs and TTALs either FIX or CTCI.

For messages in response to messages that you originate (e.g. TTENs), you may choose FIX or CTCI. In the event that you have multiple desks submitting trades via FIX and CTCI, you may choose to have FIX-entered trades come back via FIX and CTCI-entered trades come back via CTCI.

For messages in response to messages that another firm originated (e.g. TTALs), you will select FIX or CTCI.

Our Market Operations team will work with you to establish your preferences.

2.11 Explicit Fee

FINRA Rule 7230A(h) allows FINRA members to collect explicit fee amounts from broker-dealer customers through the FINRA/Nasdaq TRF. Tag 9822, ClearingPrice, was added for this reason. Firms may submit trade reports that include a transaction fee that, in turn, will be included in the regular clearance and settlement process at the National Securities Clearance Corporation (DTCC). Clearing Price contains Unit Price + Explicit Fee per share, if the tag 423, PriceType, is 98. It contains Contact Price + Total Explicit fee, if PriceType is 99.

Firms must have an agreement with each other on file before they can use trade reporting for the collection/payment of fees. These agreements will be enforced systematically and are maintained by NASDAQ on behalf of FINRA.

You may only use the FINRA/Nasdaq TRF to collect/pay fees from/to other FINRA members. A fee can only be collected when it is included as part of the clearing price. The fee must be per share. You are not allowed to enter transactions that are comprised only of fees.

You have the responsibility to make sure that the trade price is reported to the tape.

This functionality is optional. Please contact NASDAQ if you wish to participate. Section 1.2 has contact information.

PATENT
REEL: 037821 FRAME: 0189

PATENT
REEL: 037821 FRAME: 0190

3 Session Details

3.1 Hours of Operation

All times are Eastern.

3.1.1 Regular Trading Day

Logon/Logoff

- NASDAQ FIX will be up and accessible at 4:00 a.m.
- NASDAQ FIX will remain up and running until 8:00 p.m.
- Although it is not required, we suggest you log off at the end of your trading day. Otherwise, NASDAQ will log you off at shutdown.

	Start Time	End Time
FIX Engine	4:00:00 a.m.	8:00:00 p.m.

Messaging

- Pre-market hours are from 8:00:00 a.m. until 9:29:59 a.m.
- Market hours are from 9:30:00 a.m. until 4:00:00 p.m.
- Post-market hours are from 4:00:00 p.m. until 8:00 p.m.
- Trades entered between 4:00:00 a.m. and 7:59:59 a.m. will be rejected.
- Trades submitted after 8:02:00 p.m. will be rejected.
- To correct an as-of trade, you must cancel the trade and re-enter it. This also applies to non-trade reporting party entries.

Time Table	
8:00:00 a.m. to 9:29:59 a.m.	Trades executed during this period must be reported with T modifier within 10 seconds of execution. If not reported within 10 seconds of execution, must be reported with U modifier.

PATENT
REEL: 037821 FRAME: 0191

Time Table	
9:30:00 a.m. to 4:00:00 p.m.	Market Hours
4:00:00 pm to 8:00:00 p.m.	End of cancellation/correction period for trades executed between 9:30 a.m. and 4:00 p.m. Trades entered after 4:00p.m. may be cancelled.
8:00:00 p.m.	System Closed (new trade reports will be rejected)
8:00:00 pm – 08:19:59 pm	End of Trade Action You may accept or decline trades entered during regular or after market hours *** New post market hours schedule will be in effect starting October 12, 2015*
8:00:00 p.m. to 11:59:59 p.m.	Trades executed during this period are reported the next day on an as-of basis. Trades executed during this period must be reported with T modifier within 15 minutes of system open. If not reported within 15 minutes, must be reported with U modifier.
12:00:00 a.m. to 7:59:59 a.m.	Trades executed during this period must be reported with T modifier within 15 minutes of system open. If not reported within 15 minutes, must be reported with U modifier.

Trades Executed on Non-business Days

Trades executed on non-business days must be reported by 8:15 a.m. on the next business day with a T modifier.

Breakdown of cancel/correct impacts by execution and report times:

For T trades, if the Execution Time is 4:00:00 p.m. to 8:00:00 p.m., then Report Time is 4:00:00 p.m. to 8:00 p.m. and the Cancel Time is 4:00:00 p.m. to 8:20:00 p.m.

For .T trades, if the Execution Time is 12:00:00 a.m. to 9:29:59 a.m., then Report Time is 8:00:00 a.m. to 8:00:00 p.m. and the Cancel Time is 8:00:00 a.m. to 8:00:00 p.m.

For regular way or modified trades (not T), if the Execution Time is 9:30 a.m. to 4:00:00 p.m., then Report Time is 9:30:00 a.m. to 8:00:00 p.m. and the Cancel Time is 9:30:00 a.m. to 8:00:00 p.m.

For As Of trades, if the Execution Time is 8:00:00 p.m. to 11:59:59 p.m., then Report Time is 8:00:00 a.m. to 8:00:00 p.m. and the Cancel Time is 8:00:00 a.m. to 8:00:00 p.m.

NASDAQ FIX will reset its inbound and outbound sequence numbers to 1 at approximately 7:00:00 p.m. each day.

3.1.2 Early Close Trading Day

A planned early market close usually occurs at 1:00 p.m. NASDAQ will notify you of an early close by Head Trader Alert that will provide closing times. In unforeseen circumstances, an unplanned early market close may be necessary. Again, NASDAQ will notify you of such an event by Head Trader Alert. Head Trader Alerts are available online at: http://www.nasdaqtrader.com/

Logon/Logoff

- As with regular trading days, NASDAQ FIX will be up and accessible at 4:00 a.m.
- Logons are accepted any time after 4:00 a.m., and all messaging remains the same through market open.
- NASDAQ FIX will remain up and running until 4:00 p.m.
- Logoffs are not required. If you choose to log off, do so by 4:00 p.m.

Messaging

- Pre-market hours are from 8:00 a.m. until 9:30 a.m.
- Market hours are from 9:30 a.m. until 1:00 p.m.
- Post-market hours are from 1:00 p.m. until 3:30 p.m.
- Trades entered between 4:00 a.m. and 8:00 a.m. will be rejected.
- Trades submitted after 5:00 p.m. will be rejected.
- To correct an As of Trade, you must cancel the trade and re-enter it. This also applies to non-trade reporting party entries.

NASDAQ FIX will reset its inbound and outbound sequence numbers to 1 at approximately 4:00 p.m. each day.

PATENT
REEL: 037821 FRAME: 0192

3.1.3 Submission of Messages on Non-trading Days

All messages, including logon, will be rejected on non-trading days. Of course, users will be able to logon and test on User Acceptance Test days.

PATENT
REEL: 037821 FRAME: 0193

3.2 Connectivity

You have the ability to send NASDAQ FIX order messages and NASDAQ FIX trade reporting messages over the same connection, although you may choose to send them over separate connections. You should make the decision after considering your own architecture and performance requirements.

To indicate the destination of your message within NASDAQ, you will use tag 57, `TargetSubID`. The values of this tag are:

- S = NASDAQ Market Center orders
- T = FINRA/Nasdaq TRF and NASDAQ Market Center trade reporting

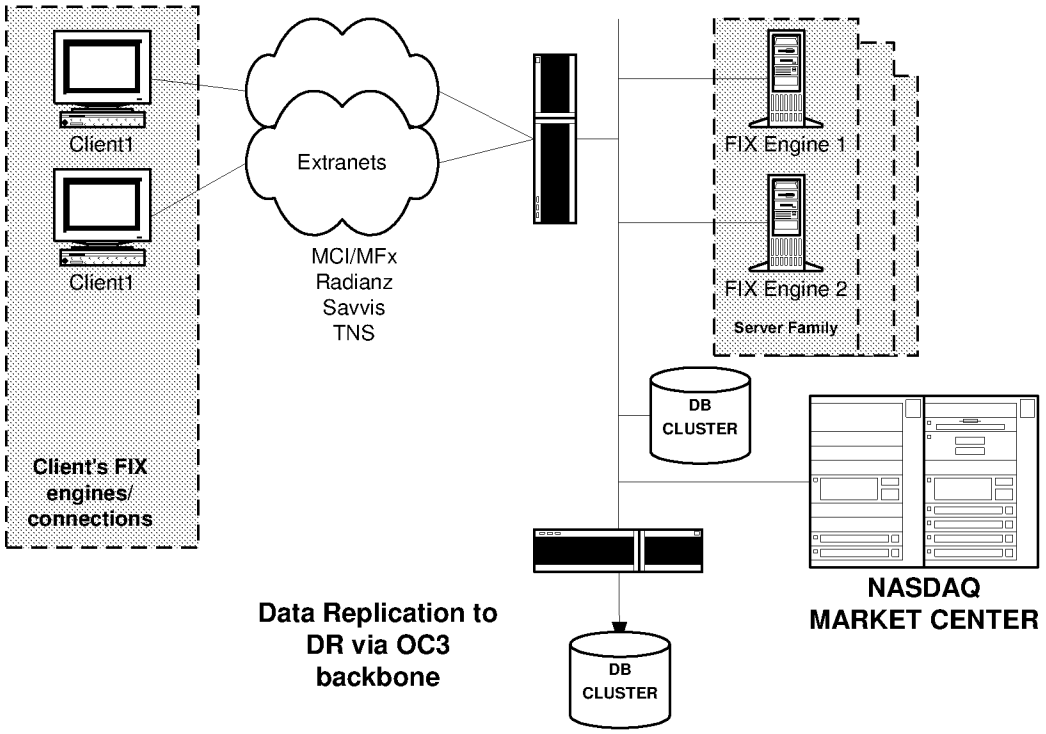
Messages associated with orders must be sent to NASDAQ's order system, while messages associated with trade entries must be sent to NASDAQ's trade reporting system. You must use T for all trade reporting messages. Trade reporting messages (35 =8) with "S" will be rejected.

- A connector ID is good for one and only one I1I2.
- The initial logon message is validated for both the sender comp ID (MPID) and the sender sub ID (I1I2).
- If logon fails, you will not receive a message indicating this failure.
- Subsequent administrative and application messages will validate the connector ID and I1I2.

PATENT
REEL: 037821 FRAME: 0194

PATENT
REEL: 037821 FRAME: 0195

3.3 Architecture



4 Message Formats

4.1 Standard Message Formats

All inbound and outbound messages will begin with a standard header and end with a standard footer.

4.1.1 Inbound to NASDAQ Header Format

Tag	Tag Name	Req'd	NASDAQ Implementation
8	BeginString	Y	Unencrypted, must be first field in the message.
9	BodyLength	Y	Unencrypted, must be second field in the message.
34	MsgSeqNum	Y	Integer message sequence number.
35	MsgType	Y	Unencrypted, must be third field in the message. Valid value: 8 = Execution Report
43	PossDupFlag	N	Required for retransmissions. Indicates possible retransmission of message with this sequence number. Valid values: Y = Possible duplicate N = Original transmission
49	SenderCompID	Y	Your 4-character ID assigned by NASDAQ as part of your NASDAQ connectivity.
50	SenderSubID	Y	Your User ID assigned to you as part of your NASDAQ connectivity.
52	SendingTime	Y	Not supported at this time.
56	TargetCompID	Y	NSDQ
57	TargetSubID	Y	1-character that identifies this entry as a trade reporting message. T = NASDAQ Market Center trade reporting For trade reporting, always use T, otherwise your message will be rejected. See section 3.2.
90	SecureDataLen	N	Not supported at this time.

PATENT
REEL: 037821 FRAME: 0196

Tag	Tag Name	Req'd	NASDAQ Implementation
91	SecureData	N	Not supported at this time.
97	PossResend	N	Required if the message is being resent and is a possible duplicate of another message sequence number.
115	OnBehalfOfCompID	N	If present, this MPID will be passed to the trade reporting application. If not present, the value in tag 49 will be passed to the trade reporting application. This allows you to use multiple MPIDs through a single connection. For Service Bureaus, if you are sending this message on behalf of your customer, their 4-character MPID is placed here. For both Broker Dealers and regular connections, you can use this field to submit your customer's MPID. This value will be returned to you in tag 128 on the outbound message. Please note that while it is possible for you submit a chain of transactions with inconsistent values for this tag in different messages, you are strongly advised not to do so.
116	OnBehalfOfSubID	N	For both Broker Dealers and regular connections, you can use this field to submit your customer's I1I2. This value will be returned to you in tag 129 on the outbound message. Please note that while it is possible for you submit a chain of transactions with inconsistent values for this tag in different messages, you are strongly advised not to do so.
122	OrigSendingTime	N	Required for message resends. NQ supports standard FIX timestamps with or without millisecond resolution.

4.1.2 Inbound to NASDAQ Trailer Format

Tag	Field Name	Req'd	NASDAQ Implementation

PATENT
REEL: 037821 FRAME: 0197

Tag	Field Name	Req'd	NASDAQ Implementation
10	CheckSum	Y	3-character end-of-message delimiter that represents the total number of bytes in this message. Unencrypted, must be last field in message.

4.1.3 Outbound from NASDAQ Header Format

Tag	Tag Name	Req'd	NASDAQ Implementation
8	BeginString	Y	Unencrypted, must be first field in the message.
9	BodyLength	Y	Unencrypted, must be second field in the message.
34	MsgSeqNum	Y	Integer message sequence number.
35	MsgType	Y	Unencrypted, must be third field in the message. Valid value: 8 = Execution Report.
43	PossDupFlag	N	Required for retransmissions. Indicates possible retransmission of message with this sequence number. Valid values: Y = Possible duplicate N = Original transmission
49	SenderCompID	Y	NSDQ
50	SenderSubID	Y	1-character indicator that identifies this response as a trade reporting message. T = NASDAQ Market Center trade reporting For trade reporting, always use T. See section 3.2.
52	SendingTime	Y	Not supported at this time.
56	TargetCompID	Y	Receiving party's MPID.
57	TargetSubID	Y	Receiving party's I1I2.
90	SecureDataLen	N	Not supported at this time.
91	SecureData	N	Not supported at this time.

PATENT
REEL: 037821 FRAME: 0198

Tag	Tag Name	Req'd	NASDAQ Implementation
97	PossResend	N	Required if the message is being resent and is a possible duplicate of another message sequence number.
122	OrigSendingTime	N	Required for message resends. NQ supports standard FIX timestamps with or without millisecond resolution.
128	DeliverToCompID	N	Your MPID as stated in tag 115 in the inbound message is returned to the service bureau in this tag.
129	DeliverToSubID	N	Your I1I2 as stated in tag 116 in the inbound header is returned to the service bureau in this tag.

4.1.4 Outbound from NASDAQ Trailer Format

Tag	Field Name	Req'd	NASDAQ Implementation
10	CheckSum	Y	3-character end-of-message delimiter that represents the total number of bytes in this message. Unencrypted, must be last field in message.

PATENT
REEL: 037821 FRAME: 0199

PATENT
REEL: 037821 FRAME: 0200

4.2 Administrative Messages

4.2.1 Heartbeat

Tag	Field Name	Req'd	Comments
	Standard Header	Y	`MsgType` = 0
112	TestReqID	N	Required when the heartbeat is in response to a Test Request. It is the `TestReqID` received from `TestRequest` message.
	Standard Trailer	Y	

4.2.2 Logon

After establishing your TCP connection with NASDAQ FIX, a Logon must be the first message that you send. NASDAQ will respond with its own Logon. You must wait for that Logon before sending additional messages.

Tag	Field Name	Req'd	Comments
	Standard Header	Y	`MsgType` = A
95	RawDataLength	N	
96	RawData	N	
98	EncryptMethod	Y	Must be 0.
108	HeartBtInt	Y	NASDAQ recommends an interval between 30-60 seconds. If you submit a value of less than 30 seconds, the logon will be rejected.
	Standard Trailer	Y	

4.2.3 Test Request

The `HeartBtInt` that is specified in the Logon message will be used to make sure that the customer is alive and functioning. If NASDAQ detects inactivity for a period longer than the `HeartBtInt` + 1 second, it will send a Test Request to determine if the customer is still active. If after another `HeartBtInt`, there is still no activity, NASDAQ will

send another test request. If after this additional `HeartBtInt` there is still no activity, NASDAQ will immediately send a logout message and the connection will be closed. It is expected that similar logic will be used on the customer's side in order to detect host activity.

Tag	Field Name	Req'd	Comments
	Standard Header	Y	`MsgType` = 1
112	TestReqID	Y	Date/Time combination
	Standard Trailer	Y	

4.2.4 Resend Request

Tag	Field Name	Req'd	Comments
	Standard Header	Y	`MsgType` = 2
7	BeginSeqNo	Y	Beginning sequence number of Requested Message
16	EndSeqNo	Y	Ending sequence number of Requested Message
	Standard Trailer	Y	

4.2.5 Sequence Reset

Tag	Field Name	Req'd	Comments
	Standard Header	Y	`MsgType` = 4
36	NewSeqNum	Y	Next expected sequence number
123	GapFillFlag	N	
	Standard Trailer	Y	

4.2.6 Logout

Logouts will occur as a normal end of day routine but may also occur as a result of inactivity. It is the customer's responsibility to logout prior to 5:00 p.m. each trading day.

Tag	Field Name	Req'd	Comments

PATENT
REEL: 037821 FRAME: 0201

Tag	Field Name	Req'd	Comments
	Standard Header	Y	`MsgType` = 5
58	Text	N	10-character alphanumeric subscriber memo field. The system does not validate this entry. Space-filled if the user has not entered any memo.
	Standard Trailer	Y	

PATENT
REEL: 037821 FRAME: 0202

4.3 Application Messages

4.3.1 Inbound to NASDAQ

4.3.1.1 Entry

Firms use an Entry message to enter either a same-day (T) or an as-of (T+n) trade. In tag 452, PartyRole, you will indicate whether you are the executing party or the contra party. After an initial trade is entered, the contra party may accept a trade entry via an accept message or by entering its version of the trade using this message.

The entry message initiates the M1 trade matching process. This process matches trade reporting firm entries with contra firm entries, which results in a locked-in trade. These entries are matched one-to-one and must, therefore, have identical information in order to be matched. Entries by Automatic Give-Up (AGU) firms and Qualified Special Representatives (QSR) represent trades that are already locked in and, therefore, do not require acceptance or match processing. AGU and QSR relationships are pre-established. Tag 577 identifies firms as AGU or QSR. See Scenario 6.1 and 6.3.

A trade entry may be designated for trade reporting only, for trade clearing only, for both trade reporting and clearing, or for regulatory reporting only (non-tape, non-clearing). If tag 852 contains a Y, this entry will be processed for tape reporting if it is a T-date trade. It will be processed for Form T if it is a T+n trade.

Because of the number of transactions that it handles, the trade reporting system does not maintain transactions from previous business days unless the transaction was clearing eligible and remains in an open status. As such, firms are not able to cancel a transaction that was locked-in or was submitted for tape-only from a previous date. Firms use a reversal transaction to offset the previous entry. The same sides of the market, i.e., the buy and sell sides, should appear on both the original trade report and the reversal report. This entry message is used for that purpose.

For Example:

If the original trade report reflects Firm A on the sell side and Firm B on the buy side, the reversal report should also reflect Firm A on the sell side and Firm B on the buy side.

For Reg NMS, we are adding a new message format. Users can use either message format **during the transition period**, but once Reg NMS is fully rolled-out, users must use the Reg NMS format which in this spec, follows the Pre-Reg NMS format.

See the scenarios in section 6 for related outbound messages.
Message Format for Reg NMS

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REEL: 037821 FRAME: 0203

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REEL: 037821 FRAME: 0204

Changes include the addition of a mandatory tag 829, and expansion of tag 277 to allow for multiple values. Additional values have been added to tag 277.

Optional tags 275, 527, 9277, 9278, and 9860 were added in version 2008-02 for expanded REG-NMS message format. These tags may be sent only if tag 452 (Party Role) is "7" Executing Firm. If any of these optional tags are present individually or in combinationthe system will process the message in the expanded format and as an Executing Firm submission.

Reversal Trades will now require 3 new tags. When 700 is flagged to either "Y" or "K", firms will be required to populate tags 880 (TrdMatchID), 22012 (OrigControlDate), and 22029 (RefReportingFacility) on Entry message.

***Note*: On Trade Entry Notification and Entry Notification messages back to firms, the Original Control Number entered in tag 880 will be sent back in tag 881.**

Tag	Field Name	Req'd	Description
	Standard Header		`MsgType` = 8
6	AvgPx	Y	Price of this fill.
11	ClOrdID	N	Your reference number. This tag is not required to be unique and is not validated in trade reporting. Maximum 20 characters.
14	CumQty	Y	Quantity bought/sold on this fill. Maximum 8 digits.
17	ExecID	Y	Your reference number or 0 (zero). This tag is not required to be unique and is not validated in trade reporting.
20	ExecTransType	Y	Valid value: 0 = New
37	OrderID	Y	Your reference number or 0 (zero). This tag is not required to be unique and is not validated in trade reporting.
39	OrdStatus	Y	0 (zero)
54	Side	Y	Valid values:

Tag	Field Name	Req'd	Description
			1 = buy 2 = sell 8 = cross Cross trades will not be supported for AGU or QSR trades beginning 2/29/16. Cross Trades will be rejected if designated as AGU or QSR.
55	Symbol	Y	This field will contain the base listed symbol only for listed securities. See `SymbolSfx` [65] field for additional information about the security.
60	TransactTime	Q	Time of execution of a particular trade expressed in UTC. ***If milliseconds are not populated, the system will append ".000" to the trade report timestamps.***
65	SymbolSfx	N	This field will contain only the additional information about the security (e.g. preferred, warrants, etc.). No delimiters are allowed in this tag.
75	TradeDate	N	Indicates date of trade referenced in this message in YYYYMMDD format. **Absence of this field indicates current day or previous day depending on the "as-of" flag (tag 5080)**. Must be entered for T+2 or older. **"Non-Execution Day" trades must be**: - entered as "as-of" - be marked "non-clearing" - These trades can be either TRF or exchange trades "Non-Execution Day" trades will not be disseminated to the SIP(s). The "Late modifier" is conditionally assigned when the trade was reported any time after 8:15am the following business day.

PATENT
REEL: 037821 FRAME: 0205

Tag	Field Name	Req'd	Description
			"Trades greater than 365 days" must be: - entered as "as-of" - be marked "non-clearing" - These trades **must** be Nasdaq TRF trades
81	ProcessCode	N	Valid values: 0 = regular (default) 3 = FINRA Step-out trade*** Q = NASDAQ Step-Out 7 = Special trade 8 = Special and Step-out trade*** F = Nasdaq Sales Fee Transfer 2 = FINRA Step-in trade*** A = FINRA Special and step-in trade*** B = FINRA Step-out trade with fees*** C = FINRA Special and Step-out trade with fees*** D = FINRA Position Transfer M = Clearing Only/Non Regulatory* N = Special and Clearing Only/Non Regulatory* O = Clearing Copy** P = Special and Clearing Copy** *Clearing Only/Non Regulatory designations will be used in regards to FINRA Rule Filing Notice 2015-035 (effective on or about February 1, 2016 pending SEC approval) **Clearing Copy designation will be used for Nasdaq NextShares. (effective on or about February 1, 2016 pending SEC approval)

PATENT
REEL: 037821 FRAME: 0206

Tag	Field Name	Req'd	Description
			*** As of 2/29/16, validations on proper step-in and step-out designations will begin. Any TRF trade designated as a step-out must be entered by the Executing Pary (MM). Any TRF trade designated as a step-in must be entered as a Contra Party (OE). On FINRA Step-Out transactions with fees (i.e. ProcessCode values of B and C): 1. Firms must set tag 852 (PublishTrdIndicator) to **"N"** (FINRA will assess the FINRA Section 3 fee) 2. Firms must have tag 577 (ClearingInstruction) set to **"0"**
107	SecurityDesc	Y	Valid values: N = NASDAQ Global Select or NASDAQ Global R = NASDAQ Capital Market C= CQS
150	ExecType	Y	Valid value: F = trade report
151	LeavesQty	Y	Valid value: 0 (zero)
275	MDMkt	N	ACT Intended Market Center. Defines the market to which the trade entry is reported. Q = NASDAQ Exchange function D = FINRA/NASDAQ TRF (Default)

PATENT
REEL: 037821 FRAME: 0207

Tag	Field Name	Req'd	Description
			If tag 81 Process code is F or Q, then MDMkt must = Q **Tag may be sent only if tag 452 (Party Role) is "7" or system will process message as Executing Firm.**
277	TradeCondition	Q	Space-delimited list of trade conditions. Modifiers may be combined, within the allowances of the SIAC CTA and UTP Specification documents. Valid values: 0 = regular B = Average Price trade C = Cash I = Late (Sold out of Sequence) J = Next Day L = Seller's Option N = Stopped Stock – may only be submitted when the Modifier 4 Time Field (Tag 22018) is more than 10 seconds prior to execution of the trade 1 = Pre/Post-market Sold out of Sequence 2 = FINRA Self Help Indicator 3 = Intermarket Sweep Outbound 4 = Derivatively Priced 5 = .T 6 = Intermarket Sweep Inbound 7 = Qualified Contingent Trade 8 = FINRA Subpenny Indicator 9 = Prior Reference Price may only be submitted when the Modifier 4 Time Field (Tag 22018) is more than 10 seconds prior to execution of the trade 16 = Away from market trade as defined in FINRA Rule 6380A(e)(2) 18 = OTC Option Exercise

PATENT
REEL: 037821 FRAME: 0208

Tag	Field Name	Req'd	Description
			19 = Error Correction 20 = Print Protection
375	ContraBroker	N	MPID of the other side. If you are submitting an internal cross trade, then this value is the same as the MMID. **Tag must be sent if tag 54 = 8.**
423	PriceType	Q	Valid values: 98 = Decimal Unit Price 99 = Contract Amount
440	ClearingAccount	N	4 digit numeric field The number of the clearing firm associated with the executing party. If you do not enter a number, then NASDAQ uses the default clearing number in your firm profile.
452	PartyRole	Q	Identifies the firm as either the executing party or contra party. See section 2.1. Valid values: 7 = executing firm 17 = contra firm
527	SecondaryExecId	N	Trade Reference Number. A Firm populated field to discretely tie a Media eligible transaction to one or more non-Media eligible transactions. The firm might populate this field with the same value on a Media trade and the subsequent non-Media Riskless Principal trade for example This is a six character alphanumeric field. **Tag may be sent only if tag 452 (Party Role) is "7" or system will process message as Executing Firm.**

PATENT
REEL: 037821 FRAME: 0209

Tag	Field Name	Req'd	Description
528	OrderCapacity	Q	Valid values: P = principal A = agent R = riskless principal Firms must submit OrderCapacity on all trade reports.
571	TradeReportID	Q	Unique identifier of trade capture report. Must be unique per day per connector for your firm across all messages. 20-character alphanumeric.
577	ClearingInstruction	Q	Valid values: 0 = clear 10 = FINRA AGU Lock-in 11 = QSR clear 97 = no clear 98 = QSR no clear 92 = NASDAQ QSR for clearing 93 = NASDAQ AGU for clearing 94 = AGU Clearing, non-risk eligible 95 = Risk Update only, not sent to clearing 96 = Clearing, non-risk eligible
700	ReversalIndicator	N	Valid values: N = Not a reversal (default) Y = reversal reported through ACT K = reversal reported through ACT
880	TrdMatchID	Q	This tag must contain the NASDAQ-assigned control number from the original trade entry acknowledgement. **Required on Reversal trade reports**

PATENT
REEL: 037821 FRAME: 0210

Tag	Field Name	Req'd	Description
829	TrdSubType	Y	Indicates whether the trade is exempt from the trade through rule or not. 0 = No Trade Through Exemption 1 = Trade Through Exemption
852	PublishTrdIndicator	N	Valid values: Y = Report to Tape (default) N = Do Not Report to Tape If tag 277 = 16, 17, or 18, then tag 852 must = N.
853	ShortSaleReason	N	Reason for short sale. Valid values: 0 = Dealer Sold Short 2 = Selling Customer Sold Short 4 = Contra Side Sold Short 1 = Dealer Sold Short Exempt 3 = Selling Customer Sold Short Exempt 5 = Contra Side Sold Short Exempt
855	SecondaryTrdType	N	Number of days associated with trade. This tag must contain a value for ex-clearing transactions; otherwise, NASDAQ will process as a regular trade. Valid values: 00 – Cash Trade 01 – Next Day 02, 04-60 – Seller's Option
856	TradeReportType	Q	Used to identify message type. When entering a new trade, the only valid value is: 0 = submit See Appendix A: Message Flow ScenariosAppendix A: Message Flow Scenarios.

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REEL: 037821 FRAME: 0211

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Tag	Field Name	Req'd	Description
5080	AsOfIndicator	Q	Valid values: Y = As-of (T+1 to T+n) N = Original (T-day entry)
5149	Memo	N	User Memo. (For ACT messaging, please limit to 10 char or less).
9277	RelatedMarketCenter	N	Related Market Center. Required on transaction reports submitted to the TRF relating to Intended Market Center D step-outs, reversals, Non-tape, and riskless principal transactions, the market where the underlying transaction was reported, as applicable. Blank A = NYSE MKT trade B = NASDAQ BX trade C = National Stock Exchange trade F = Foreign Market G = BATS Y Exchange trade H = BATS Exchange trade I = International Securities Exchange trade J = Direct Edge A Exchange trade K = Direct Edge X Exchange trade M = Chicago Stock Exchange trade N = New York Stock Exchange trade P = NYSE ARCA trade Q = NASDAQ Exchange trade W = Chicago Board Options Exchange trade X = NASDAQ PSX trade Z = Unknown Market Center U = Unspecified Multiple Market trades 0 = ADF 1 = FINRA/NASDAQ TRF 3 = FINRA/NYSE TRF

PATENT
REEL: 037821 FRAME: 0212

Tag	Field Name	Req'd	Description
			Tag may be sent only if tag 452 (Party Role) is "7" or system will process message as Executing Firm.
9278	Advertisement Instruction	N	1 character field. Valid values: 1 = publish Default is to not publish. **Tag may be sent only if tag 452 (Party Role) is "7" or system will process message as Executing Firm.**
9822	ClearingPrice	N	Price inclusive of Explicit Fee. Cannot equal trade price.
9825	ReportingGUID	N	MPID of executing party's give-up firm associated with the trade
9826	NonReportingGUID	N	MPID of contra party's give-up firm associated with trade.
9854	OverrideFlag	Q	Valid values: Y = Override N = No override
9860	ContraBranchSeqNbr	N	20 chars. Required where the CP party was also required to submit an OATS Execution Report to FINRA pursuant to FINRA Rule 7450. Field is 1-20 alphanumeric, embedded spaces included. **Tag may be sent only if tag 452 (Party Role) is "7" or system will process message as Executing Firm.**

PATENT
REEL: 037821 FRAME: 0213

Tag	Field Name	Req'd	Description
9861	BranchSeqNbr	N	20 chars. Required where the EP party was also required to submit an OATS Execution Report to FINRA pursuant to FINRA Rule 7450. Field is 1-20 alphanumeric, embedded spaces included.
9862	ContraTradePA	N	Valid values: P = Principal A = agent R = Riskless Principal Required on all non-match eligible trades. **For example:** - Non-Media/No Clear - QSR - AGU Allowable on cross trades and customer trades when applicable.
9863	ContraClearingAcct	N	The number of the clearing firm associated with the contra party. If you do not enter a number, then NASDAQ uses the default clearing number in the contra firm profile.
22012	OrigControlDate	N	Original Control Number Date of Original Trade Format: YYYYMMDD *Required on Reversal trade reports*

PATENT
REEL: 037821 FRAME: 0214

Tag	Field Name	Req'd	Description
22018	TradeModifier4Time	N	Time associated with Prior Reference Price or Stopped Stock trade, (in **UTC/GMT**). Format: HH:MM:SS.sss ***If milliseconds are not populated, the system will append ".000" to the trade report timestamps.*** Required when Tag 277 TradeCondition contains N (Stopped Stock) or 9 (Prior Reference Price). Firms will receive a reject when: - A Trade Modifier of PRP or Stop Stock is entered without a Mod 4 Time - A Mod 4 Time is entered on a trade report where the Trade Modifier is not a PRP or Stop Stock - The Mod 4 Time is **not** more than 10 seconds before the execution time (Tag 60)
22029	RefReportingFacility	N	Reporting facility identified on the original trade. Valid values: A = ADF Q = FINRA/NASDAQ TRF N = FINRA/NYSE TRF O = ORF (OTC Equity Reporting Facility) space = FINRA/NASDAQ TRF *Required on Reversal trade reports*

PATENT
REEL: 037821 FRAME: 0215

Tag	Field Name	Req'd	Description
22033	TradeModifier2Time	N	Time associated with Intermarket sweep outbound trades, (in **UTC/GMT**). Format: HH:MM:SS.sss ***If milliseconds are not populated, the system will append ".000" to the trade report timestamps.*** Optional, may only be submitted when Tag 277 TradeCondition contains 3 (Intermarket sweep outbound). Firms will receive a reject when: - A Mod 2 Time is entered on a Trade Report that ***is not*** flagged as an Outbound ISO in Trade Modifier
	Standard Trailer		

PATENT
REEL: 037821 FRAME: 0216

PATENT
REEL: 037821 FRAME: 0217

4.3.1.2 Accept, Break, Cancel, Decline, Error

Instead of sending in its version of the trade via an entry message, the contra party uses an Accept (Function A) message to accept a trade entry and enter into a locked-in trade. Using this message prevents the M1 match process from initiating. By accepting a trade entry, the contra party confirms and agrees to the terms of the trade. See section 6.1 for related outbound messages.

Both executing and contra parties may enter a Break (Function B) message to break a locked-in trade. A locked-in trade will be broken only after both the executing party and the contra party have submitted this message. When one party submits this message, cancel messages are disseminated to both parties. This alerts the other party to send in a break trade message. Once a trade has been broken, further trade reconciliation action is prevented, and the trade will be deleted at the end of the entry day. See section 6.7 for related outbound messages.

Both executing and contra parties may use the Cancel (Function C) message to cancel a previously reported trade that is not yet locked-in. A QSR firm may, however, cancel a QSR locked-in trade. If the trade is already locked in, firms must use the Break function. If the executing party enters a cancel trade message for a disseminated TRADE REPORTING 1 (T-day) entry, a cancel trade report will be sent to the tape. If the trade was entered in TRADE REPORTING 2 (T+n), this message will act like an error message. If the contra party enters a cancel trade message, the trade will not be processed for clearing. A cancel trade report will not be sent to the tape. All canceled trades will be deleted at the end of the entry day. See section 6.9 for related outbound messages.

The contra party or executing party may use the Decline (Function D) message to decline or reject a trade entry because of a disagreement with the terms of the trade. Declined trades will be assigned status "D". However the contra party is still allowed to accept the transaction. Please note:

- Declined trades shall carryover to the next day and be eligible to be Accepted.
- Trades T+22 and older will carryover to the next day and be eligible for match/compare, Accept, or Decline.
  - These trades will not be included in the Auto-lock process

The executing party may use an Error (Function E) message to cancel a previously entered trade that was reported today, but never actually took place. If the trade is already locked in, the executing party must use the Break function. If the original trade was same-day and reported to the tape, then the error will be reported to the tape. If the original trade was not same-day, then the error will not be reported as an error to the tape, but the trade will be marked as an error. NASDAQ will forward a TCER message to both the executing party and contra party to advise them that the

specified trade is updated to Error status. NASDAQ will not match errored trades, allow acceptance of errored trades, forward the trade to clearing, or keep it on record after the end of the entry day. See section 6.11 for related outbound messages.

Message Format

Tag	Field Name	Req'd	Description
	Standard Header		`MsgType` = 8
6	AvgPx	Y	Price of this fill.
11	ClOrdID	N	Your reference number. This tag is not required to be unique and is not validated in trade reporting. Maximum 20 characters.
14	CumQty	Y	Quantity bought/sold on this fill. Maximum 8 digits.
17	ExecID	Y	Your reference number or 0 (zero). This tag is not required to be unique and is not validated in trade reporting.
20	ExecTransType	Y	Valid value: 0 = New
37	OrderID	Y	Your reference number or 0 (zero). This tag is not required to be unique and is not validated in trade reporting.
39	OrdStatus	Y	0 (zero)
54	Side	Y	Valid values: 1 = buy 2 = sell 8 = cross Cross trades will not be supported for AGU or QSR trades beginning 2/29/16. Cross Trades will be rejected if designated as AGU or QSR.
55	Symbol	Y	This field will contain the base listed symbol only for listed securities. See `SymbolSfx` [65] field for additional information about the security.

PATENT
REEL: 037821 FRAME: 0218

Tag	Field Name	Req'd	Description
65	SymbolSfx	N	This field will contain only the additional information about the security (e.g. preferred, warrants, etc.) for listed securities. This additional information must be in CQS or TMTR format . No delimiters are allowed in this tag. For example, security "OXYpB" would be formatted as follows: Symbol [55]: OXY SymbolSfx [65]: CQS format: pB TMTR format: .PRB
150	ExecType	Y	Valid value: F = trade report
151	LeavesQty	Y	Valid value: 0 (zero)
571	TradeReportID	Q	Unique identifier of trade capture report. Must be unique per day per connector for your firm across all messages. 20-character alphanumeric.
572	TradeReportRefID	N	Contains the value indicated in tag 571 in the original trade entry message.

PATENT
REEL: 037821 FRAME: 0219

Tag	Field Name	Req'd	Description
856	TradeReportType	Q	Used to identify message type. When specifying acceptance, the only valid value is: 2 = accept When specifying a break, the only valid value is: 7 = locked-in trade break When specifying a cancel, the only valid value is: 6 = trade report cancel When specifying a decline, the only valid value is: 3 = decline When specifying an error, the only valid value is: 8 = error See Appendix A: Message Flow Scenarios~~Appendix A: Message Flow Scenarios~~.
880	TrdMatchID	Q	This tag must contain the NASDAQ-assigned control number from the original trade entry acknowledgement.
9862	ContraTradePA	N	Valid values: P = Principal A = agent R = Riskless Principal This is required on all "Accept" transactions where TradeReportType is "2".
	Standard Trailer		

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REEL: 037821 FRAME: 0220

PATENT
REEL: 037821 FRAME: 0221

4.3.1.3 No/Was

The trade reporting party uses a No/Was (Function X) message to correct the details of a trade reported earlier in the day. The No/Was trade is applicable to T-day open trades and QSR reportable entries only.

In the No/Was message, only the reference number in tag 572 and the control number in tag 880 are applicable to the No (old) portion. All other fields apply to the Was (new) portion.

The security symbol field cannot be changed using this message. A cancel or error message should be used for that purpose.

If the original contra firm ID is changed, an error message (TCER) will be sent to the original contra firm and an allege message (TTAL) will be sent to the new contra firm. The executing firm will receive the no/was acknowledgment message (TTNW).

This message will be processed for trade reporting and disseminated to data vendors. The information from the original trade entry will not be forwarded to clearing. The system will assign a new control number to the new information, and it will be processed as a new trade entry.

See scenarios 6.14, 6.15, 6.16, 6.17, and 6.18 for related outbound messages.

Reg-NMS Message Format

Tag	Field Name	Req'd	Description
	Standard Header		`MsgType` = 8
6	AvgPx	Y	Price of this fill.
11	ClOrdID	N	Your reference number. This tag is not required to be unique and is not validated in trade reporting. Maximum 20 characters.
14	CumQty	Y	Quantity bought/sold on this fill. Maximum 8 digits.
17	ExecID	Y	Your reference number or 0 (zero). This tag is not required to be unique and is not validated in trade reporting.
20	ExecTransType	Y	Valid value:

Tag	Field Name	Req'd	Description
			0 = New
37	OrderID	Y	Your reference number or 0 (zero). This tag is not required to be unique and is not validated in trade reporting.
39	OrdStatus	Y	0 (zero)
54	Side	Y	Valid values: 1 = buy 2 = sell 8 = cross Cross trades will not be supported for AGU or QSR trades beginning 2/29/16. Cross Trades will be rejected if designated as AGU or QSR.
55	Symbol	Y	This field will contain the base listed symbol only for listed securities. See `SymbolSfx` [65] field for additional information about the security.
60	TransactTime	Q	Time of execution of a particular trade expressed in UTC. ***If milliseconds are not populated, the system will append ".000" to the trade report timestamps.***
65	SymbolSfx	N	This field will contain only the additional information about the security (e.g. preferred, warrants, etc.). No delimiters are allowed in this tag.
75	TradeDate	N	Indicates date of trade referenced in this message in YYYYMMDD format. **Absence of this field indicates current day or previous day depending on the "as-of" flag (tag 5080)**. Must be entered for T+2 or older. **"Non-Execution Day" trades must be**: - entered as "as-of"

PATENT
REEL: 037821 FRAME: 0222

Tag	Field Name	Req'd	Description
			- be marked "non-clearing" - These trades can be either TRF or exchange trades "Non-Execution Day" trades will not be disseminated to the SIP(s). The "Late modifier" is conditionally assigned when the trade was reported any time after 8:15am the following business day. **"Trades greater than 365 days"** must be: - entered as "as-of" - be marked "non-clearing" - These trades **must** be Nasdaq TRF trades
81	ProcessCode	N	Valid values: 0 = regular (default) 3 = FINRA Step-out trade*** Q = NASDAQ Step-Out 7 = Special trade 8 = Special and Step-out trade*** F = Nasdaq Sales Fee Transfer 2 = FINRA Step-in trade*** A = FINRA Special and step-in trade*** B = FINRA Step-out trade with fees*** C = FINRA Special and Step-out trade with fees*** D = FINRA Position Transfer M = Clearing Only/Non Regulatory* N = Special and Clearing Only/Non Regulatory* O = Clearing Copy** P = Special and Clearing Copy**

PATENT
REEL: 037821 FRAME: 0223

Tag	Field Name	Req'd	Description
			*Clearing Only/Non Regulatory designations will be used in regards to FINRA Rule Filing Notice 2015-035 (effective on or about February 1, 2016 pending SEC approval) **Clearing Copy designation will be used for Nasdaq NextShares. (effective on or about February 1, 2016 pending SEC approval) *** As of 2/29/16, validations on proper step-in and step-out designations will begin. Any TRF trade designated as a step-out must be entered by the Executing Party (MM). Any TRF trade designated as a step-in must be entered as a Contra Party (OE). On FINRA Step-Out transactions with fees (i.e. ProcessCode values of B and C): 1. Firms must set tag 852 (PublishTrdIndicator) to "N" (FINRA will assess the FINRA Section 3 fee) ~~3.~~2. Firms must have tag 577 (ClearingInstruction) set to "0"
107	SecurityDesc	Y	Valid values: N = NASDAQ Global Market or NASDAQ Global Select Market R = NASDAQ Capital Market C = CQS
150	ExecType	Y	Valid value: F = trade report
151	LeavesQty	Y	Valid value: 0 (zero)

PATENT
REEL: 037821 FRAME: 0224

Tag	Field Name	Req'd	Description
275	MDMkt	N	ACT Intended Market Center. Defines the market to which the trade entry is reported. Q = NASDAQ Exchange function D = FINRA/NASDAQ TRF (Default) If tag 81 Process code is F or Q, then MDMkt must = Q **Tag may be sent only if tag 452 (Party Role) is "7" or system will process message as Executing Firm.**

PATENT
REEL: 037821 FRAME: 0225

Tag	Field Name	Req'd	Description
277	TradeCondition	Y	Space-delimited list of trade conditions. Modifiers may be combined, within the allowances of the SIAC CTA and UTP Specification documents. Valid values: 0 = regular B = Average Price trade C = Cash I = Late (Sold out of Sequence) J = Next Day L = Seller's Option N = Stopped Stock (may only be submitted when the Modifier 4 Time Field (Tag 22018) is more than 10 seconds prior to execution of the trade) 1 = Pre/Post-market Sold out of Sequence 2 = FINRA Self Help Indicator 3 = Intermarket Sweep Outbound 4 = Derivatively Priced 5 = .T 6 = Intermarket Sweep Inbound 7 = Qualified Contingent Trade 8 = FINRA Subpenny Indicator 9 = Prior Reference Price (may only be submitted when the Modifier 4 Time Field (Tag 22018) is more than 10 seconds prior to execution of the trade) 16 = Away from market trade (as defined in FINRA Rule 6380A(e)(2)) 18 = OTC Option Exercise 19 = Error Correction 20 = Print Protection
375	ContraBroker	N	MPID of the other side.

PATENT
REEL: 037821 FRAME: 0226

Tag	Field Name	Req'd	Description
423	PriceType	Q	Valid values: 98 = Decimal Unit Price 99 = Contract Amount
527	SecondaryExecId	N	Trade Reference Number. A Firm populated field to discretely tie a Media eligible transaction to one or more non-Media eligible transactions. The firm might populate this field with the same value on a Media trade and the subsequent non-Media Riskless Principal trade for example **This is a six character alphanumeric field.**
440	ClearingAccount	N	4 digit numeric field. The number of the clearing firm associated with the Executing party. If you do not enter a number, then NASDAQ uses the default clearing number in your firm profile.
528	OrderCapacity	Q	Valid values: P = principal A = agent R = riskless principal Firms must submit OrderCapacity on all trade reports.
571	TradeReportID	Q	Unique identifier of trade capture report. Must be unique per day per connector for your firm across all messages. 20-character alphanumeric.
572	TradeReportRefID	N	Contains the value indicated in tag 571 in the original trade entry message.
577	ClearingInstruction	Q	Valid values: 0 = clear

PATENT
REEL: 037821 FRAME: 0227

Tag	Field Name	Req'd	Description
			10 = FINRA AGU Lock-in 11 = QSR clear 97 = no clear 98 = QSR no clear 92 = NASDAQ QSR for clearing 93 = NASDAQ AGU for clearing 94 = AGU Clearing, non-risk eligible 95 = Risk Update only, not sent to clearing 96 = Clearing, non-risk eligible
829	TrdSubType	Y	Indicates whether the trade is exempt from the trade through rule or not. 0 = No Trade Through Exemption 1 = Trade Through Exemption
852	PublishTrdIndicator	N	Valid values: Y = Report to Tape (default) N = Do Not Report to Tape If tag 277 = 16, 17, or 18, then tag 852 must = N.
853	ShortSaleReason	N	Reason for short sale. Valid values: 0 = Dealer Sold Short 2 = Selling Customer Sold Short 4 = Contra Side Sold Short 1 = Dealer Sold Short Exempt 3 = Selling Customer Sold Short Exempt 5 = Contra Side Sold Short Exempt
855	SecondaryTrdType	N	Number of days associated with trade. This tag must contain a value for ex-clearing transactions; otherwise, NASDAQ will process as a regular trade. Valid values:

PATENT
REEL: 037821 FRAME: 0228

Tag	Field Name	Req'd	Description
			00 – Cash Trade 01 – Next Day 02, 04-60 – Seller's Option
856	TradeReportType	Q	Used to identify message type. When entering a no/was, the only valid value is: 5 = no/was See Appendix A: Message Flow ScenariosAppendix A: Message Flow Scenarios
880	TrdMatchID	Q	This tag must contain the NASDAQ-assigned control number from the original trade entry acknowledgement.
5149	Memo	N	User memo. (For ACT messaging, please limit to 10 char or less)
9277	RelatedMarketCenter	N	Related Market Center. Required on transaction reports submitted to the TRF relating to Intended Market Center D step-outs, reversals, Non-tape, and riskless principal transactions, the market where the underlying transaction was reported, as applicable. Blank A = NYSE MKT trade B = NASDAQ BX trade C = National Stock Exchange trade F = Foreign Market G = BATS Y Exchange trade H = BATS Exchange trade I = International Securities Exchange trade J = Direct Edge A Exchange trade K = Direct Edge X Exchange trade M = Chicago Stock Exchange trade

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PATENT
REEL: 037821 FRAME: 0229

Tag	Field Name	Req'd	Description
			N = New York Stock Exchange trade P = NYSE ARCA trade Q = NASDAQ Exchange trade W = Chicago Board Options Exchange trade X = NASDAQ PSX trade O = Unknown Market Center U = Unspecified Multiple Market trades 0 = ADF 1 = FINRA/NASDAQ TRF 3 = FINRA/NYSE TRF **Tag may be sent only if tag 452 (Party Role) is "7" or system will process message as Executing Firm.**
9278	Advertisement Instruction	N	1 character field. Valid values: 1 = publish Default is to not publish.
9822	ClearingPrice	N	Price inclusive of Explicit Fee. Cannot equal trade price.
9825	ReportingGUID	N	MPID of contra party's give-up firm associated with trade.with trade.
9826	NonReportingGUID	N	MPID of contra party's give-up firm associated with trade.
9854	OverrideFlag	Q	Valid values: Y = Override N = No override
9860	ContraBranchSeqNbr	N	20 chars. Required where the CP party was also required to submit an OATS Execution Report to FINRA pursuant to FINRA Rule 7450. Field is 1-20 alphanumeric, embedded spaces included.

PATENT
REEL: 037821 FRAME: 0230

Tag	Field Name	Req'd	Description
9861	BranchSeqNbr	N	20 chars. Required by OATS for trade reporting. Field is 1-20 alphanumeric, embedded spaces included.
9862	ContraTradePA	N	Valid values: P = Principal A = agent R = Riskless Principal Required on all non-match eligible trades. **For example:** - Non-Media/No Clear - QSR - AGU Allowable on cross trades and customer trades when applicable.
9863	ContraClearingAcct	N	The number of the clearing firm associated with the contra party. If you do not enter a number, then NASDAQ uses the default clearing number in the contra firm profile.

PATENT
REEL: 037821 FRAME: 0231

Tag	Field Name	Req'd	Description
22018	TradeModifier4Time	N	Time associated with Prior Reference Price or Stopped Stock trade, (in **UTC/GMT**). Format: HH:MM:SS.sss ***If milliseconds are not populated, the system will append ".000" to the trade report timestamps.*** Required when Tag 277 TradeCondition contains N (Stopped Stock) or 9 (Prior Reference Price). Firms will receive a reject when: - A Trade Modifier of PRP or Stop Stock is entered without a Mod 4 Time - A Mod 4 Time is entered on a trade report where the Trade Modifier is not a PRP or Stop Stock - The Mod 4 Time is **not** more than 10 seconds before the execution time (Tag 60)
22033	TradeModifier2Time	N	Time associated with Intermarket sweep outbound trades, (in **UTC/GMT**). Format: HH:MM:SS.sss ***If milliseconds are not populated, the system will append ".000" to the trade report timestamps.*** Optional, may only be submitted when Tag 277 TradeCondition contains 3 (Intermarket sweep outbound).
	Standard Trailer		

PATENT
REEL: 037821 FRAME: 0232

PATENT
REEL: 037821 FRAME: 0233

4.3.2 Outbound from NASDAQ

Acknowledgement messages (ACKs) are sent only to the originator of an inbound message. All other parties associated with the trade receive unsolicited messages (UMs).

For all UMs, tag 571 is a unique, NASDAQ-defined number. For all ACKs, tag 571 is an echo of the unique, customer-defined number sent in the inbound message.

For all UMs, tags 11, 17, and 37 will not be returned. For all ACKs, tags 11, 17, and 37 will be returned. In this way, only executing parties receive an echo of their IDs, i.e. contra parties and clearing firms do not receive the executing party's reference numbers.

NASDAQ has condensed 3 message formats in the "Outbound from NASDAQ" section. The 3 message formats condensed were formerly:

- **Trade Entry Notification:**
  - **TREN/CREN** (previously called Reg NMS Message Format for TTEN/CTEN)
  - **TGEN/CGEN** (Expanded ACT MM Message Format)

- **Entry Notification to Alleged Firm:**
  - **TRAL/CRAL** (previously called Reg NMS Message Format for TTAL/CTAL)
  - **TGAL/CGAL** (Expanded Reg-NMS format message)

- **No/Was Notification Message**
  - **TRNW/CRNW** (previously called Reg NMS Message Format)
  - Expanded No/Was Notification TGNW/CGNW

PATENT
REEL: 037821 FRAME: 0234

4.3.2.1 Trade Entry Notification Message Format TKEN/CKEN

When a firm submits an expanded ACT EP trade entry and NASDAQ accepts that entry, a TGEN will be forwarded to the originator. If the executing party is a correspondent of a clearing firm and the clearing firm is elected to receive clearing correspondent messages, a CGEN will be forwarded to the specified clearing firm.

Clients may elect to receive a version 2 format (TKEN/CKEN) containing additional fields, as noted below.

Expanded Reg NMS Format

Tag	Tag Name	Req'd	Description
	Standard Header		`MsgType` = 8
6	AvgPx	Y	Price of this fill.
11	ClOrdID	N	If the clearing firm entered the trade entry, then this tag contains the value indicated in the inbound message or "NA". If this message is a UM, then this tag will not be returned.
14	CumQty	Y	Quantity bought/sold on this fill. Maximum 8 digits.
17	ExecID	Y	Contains the value indicated in the inbound message or 0 (zero).
20	ExecTransType	Y	Valid value: 0 = New
37	OrderID	Y	Contains the value indicated in the inbound message or 0 (zero).
39	OrdStatus	Y	0 (zero)
54	Side	Y	Valid values: 1 = buy 2 = sell 8 = cross Cross trades will not be supported for AGU or OSR trades beginning 2/29/16. Cross Trades will be rejected if designated as AGU or OSR.

Tag	Tag Name	Req'd	Description
55	Symbol	Y	This field will contain the base listed symbol only for listed securities. See `SymbolSfx` [65] field for additional information about the security.
58	Text	Q	Contains message name. TREN or CREN = Reg NMS Format TGEN or CGEN = Expanded Format TKEN or CKEN = FINRA Format (2015)
60	TransactTime	Q	Time of execution of a particular trade expressed in UTC. ***If milliseconds are not populated, the system will append ".000" to the trade report timestamps.***
65	SymbolSfx	N	This field will contain only the additional information about the security (e.g. preferred, warrants, etc.). No delimiters are allowed in this tag.
75	TradeDate	Q	Indicates date of trade referenced in this message in YYYYMMDD format.
81	ProcessCode	N	Valid values: 0 = regular (default) 3 = FINRA Step-out trade*** Q = NASDAQ Step-Out 7 = Special trade 8 = Special and Step-out trade*** F = Nasdaq Sales Fee Transfer 2 = FINRA Step-in trade*** A = FINRA Special and step-in trade*** B = FINRA Step-out trade with fees*** C = FINRA Special and Step-out trade with fees*** D = FINRA Position Transfer M = Clearing Only/Non Regulatory* N = Special and Clearing Only/Non Regulatory* O = Clearing Copy**

PATENT
REEL: 037821 FRAME: 0235

Tag	Tag Name	Req'd	Description
			P = Special and Clearing Copy** *Clearing Only/Non Regulatory designations will be used in regards to FINRA Rule Filing Notice 2015-035 (effective on or about February 1, 2016 pending SEC approval) **Clearing Copy designation will be used for Nasdaq NextShares. (effective on or about February 1, 2016 pending SEC approval) *** As of 2/29/16, validations on proper step-in and step-out designations will begin. Any TRF trade designated as a step-out must be entered by the Executing Party (MM). Any TRF trade designated as a step-in must be entered as a Contra Party (OE). On FINRA Step-Out transactions with fees (i.e. ProcessCode values of B and C): 1. Firms must set tag 852 (PublishTrdIndicator) to "N" (FINRA will assess the FINRA Section 3 fee) 2. Firms must have tag 577 (ClearingInstruction) set to "0"
107	SecurityDesc	Y	Valid values: N = NASDAQ Global Market or NASDAQ Global Select Market R = NASDAQ Capital Market C= CQS
109	ClientID	N	Sent only for clearing messages (CGEN), this field will contain the MMID on the trade.

PATENT
REEL: 037821 FRAME: 0236

Tag	Tag Name	Req'd	Description
150	ExecType	Y	Valid value: I = status
151	LeavesQty	Y	Valid value: 0 (zero)
275	MDMkt	N	ACT Intended Market Center. Defines the market to which the trade entry is reported. Q = NASDAQ Exchange function D = FINRA/NASDAQ TRF (Default) If tag 81 Process code is F or Q, then MDMkt must = Q **Tag may be sent only if tag 452 (Party Role) is "7" or system will process message as Executing Firm.**
277	TradeCondition	Q	Space-delimited list of trade conditions. 0 = regular B = Average Price trade C = Cash I = Late (Sold out of Sequence) J = Next Day L = Seller's Option N = Stopped Stock 1 = Pre/Post-market Sold out of Sequence 2 = FINRA Self Help Indicator 3 = Intermarket Sweep Outbound 4 = Derivatively Priced 5 = .T 6 = Intermarket Sweep Inbound 7 = Qualified Contingent Trade 8 = FINRA Subpenny Indicator 9 = Prior Reference Price 16 = Price unrelated to market

PATENT
REEL: 037821 FRAME: 0237

Tag	Tag Name	Req'd	Description
			18 = OTC Option 19 = Error Correction 20 = Print Protection
375	ContraBroker	Q	MPID of the other side. For clearing messages (CGEN) this will always contain the CPID.
423	PriceType	Q	Indicates whether the average price tag contains contract amount or trade price. This tag is used in conjunction with tag 6. Valid values: 98 = decimal unit price 99 = contract amount
440	ClearingAccount	N	4 digit numeric field. The number of the clearing firm associated with the executing party. If you do not enter a number, then NASDAQ uses the default clearing number in your firm profile.
527	SecondaryExecId	N	Trade Reference Number. A Firm populated field to discretely tie a Media eligible transaction to one or more non-Media eligible transactions. The firm might populate this field with the same value on a Media trade and the subsequent non-Media Riskless Principal trade for example This is a six character alphanumeric field.
528	OrderCapacity	Q	Valid values: P = Principal A = agent R = Riskless Principal

PATENT
REEL: 037821 FRAME: 0238

Tag	Tag Name	Req'd	Description
571	TradeReportID	Q	If the clearing firm entered the trade entry, then this tag contains the value indicated in the inbound message. If this message is a UM, then this tag contains a NASDAQ-defined, unique identification number for this message.
577	ClearingInstruction	Q	Eligibility of this trade for clearing and central counterparty processing. Valid values: 0 = clear 10 = FINRA AGU Lock-in 11 = QSR clear 97 = no clear 98 = QSR no clear 99 = ext. sys. locked-in 92 = NASDAQ QSR for clearing 93 = NASDAQ AGU for clearing 94 = AGU Clearing, non-risk eligible 95 = Risk Update only, not sent to clearing 96 = Clearing, non-risk eligible
700	ReversalIndicator	N	Valid values: N = Not a reversal (default) Y = reversal reported through ACT K = reversal reported through ACT
829	TrdSubType	Y	Indicates whether the trade is exempt from the trade through rule or not. 0 = No Trade Through Exemption 1 = Trade Through Exemption
852	PublishTrdIndicator	N	Valid values: Y = Report to Tape (default) N = Do Not Report to Tape If tag 277 = 16, 17, or 18, then tag 852 must = N.

PATENT
REEL: 037821 FRAME: 0239

Tag	Tag Name	Req'd	Description
853	ShortSaleReason	N	Reason for short sale. Valid values: 0 = Dealer Sold Short 2 = Selling Customer Sold Short 4 = Contra Side Sold Short 1 = Dealer Sold Short Exempt 3 = Selling Customer Sold Short Exempt 5 = Contra Side Sold Short Exempt
855	SecondaryTrdType	N	Number of days associated with trade. This tag will be returned for ex-clearing transactions. Valid values: 00 – Cash Trade 01 – Next Day 02, 04-60 – Seller's Option
856	TradeReportType	Q	Used to identify message type. The TTEN/CTEN message will always contain this value: 0 = Submit See Appendix A: Message Flow Scenarios.
880	TrdMatchID	Q	NASDAQ-assigned, unique control number, commonly known as the ACT control number.
881	SecondaryTradeReportRefID	Q	The trade match ID from the original trade being reversed. Reversal Trades will now require the original control number of the trade. Original Control Number entered in tag 880 on Entry message will Be found in this tag.
939	TrdRptStatus	Q	Valid values: 92 = M1 Matched (locked-in trade)

PATENT
REEL: 037821 FRAME: 0240

Tag	Tag Name	Req'd	Description
			94 = contra party entered trade 95 = Locked-in trades from other NASDAQ systems or QSR trades 97 = Trades entered for Ticker only (no clearing only) 98 = Unanswered (executing party entry)
5080	AsOfIndicator	Q	Valid values: Y = As-of (T+1 to T+n) N = Original (T-day entry)
5149	Memo	N	User memo.
9277	RelatedMarketCenter	N	Related Market Center. Required on transaction reports submitted to the TRF relating to Intended Market Center D step-outs, reversals, Non-tape, and riskless principal transactions, the market where the underlying transaction was reported, as applicable. Blank A = NYSE MKT trade B = NASDAQ BX trade C = National Stock Exchange trade F = Foreign Market G = BATS Y Exchange trade H = BATS Exchange trade I = International Securities Exchange trade J = Direct Edge A Exchange trade K = Direct Edge X Exchange trade M = Chicago Stock Exchange trade N = New York Stock Exchange trade P = NYSE ARCA trade Q = NASDAQ Exchange trade W = Chicago Board Options Exchange trade X = NASDAQ PSX trade Q = Unknown Market Center U = Unspecified Multiple Market trades

PATENT
REEL: 037821 FRAME: 0241

Tag	Tag Name	Req'd	Description
			0 = ADF 1 = FINRA/NASDAQ TRF 3 = FINRA/NYSE TRF **Tag may be sent only if tag 452 (Party Role) is "7" or system will process message as Executing Firm.**
9278	Advertisement Instruction	N	1 character field. Valid values: 1 = publish Default is to not publish.
9807	RegFeeFlag	N	For future use. 1 char field.
9822	ClearingPrice	N	Price inclusive of Explicit Fee.
9825	ReportingGUID	N	MPID of executing party's give-up firm associated with the trade
9826	NonReportingGUID	N	MPID of contra party's give-up firm associated with trade.
9854	OverrideFlag	Q	Valid values: Y = Override N = No override
9860	ContraBranchSeqNbr	N	20 chars. Required where the CP party was also required to submit an OATS Execution Report to FINRA pursuant to FINRA Rule 7450. Field is 1-20 alphanumeric, embedded spaces included. **Tag may be sent only if tag 452 (Party Role) is "7" or system will process message as Executing Firm.**
9862	ContraTradePA	N	Valid values: P = Principal A = agent

PATENT
REEL: 037821 FRAME: 0242

Tag	Tag Name	Req'd	Description
			R = Riskless Principal
9863	ContraClearingAcct	N	The number of the clearing firm associated with the contra party. If you do not enter a number, then NASDAQ uses the default clearing number in the contra firm profile.
22012	OrigControlDate	Y	Original Control Number Date of Original Trade Format: YYYYMMDD *Required on Reversal trade reports*
22018	TradeModifier4Time	N	Time associated with Prior Reference Price or Stopped Stock trade, (in **UTC/GMT**). Format: HH:MM:SS.sss ***If milliseconds are not populated, the system will append ".000" to the trade report timestamps.*** Required when Tag 277 TradeCondition contains N (Stopped Stock) or 9 (Prior Reference Price). Firms will receive a reject when: - A Trade Modifier of PRP or Stop Stock is entered without a Mod 4 Time - A Mod 4 Time is entered on a trade report where the Trade Modifier is not a PRP or Stop Stock - The Mod 4 Time is **not** more than 10 seconds before the execution time (Tag 60)

PATENT
REEL: 037821 FRAME: 0243

Tag	Tag Name	Req'd	Description
	RefReportingFacility	N	Reporting facility identified on the original trade. Valid values: A = ADF Q = FINRA/NASDAQ TRF N = FINRA/NYSE TRF O = ORF (OTC Equity Reporting Facility) space = FINRA/NASDAQ TRF *Reversal Trades will now require the Reporting Facility of the trade.*
22033	TradeModifier2Time	N	Time associated with Intermarket sweep outbound trades, (in UTC/GMT). Format: HH:MM:SS.sss ***If milliseconds are not populated, the system will append ".000" to the trade report timestamps.*** Firms will receive a reject when: - A Mod 2 Time is entered on a Trade Report that is not flagged as an Outbound ISO in Trade Modifier Optional, may only be submitted when Tag 277 TradeCondition contains 3 (Intermarket sweep outbound).
	Standard Trailer		

PATENT
REEL: 037821 FRAME: 0244

PATENT
REEL: 037821 FRAME: 0245

4.3.2.2 Entry Notification to Alleged Firm Message Format TKAL/CKAL

When a firm enters an expanded Reg NMS compliant trade entry and NASDAQ accepts the entry, a TGAL will be forwarded to the contra party. If the contra party is a correspondent of a clearing firm and the clearing firm is elected to receive clearing correspondent messages, a CGAL with identical contents of the TGAL will be forwarded to the specified clearing firm.

Clients may elect to receive a version 2 format (TKEN/CKEN) containing additional fields, as noted below.

Expanded Reg NMS Message Format:

Tag	Tag Name	Req'd	Description
	Standard Header		`MsgType` = 8
6	AvgPx	Y	Price of this fill.
14	CumQty	Y	Quantity bought/sold on this fill. Maximum 8 digits.
17	ExecID	Y	0 (zero)
20	ExecTransType	Y	Valid value: 0 = New
37	OrderID	Y	0 (zero)
39	OrdStatus	Y	0 (zero)
54	Side	Y	Valid values: 1 = buy 2 = sell 8 = cross Cross trades will not be supported for AGU or QSR trades beginning 2/29/16. Cross Trades will be rejected if designated as AGU or QSR.
55	Symbol	Y	This field will contain the base listed symbol only for listed securities. See `SymbolSfx` [65] field for additional information about the security.
58	Text	Q	Contains message name.

Tag	Tag Name	Req'd	Description
			TRAL or CRAL = Reg NMS Format TGAL or CGAL = Expanded Format TKAL or CKAL = FINRA Format (2015)
60	TransactTime	Q	Time of execution of a particular trade expressed in UTC. ***If milliseconds are not populated, the system will append ".000" to the trade report timestamps.***
65	SymbolSfx	N	This field will contain only the additional information about the security (e.g. preferred, warrants, etc.). No delimiters are allowed in this tag.
75	TradeDate	Q	Indicates date of trade referenced in this message in YYYYMMDD format.
81	ProcessCode	N	Indicates whether or not trade was entered as special. Valid values: 0 = regular (default) 3 = FINRA Step-out trade*** Q = NASDAQ Step-Out 7 = Special trade 8 = Special and Step-out trade*** F = Nasdaq Sales Fee Transfer 2 = FINRA Step-in trade*** A = FINRA Special and step-in trade*** B = FINRA Step-out trade with fees*** C = FINRA Special and Step-out trade with fees*** D = FINRA Position Transfer M = Clearing Only/Non Regulatory* N = Special and Clearing Only/Non Regulatory* O = Clearing Copy** P = Special and Clearing Copy**

PATENT
REEL: 037821 FRAME: 0246

Tag	Tag Name	Req'd	Description
			*Clearing Only/Non Regulatory designations will be used in regards to FINRA Rule Filing Notice 2015-035 (effective on or about February 1, 2016 pending SEC approval) **Clearing Copy designation will be used for Nasdaq NextShares. (effective on or about February 1, 2016 pending SEC approval) *** As of 2/29/16, validations on proper step-in and step-out designations will begin. Any TRF trade designated as a step-out must be entered by the Executing Party (MM). Any TRF trade designated as a step-in must be entered as a Contra Party (OE). On FINRA Step-Out transactions with fees (i.e. ProcessCode values of B and C): 1. Firms must set tag 852 (PublishTrdIndicator) to "N" (FINRA will assess the FINRA Section 3 fee) ~~1.~~ 2. Firms must have tag 577 (ClearingInstruction) set to "0"
107	SecurityDesc	Y	Valid values: N = NASDAQ Global Select Market or NASDAQ Global Market R = NASDAQ Capital Market C= CQS
109	ClientID	N	Sent only for clearing messages (CGAL), this field will contain the MMID on the trade.

PATENT
REEL: 037821 FRAME: 0247

Tag	Tag Name	Req'd	Description
150	ExecType	Y	Valid value: I = status
151	LeavesQty	Y	Valid value: 0 (zero)
275	MDMkt	N	ACT Intended Market Center. Defines the market to which the trade entry is reported. Q = NASDAQ Exchange function D = FINRA/NASDAQ TRF (Default) If tag 81 Process code is F or Q, then MDMkt must = Q **Tag may be sent only if tag 452 (Party Role) is "7" or system will process message as Executing Firm.**
277	TradeCondition	Q	Space-delimited list of trade conditions. Valid values: 0 = regular B = Average Price trade C = Cash I = Late (Sold out of Sequence) J = Next Day L = Seller's Option N = Stopped Stock 1 = Pre/Post-market Sold out of Sequence 2 = FINRA Self Help Indicator 3 = Intermarket Sweep Outbound 4 = Derivatively Priced 5 = .T 6 = Intermarket Sweep Inbound

PATENT
REEL: 037821 FRAME: 0248

Tag	Tag Name	Req'd	Description
			7 = Qualified Contingent Trade 8 = FINRA Subpenny Indicator 9 = Prior Reference Price 16 = Price unrelated to market 18 = OTC Option 19 = Error Correction 20 = Print Protection
375	ContraBroker	Q	MPID of the other side. For clearing messages (CGAL) this will always contain the CPID.
423	PriceType	Q	Indicates whether the average price tag contains contract amount or trade price. This tag is used in conjunction with tag 6. Valid values: 98 = decimal unit price 99 = contract amount
440	ClearingAccount	N	4 digit numeric field. The number of the clearing firm associated with the Executing party. If you do not enter a number, then NASDAQ uses the default clearing number in your firm profile.
527	SecondaryExecId	N	Trade Reference Number. A Firm populated field to discretely tie a Media eligible transaction to one or more non-Media eligible transactions. The firm might populate this field with the same value on a Media trade and the subsequent non-Media Riskless Principal trade for example. This is a six character alphanumeric field.
528	OrderCapacity	Q	Valid values: P = Principal A = agent R = Riskless Principal

PATENT
REEL: 037821 FRAME: 0249

Tag	Tag Name	Req'd	Description
571	TradeReportID	Q	Contains a NASDAQ-defined, unique identification number for this message.
577	ClearingInstruction	Q	Eligibility of this trade for clearing and central counterparty processing. Valid values: 0 = clear 10 = FINRA AGU Lock-in 11 = QSR clear 97 = no clear 98 = QSR no clear 99 = ext. sys. locked-in 92 = NASDAQ QSR for clearing 93 = NASDAQ AGU for clearing 94 = AGU Clearing, non-risk eligible 95 = Risk Update only, not sent to clearing 96 = Clearing, non-risk eligible
700	ReversalIndicator	N	Valid values: N = Not a reversal (default) Y = reversal reported through ACT K = reversal reported through ACT
829	TrdSubType	Y	Indicates whether the trade is exempt from the trade through rule or not. 0 = No Trade Through Exemption 1 = Trade Through Exemption
852	PublishTrdIndicator	Q	Valid values: Y = Report to Tape (default) N = Do Not Report to Tape If tag 277 = 16, 17, or 18, then tag 852 must = N.

PATENT
REEL: 037821 FRAME: 0250

Tag	Tag Name	Req'd	Description
853	ShortSaleReason	N	Reason for short sale. Valid values: 0 = Dealer Sold Short 2 = Selling Customer Sold Short 4 = Contra Side Sold Short 1 = Dealer Sold Short Exempt 3 = Selling Customer Sold Short Exempt 5 = Contra Side Sold Short Exempt
855	SecondaryTrdType	N	Number of days associated with trade. This tag will be returned for ex-clearing transactions. Valid values: 00 – Cash Trade 01 – Next Day 02, 04-60 – Seller's Option
856	TradeReportType	Q	Used to identify message type. The TGAL/CGAL message will always contain this value: 1 = alleged See Appendix A: Message Flow Scenarios.
880	TrdMatchID	Q	NASDAQ-assigned, unique control number, commonly known as the ACT control number.
881	SecondaryTradeReportRefID	Q	The trade match ID from the original trade being reversed. Reversal Trades will now require the original control number of the trade. Original Control Number entered in tag 880 on Entry message will be found in this tag.
939	TrdRptStatus	Q	Valid values: 92 = M1 Matched (locked-in trade)

PATENT
REEL: 037821 FRAME: 0251

Tag	Tag Name	Req'd	Description
			94 = contra party entered trade 95 = Locked-in trades from other NASDAQ systems or QSR trades 97 = Trades entered for Ticker only (no clearing only) 98 = Unanswered (executing party entry)
5080	AsOfIndicator	Q	Valid values: Y = As-of (T+1 to T+n) N = Original (T-day entry)
5149	Memo	N	User memo.
9277	RelatedMarketCenter	N	Related Market Center. Required on transaction reports submitted to the TRF relating to Intended Market Center D step-outs, reversals, Non-tape, and riskless principal transactions, the market where the underlying transaction was reported, as applicable. Blank A = NYSE MKT trade B = NASDAQ BX trade C = National Stock Exchange trade F = Foreign Market G = BATS Y Exchange trade H = BATS Exchange trade I = International Securities Exchange trade J = Direct Edge A Exchange trade K = Direct Edge X Exchange trade M = Chicago Stock Exchange trade N = New York Stock Exchange trade P = NYSE ARCA trade Q = NASDAQ Exchange trade W = Chicago Board Options Exchange trade X = NASDAQ PSX trade O = Unknown Market Center

PATENT
REEL: 037821 FRAME: 0252

Tag	Tag Name	Req'd	Description
			U = Unspecified Multiple Market trades 0 = ADF 1 = FINRA/NASDAQ TRF 3 = FINRA/NYSE TRF **Tag may be sent only if tag 452 (Party Role) is "7" or system will process message as Executing Firm.**
9278	Advertisement Instruction	N	1 character field. Valid values: 1 = publish Default is to not publish.
9807	RegFeeFlag	N	For future use. 1 char field.
9822	ClearingPrice	N	Price inclusive of Explicit Fee.
9825	ReportingGUID	N	MPID of executing party's give-up firm associated with the trade
9826	NonReportingGUID	N	MPID of contra party's give-up firm associated with trade.
9854	OverrideFlag	Q	Valid values: Y = Override N = No override
9860	ContraBranchSeqNbr	N	20 chars. Required where the CP party was also required to submit an OATS Execution Report to FINRA pursuant to FINRA Rule 7450. Field is 1-20 alphanumeric, embedded spaces included. **Tag may be sent only if tag 452 (Party Role) is "7" or system will process message as Executing Firm.**
9862	ContraTradePA	N	Valid values:

PATENT
REEL: 037821 FRAME: 0253

Tag	Tag Name	Req'd	Description
			P = Principal A = agent R = Riskless Principal
9863	ContraClearingAcct	N	The number of the clearing firm associated with the contra party. If you do not enter a number, then NASDAQ uses the default clearing number in the contra firm profile.
22012	OrigControlDate	Y	Original Control Number Date of Original Trade Format: YYYYMMDD *Required on Reversal trade reports*
22018	TradeModifier4Time	N	Time associated with Prior Reference Price or Stopped Stock trade, (in **UTC/GMT**). Format: HH:MM:SS.sss ***If milliseconds are not populated, the system will append ".000" to the trade report timestamps.*** Required when Tag 277 TradeCondition contains N (Stopped Stock) or 9 (Prior Reference Price). Firms will receive a reject when: - A Trade Modifier of PRP or Stop Stock is entered without a Mod 4 Time - A Mod 4 Time is entered on a trade report where the Trade Modifier is not a PRP or Stop Stock - The Mod 4 Time is **not** more than 10 seconds before the execution time (Tag 60)

PATENT
REEL: 037821 FRAME: 0254

Tag	Tag Name	Req'd	Description
22029	RefReportingFacility	N	Reporting facility identified on the original trade. Valid values: A = ADF Q = FINRA/NASDAQ TRF N = FINRA/NYSE TRF O = ORF (OTC Equity Reporting Facility) space = FINRA/NASDAQ TRF *Reversal Trades will now require the Reporting Facility of the trade.*
22033	TradeModifier2Time	N	Time associated with Intermarket sweep outbound trades, (in UTC/GMT). Format: HH:MM:SS.sss Firms will receive a reject when: - A Mod 2 Time is entered on a Trade Report that ***is not*** flagged as an Outbound ISO in Trade Modifier ***If milliseconds are not populated, the system will append ".000" to the trade report timestamps.*** Optional, may only be submitted when Tag 277 TradeCondition contains 3 (Intermarket sweep outbound).

PATENT
REEL: 037821 FRAME: 0255

Tag	Tag Name	Req'd	Description
	Standard Trailer		

PATENT
REEL: 037821 FRAME: 0256

PATENT
REEL: 037821 FRAME: 0257

4.3.2.3 Locked-in Notification TCLK/CCLK

If a trade is accepted by the contra party or if the trade is matched from both sides' entries, then the trade is considered locked-in. If an executing party is locked-in by contra party acceptance or by M1 trade matching, this message will be forwarded to both parties. Because NASDAQ will match buy and sell entries regardless of who entered them, the TCLK message will transmit buy/sell control numbers. CCLK messages will be sent to the appropriate clearing firms.

Message Format if Locked-in by Acceptance or Midday Lock of Carryover Trades

Tag	Tag Name	Req'd	Description
	Standard Header		`MsgType` = 8
6	AvgPx	Y	0 (zero)
11	ClOrdID	N	If this message is an ACK, then this tag contains the value indicated in the inbound message or "NA". If this message is a UM, then this tag is not returned.
14	CumQty	Y	0 (zero)
17	ExecID	Y	If this message is an ACK, then this tag contains the value indicated in the inbound message. If this message is a UM, then this tag is 0 (zero).
20	ExecTransType	Y	Valid value: 0 = New
37	OrderID	Y	Contains the value indicated in the inbound message or 0 (zero).
39	OrdStatus	Y	0 (zero)
54	Side	Y	Valid value: 7 = unknown
55	Symbol	Y	This tag will always have the value, "N/A".
58	Text	Q	Contains message name, either "TCLK" or "CCLK".
150	ExecType	Y	Valid value: I = status
151	LeavesQty	Y	Valid value: 0 (zero)

Tag	Tag Name	Req'd	Description
571	TradeReportID	Q	If this message is an ACK, then this tag contains the value indicated in the inbound message. If this message is a UM, then this tag contains a NASDAQ-defined, unique identification number for this message.
572	TradeReportRefID	N	If this message is an ACK, then this tag contains the first 6 characters of the value indicated in tag 571 in the original trade entry message.
856	TradeReportType	Q	Used to identify message type. The TCLK/CCLK message will always contain this value: 2 = Accept See Appendix A: Message Flow Scenarios.
880	TrdMatchID	Q	The trade match ID number from the buy side of the original trade entry message.
9857	LockedIn	Q	Valid values: A = locked-in by acceptance, else sell control number S = locked-in by acceptance with short sale indication (sent to responsible party accepting the trade only) X = locked-in by acceptance with short sale indication (sent to responsible party accepting the trade only) L = denotes an auto locked in trade against the contra side Z = denotes a split locked in trade against the contra side
	Standard Trailer		

Message Format if Locked-in by M1

PATENT
REEL: 037821 FRAME: 0258

Tag	Tag Name	Req'd	Description
	Standard Header		`MsgType` = 8
6	AvgPx	Y	0 (zero)
11	ClOrdID	N	If this message is an ACK, then this tag contains the value indicated in the inbound message or "NA". If this message is a UM, then this tag is not returned.
14	CumQty	Y	0 (zero)
17	ExecID	Y	If this message is an ACK, then this tag contains the value indicated in the inbound message. If this message is a UM, then this tag is 0 (zero).
20	ExecTransType	Y	Valid value: 0 = New
37	OrderID	Y	Contains the value indicated in the inbound message or 0 (zero).
39	OrdStatus	Y	0 (zero)
54	Side	Y	Valid value: 7 = unknown
55	Symbol	Y	This tag will always have the value, "N/A".
58	Text	Q	Contains message name, either "TCLK" or "CCLK".
150	ExecType	Y	Valid value: I = status
151	LeavesQty	Y	Valid value: 0 (zero)
571	TradeReportID	Q	If this message is an ACK, then this tag contains the value indicated in the inbound message. If this message is a UM, then this tag contains a NASDAQ-defined, unique identification number for this message.

PATENT
REEL: 037821 FRAME: 0259

Tag	Tag Name	Req'd	Description
856	TradeReportType	Q	Used to identify message type. The TCLK/CCLK message will always contain this value: 2 = Accept See Appendix A: Message Flow Scenarios.
880	TrdMatchID	Q	The trade match ID from the buy side of the trade.
881	SecondaryTradeReportRefID	Q	The trade match ID from the sell side of the trade.
	Standard Trailer		

PATENT
REEL: 037821 FRAME: 0260

PATENT
REEL: 037821 FRAME: 0261

4.3.2.4 Locked-in Notification TGLK/CGLK

The only difference between this message and the TCLK/CCLK is the addition of tag 275, MDMarket.

If a trade is accepted by the contra party or if the trade is matched from both sides' entries, then the trade is considered locked-in. If an executing party is locked-in by contra party acceptance or by M1 trade matching, this message will be forwarded to both parties. Because NASDAQ will match buy and sell entries regardless of who entered them, the TCLK message will transmit buy/sell control numbers. CCLK messages will be sent to the appropriate clearing firms.

Message Format if Locked-in by Acceptance or Midday Lock of Carryover Trades

Tag	Tag Name	Req'd	Description
	Standard Header		`MsgType` = 8
6	AvgPx	Y	0 (zero)
11	ClOrdID	N	If this message is an ACK, then this tag contains the value indicated in the inbound message or "NA". If this message is a UM, then this tag is not returned.
14	CumQty	Y	0 (zero)
17	ExecID	Y	If this message is an ACK, then this tag contains the value indicated in the inbound message. If this message is a UM, then this tag is 0 (zero).
20	ExecTransType	Y	Valid value: 0 = New
37	OrderID	Y	Contains the value indicated in the inbound message or 0 (zero).
39	OrdStatus	Y	0 (zero)
54	Side	Y	Valid value: 7 = unknown
55	Symbol	Y	This tag will always have the value, "N/A".
58	Text	Q	Contains message name, either "TCLK" or "CCLK".
150	ExecType	Y	Valid value: I = status

Tag	Tag Name	Req'd	Description
151	LeavesQty	Y	Valid value: 0 (zero)
275	MDMkt	N	ACT Intended Market Center. Defines the market to which the trade entry is reported. Q = NASDAQ Exchange function D = FINRA/NASDAQ TRF (Default) If tag 81 Process code is F or Q, then MDMkt must = Q **Tag may be sent only if tag 452 (Party Role) is "7" or system will process message as Executing Firm.**
571	TradeReportID	Q	If this message is an ACK, then this tag contains the value indicated in the inbound message. If this message is a UM, then this tag contains a NASDAQ-defined, unique identification number for this message.
572	TradeReportRefID	N	If this message is an ACK, then this tag contains the first 6 characters of the value indicated in tag 571 in the original trade entry message.
856	TradeReportType	Q	Used to identify message type. The TCLK/CCLK message will always contain this value: 2 = Accept See Appendix A: Message Flow Scenarios.
880	TrdMatchID	Q	The trade match ID number from the buy side of the original trade entry message.

PATENT
REEL: 037821 FRAME: 0262

Tag	Tag Name	Req'd	Description
9857	LockedIn	Q	Valid values: A = locked-in by acceptance, else sell control number S = locked-in by acceptance with short sale indication (sent to responsible party accepting the trade only) X = locked-in by acceptance with short sale indication (sent to responsible party accepting the trade only) L = denotes an auto locked in trade against the contra side Z = denotes a split locked in trade against the contra side
	Standard Trailer		

Message Format if Locked-in by M1

Tag	Tag Name	Req'd	Description
	Standard Header		`MsgType` = 8
6	AvgPx	Y	0 (zero)
11	ClOrdID	N	If this message is an ACK, then this tag contains the value indicated in the inbound message or "NA". If this message is a UM, then this tag is not returned.
14	CumQty	Y	0 (zero)
17	ExecID	Y	If this message is an ACK, then this tag contains the value indicated in the inbound message. If this message is a UM, then this tag is 0 (zero).
20	ExecTransType	Y	Valid value: 0 = New
37	OrderID	Y	Contains the value indicated in the inbound message or 0 (zero).
39	OrdStatus	Y	0 (zero)
54	Side	Y	Valid value:

PATENT
REEL: 037821 FRAME: 0263

Tag	Tag Name	Req'd	Description
			7 = unknown
55	Symbol	Y	This tag will always have the value, "N/A".
58	Text	Q	Contains message name, either "TCLK" or "CCLK".
150	ExecType	Y	Valid value: I = status
151	LeavesQty	Y	Valid value: 0 (zero)
275	MDMkt	N	ACT Intended Market Center. Defines the market to which the trade entry is reported. Q = NASDAQ Exchange function D = FINRA/NASDAQ TRF (Default) If tag 81 Process code is F or Q, then MDMkt must = Q **Tag may be sent only if tag 452 (Party Role) is "7" or system will process message as Executing Firm.**
571	TradeReportID	Q	If this message is an ACK, then this tag contains the value indicated in the inbound message. If this message is a UM, then this tag contains a NASDAQ-defined, unique identification number for this message.
856	TradeReportType	Q	Used to identify message type. The TCLK/CCLK message will always contain this value: 2 = Accept See Appendix A: Message Flow Scenarios.

PATENT
REEL: 037821 FRAME: 0264

Tag	Tag Name	Req'd	Description
880	TrdMatchID	Q	The trade match ID from the buy side of the trade.
881	SecondaryTradeReportRefID	Q	The trade match ID from the sell side of the trade.
	Standard Trailer		

PATENT
REEL: 037821 FRAME: 0265

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REEL: 037821 FRAME: 0266

4.3.2.5 Break Notification TCBK/CCBK

This message notifies the contra party that a executing party or contra party has entered a break entry. If this message is used to break a locked-in trade, this message will be forwarded to both buyer and seller. Because NASDAQ will match buy and sell entries regardless of who entered them, the TCLK and TCBK messages will transmit buy/sell control numbers. CCBK messages will be sent to the appropriate clearing firms.

Tag	Tag Name	Req'd	Description
	Standard Header		`MsgType` = 8
6	AvgPx	Y	0 (zero)
11	ClOrdID	N	If this message is an ACK, then this tag contains the value indicated in the inbound message or "NA". If this message is a UM, then this tag is not returned.
14	CumQty	Y	0 (zero)
17	ExecID	Y	Contains the value indicated in the inbound message or 0 (zero).
20	ExecTransType	Y	Valid value: 0 = New
37	OrderID	Y	Contains the value indicated in the inbound message or 0 (zero).
39	OrdStatus	Y	0 (zero)
54	Side	Y	Valid value: 7 = unknown
55	Symbol	Y	This tag will always have the value, "N/A".
58	Text	Q	Contains message name, either "TCBK" or "CCBK".
150	ExecType	Y	Valid value: I = status
151	LeavesQty	Y	Valid value: 0 (zero)
571	TradeReportID	Q	If this message is an ACK, then this tag contains the value indicated in the inbound

Tag	Tag Name	Req'd	Description
			message. If this message is a UM, then this tag contains a NASDAQ-defined, unique identification number for this message.
572	TradeReportRefID	N	If this message is an ACK, then this tag contains the first 6 characters of the value indicated in tag 571 in the break message.
856	TradeReportType	Q	Used to identify message type. The TCBK message will always contain this value: 7 = Break See Appendix A: Message Flow Scenarios.
880	TrdMatchID	Q	If the trade being broken was locked in by M1, then this tag contains the trade match ID from the buy side of the trade. If the trade being broken was locked in by contra party acceptance, then this tag contains the trade match ID from the original trade entry acknowledgement.
881	SecondaryTradeReportRefID	Q	If the trade being broken was locked in by M1, then this tag contains the trade match ID from the sell side of the trade. If the trade being broken was locked in by contra party acceptance, then this tag contains the value, A.
9847	LockedInStatus	Q	Contains the current status of the locked-in trade. Valid values: A = The trade is still locked-in (by trade acceptance) because both trading parties' Break Trade transaction have not been received. M = The trade is still locked-in (by trade

PATENT
REEL: 037821 FRAME: 0267

Tag	Tag Name	Req'd	Description
			matching) because both trading parties' Break Trade transactions have not been received. B = The locked-in trade is effectively broken because both trading parties' Break Trade transactions have been received.
9856	BreakIndicator	Q	B = only buyer has broken S = only seller has broken X = both buyer and seller have broken L = broken through market center
	Standard Trailer		

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REEL: 037821 FRAME: 0268

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REEL: 037821 FRAME: 0269

4.3.2.6 Cancel Notification TCAN/CCAN

If an executing party or contra party cancels a trade, this message will be forwarded to both sides of the trade. CCAN messages will be sent to the appropriate clearing firms.

Tag	Tag Name	Req'd	Description
	Standard Header		`MsgType` = 8
6	AvgPx	Y	0 (zero)
11	ClOrdID	N	If this message is an ACK, then this tag contains the value indicated in the inbound message or "NA". If this message is a UM, then this tag is not returned.
14	CumQty	Y	0 (zero)
17	ExecID	Y	Contains the value indicated in the inbound message or 0 (zero).
20	ExecTransType	Y	Valid value: 0 = New
37	OrderID	Y	Contains the value indicated in the inbound message or 0 (zero).
39	OrdStatus	Y	0 (zero)
54	Side	Y	Valid value: 7 = unknown
55	Symbol	Y	This tag will always have the value, "N/A".
58	Text	Q	Contains message name, either "TCAN" or "CCAN".
150	ExecType	Y	Valid value: I = status
151	LeavesQty	Y	Valid value: 0 (zero)
571	TradeReportID	Q	If this message is an ACK, then this tag contains the value indicated in the inbound message. If this message is a UM, then this tag contains a NASDAQ-defined, unique identification number for this message.
856	TradeReportType	Q	Used to identify message type.

Tag	Tag Name	Req'd	Description
			The TCAN message will always contain this value: 6 = Cancel See Appendix A: Message Flow ScenariosAppendix A: Message Flow Scenarios.
880	TrdMatchID	Q	NASDAQ-assigned, unique control number, commonly known as the ACT control number.
	Standard Trailer		

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REEL: 037821 FRAME: 0270

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REEL: 037821 FRAME: 0271

4.3.2.7 Decline Notification TCDE/CCDE

Executing firms receive this message whenever the contra party declines a trade. CCDE messages will be sent to the appropriate clearing firms.

Tag	Tag Name	Req'd	Description
	Standard Header		`MsgType` = 8
6	AvgPx	Y	0 (zero)
11	ClOrdID	N	If this message is an ACK, then this tag contains the value indicated in the inbound message or "NA". If this message is a UM, then this tag is not returned.
14	CumQty	Y	0 (zero)
17	ExecID	Y	Contains the value indicated in the inbound message or 0 (zero).
20	ExecTransType	Y	Valid value: 0 = New
37	OrderID	Y	Contains the value indicated in the inbound message or 0 (zero).
39	OrdStatus	Y	0 (zero)
54	Side	Y	Valid value: 7 = unknown
55	Symbol	Y	This tag will always have the value, "N/A".
58	Text	Q	Contains message name, either "TCDE" or "CCDE".
150	ExecType	Y	Valid value: I = status
151	LeavesQty	Y	Valid value: 0 (zero)
571	TradeReportID	Q	If this message is an ACK, then this tag contains the value indicated in the inbound message. If this message is a UM, then this tag contains a NASDAQ-defined, unique identification number for this message.
856	TradeReportType	Q	Used to identify message type.

Tag	Tag Name	Req'd	Description
			The TCDE message will always contain this value: 3 = Decline See Appendix A: Message Flow Scenarios.
880	TrdMatchID	Q	NASDAQ-assigned, unique control number, commonly known as the ACT control number.
	Standard Trailer		

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REEL: 037821 FRAME: 0272

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REEL: 037821 FRAME: 0273

4.3.2.8 Error Notification TCER/CCER

Both sides of a trade receive this message when the executing party errors a trade. CCER messages will be forwarded to the appropriate clearing firms. When a firm submits a No/Was transaction to change the CONTRA PARTYID in a trade, the former contra firm will receive this TCER message.

Tag	Tag Name	Req'd	Description
	Standard Header		`MsgType` = 8
6	AvgPx	Y	0 (zero)
11	ClOrdID	N	If this message is an ACK, then this tag contains the value indicated in the inbound message or "NA". If this message is a UM, then this tag is not returned.
14	CumQty	Y	0 (zero)
17	ExecID	Y	Contains the value indicated in the inbound message or 0 (zero).
20	ExecTransType	Y	Valid value: 0 = New
37	OrderID	Y	Contains the value indicated in the inbound message or 0 (zero).
39	OrdStatus	Y	0 (zero)
54	Side	Y	Valid value: 7 = unknown
55	Symbol	Y	This tag will always have the value, "N/A".
58	Text	Q	Contains message name, either "TCER" or "CCER".
150	ExecType	Y	Valid value: I = status
151	LeavesQty	Y	Valid value: 0 (zero)
571	TradeReportID	Q	If this message is an ACK, then this tag contains the value indicated in the inbound message. If this message is a UM, then this tag contains a NASDAQ-defined, unique identification number for this message.
856	TradeReportType	Q	Used to identify message type.

Tag	Tag Name	Req'd	Description
			The TCER/CCER will always contain this value: 8 = Error See Appendix A: Message Flow ScenariosAppendix A: Message Flow Scenarios.
880	TrdMatchID	Q	NASDAQ-assigned, unique control number, commonly known as the ACT control number.
	Standard Trailer		

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REEL: 037821 FRAME: 0274

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REEL: 037821 FRAME: 0275

4.3.2.9 No/Was Notification Message Format TKNW/CKNW

This message will always be forwarded to the updating executing party. This message will be forwarded to the contra party firm if the CONTRA PARTY ID does not change. If the transaction changed the CONTRA PARTY ID, a TCER Message will be forwarded to the contra party in the No part, and a TGAL Message will be forwarded to the contra party in the Was part. If the executing party is a correspondent of a clearing firm and the clearing firm is elected to receive clearing correspondent messages, a CGNW with identical contents of the TGNW will be forwarded to the specified clearing firm.

Clients may elect to receive a version 2 format (TKEN/CKEN) containing additional fields, as noted below.

Expanded Reg-NMS Message Format:

Tag	Tag Name	Req'd	Description
	Standard Header		`MsgType` = 8
6	AvgPx	Y	Price of this fill.
11	ClOrdID	N	If this message is an ACK, then this tag contains the value indicated in the inbound message or "NA". If this message is a UM, then this tag is not returned.
14	CumQty	Y	Quantity bought/sold on this fill. Maximum 8 digits.
17	ExecID	Y	Contains the value indicated in the inbound message or 0 (zero).
20	ExecTransType	Y	Valid value: 0 = New
37	OrderID	Y	Contains the value indicated in the inbound message or 0 (zero).
39	OrdStatus	Y	0 (zero)
54	Side	Y	Valid values: 1 = buy 2 = sell 8 = cross

Tag	Tag Name	Req'd	Description
			Cross trades will not be supported for AGU or QSR trades beginning 2/29/16. Cross Trades will be rejected if designated as AGU or QSR.
55	Symbol	Y	This field will contain the base listed symbol only for listed securities. See `SymbolSfx` [65] field for additional information about the security.
58	Text	Q	Contains message name. TRNW or CRNW = Reg NMS Format TGNW or CGNW = Expanded Format TKNW or CKNW = FINRA Format (2015)
60	Transact Time	Q	Time of execution of a particular trade expressed in UTC.
65	SymbolSfx	N	This field will contain only the additional information about the security (e.g. preferred, warrants, etc.) for listed securities. This additional information must be in CQS or TMTR format. No delimiters are allowed in this tag. For example, security "OXYpB" would be formatted as follows: Symbol [55]: OXY SymbolSfx [65]: CQS format: pB TMTR format: .PRB
75	TradeDate	Q	Indicates date of trade referenced in this message in YYYYMMDD format.
81	ProcessCode	N	Indicates whether or not trade was entered as special. Valid values: 0 = regular (default) 3 = FINRA Step-out trade*** Q = NASDAQ Step-Out 7 = Special trade 8 = Special and Step-out trade***

PATENT
REEL: 037821 FRAME: 0276

Tag	Tag Name	Req'd	Description
			F = Nasdaq Sales Fee Transfer 2 = FINRA Step-in trade*** A = FINRA Special and step-in trade*** B = FINRA Step-out trade with fees*** C = FINRA Special and Step-out trade with fees*** D = FINRA Position Transfer M = Clearing Only/Non Regulatory* N = Special and Clearing Only/Non Regulatory* O = Clearing Copy** P = Special and Clearing Copy** *Clearing Only/Non Regulatory designations will be used in regards to FINRA Rule Filing Notice 2015-035 (effective on or about February 1, 2016 pending SEC approval) **Clearing Copy designation will be used for Nasdaq NextShares. (effective on or about February 1, 2016 pending SEC approval) *** As of 2/29/16, validations on proper step-in and step-out designations will begin. Any TRF trade designated as a step-out must be entered by the Executing Party (MM). Any TRF trade designated as a step-in must be entered as a Contra Party (OE).

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REEL: 037821 FRAME: 0277

Tag	Tag Name	Req'd	Description
			On FINRA Step-Out transactions with fees (i.e. ProcessCode values of B and C): 1. Firms must set tag 852 (PublishTrdIndicator) to "N" (FINRA will assess the FINRA Section 3 fee) 2. Firms must have tag 577 (ClearingInstruction) set to "0"
107	SecurityDesc	Q	Valid values: N = Global Select or Global R = NASDAQ Capital Market C= CQS
109	ClientID	N	Sent only for clearing messages (CGNW), this field will contain the MMID on the trade.
150	ExecType	Y	Valid value: I = status
151	LeavesQty	Y	Valid value: 0 (zero)
275	MDMkt	N	ACT Intended Market Center. Defines the market to which the trade entry is reported. Q = NASDAQ Exchange function D = FINRA/NASDAQ TRF (Default) If tag 81 Process code is F or Q, then MDMkt must = Q **Tag may be sent only if tag 452 (Party Role) is "7" or system will process message as Executing Firm.**

PATENT
REEL: 037821 FRAME: 0278

Tag	Tag Name	Req'd	Description
277	TradeCondition	Q	Space-delimited list of trade conditions. Valid values: 0 = regular B = Average Price trade C = Cash I = Late (Sold out of Sequence) J = Next Day L = Seller's Option N = Stopped Stock 1 = Pre/Post-market Sold out of Sequence 2 = FINRA Self Help Indicator 3 = Intermarket Sweep Outbound 4 = Derivatively Priced 5 = .T 6 = Intermarket Sweep Inbound 7 = Qualified Contingent Trade 8 = FINRA Subpenny Indicator 9 = Prior Reference Price 16 = Price unrelated to market 18 = OTC Option 19 = Error Correction 20 = Print Protection
375	ContraBroker	Q	MPID of the other side. For clearing messages (CGNW) this will always contain the CPID.
423	PriceType	Q	Indicates whether the average price tag contains contract amount or trade price. This tag is used in conjunction with tag 6. Valid values: 98 = decimal unit price 99 = contract amount
440	ClearingAccount	N	4 digit numeric field. The number of the clearing firm associated with the executing party. If you do not enter a number, then

PATENT
REEL: 037821 FRAME: 0279

Tag	Tag Name	Req'd	Description
			NASDAQ uses the default clearing number in your firm profile.
527	SecondaryExecId	N	Trade Reference Number. A Firm populated field to discretely tie a Media eligible transaction to one or more non-Media eligible transactions. The firm might populate this field with the same value on a Media trade and the subsequent non-Media Riskless Principal trade for example. This is a six character alphanumeric field.
528	OrderCapacity	Q	Valid values: P = Principal A = agent R = Riskless Principal
571	TradeReportID	Q	If this message is an ACK, then this tag contains the value indicated in the inbound message. If this message is a UM, then this tag contains a NASDAQ-defined, unique identification number for this message.
572	TradeReportRefID	N	Contains the first 6 characters of the value indicated in tag 571 in the original trade entry message.
577	ClearingInstruction	Q	Eligibility of this trade for clearing and central counterparty processing. Valid values: 0 = clear 10 = FINRA AGU Lock-in 11 = QSR clear 97 = no clear 98 = QSR no clear 99 = ext. sys. locked-in (for ESI transacations) 92 = NASDAQ QSR for clearing 93 = NASDAQ AGU for clearing

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REEL: 037821 FRAME: 0280

Tag	Tag Name	Req'd	Description
			94 = AGU Clearing, non-risk eligible 95 = Risk Update only, not sent to clearing 96 = Clearing, non-risk eligible
852	PublishTrdIndicator	N	Valid values: Y = Report to Tape (default) N = Do Not Report to Tape If tag 277 = 16, 17, or 18, then tag 852 must = N.
853	ShortSaleReason	N	Reason for short sale. Valid values: 0 = Dealer Sold Short 2 = Selling Customer Sold Short 4 = Contra Side Sold Short 1 = Dealer Sold Short Exempt 3 = Selling Customer Sold Short Exempt 5 = Contra Side Sold Short Exempt
855	SecondaryTrdType	N	Number of days associated with trade. This tag will be returned for ex-clearing transactions. Valid values: 02 04-60
856	TradeReportType	Q	Used to identify message type. The TGNW/CGNW message will always contain this value: 5 = no/was See Appendix A: Message Flow ScenariosAppendix A: Message Flow Scenarios.
880	TrdMatchID	Q	The trade match ID for the new (was) transaction.
881	SecondaryTradeReportRefID	Q	The trade match ID for the original (no) transaction.

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REEL: 037821 FRAME: 0281

Tag	Tag Name	Req'd	Description
939	TrdRptStatus	Q	Valid values: 0 = Accepted 82 = Broken 83 = Cancelled 84 = Declined 85 = Errored 87 = Trades forwarded as one-sided to DTCC 88 = A blockbuster or sizable trade being held pending clearing firm action or expiration of 15 minute held period 89 = A blockbuster or sizable trade that was inhibited from being locked in by the clearing firm. 90 = Sizable trade killed by NASDAQ at the end of the 15 minute held period 91 = Automatic Locked-in trade (end of T+1) 92 = M1 Matched 93 = No/Was 94 = contra party entered trade 95 = Locked-in trades from other NASDAQ systems or QSR trades 97 = Trades entered for Ticker only 98 = Unanswered entry 99 = Trades purged from the trade reporting file The 86, 87, 91, 96, 99 statuses are assigned by the system during off-line processing will not be available during the on-line hours.
5080	AsOfIndicator	Q	Valid values: Y = As-of (T+1 to T+n) N = Original (T-day entry)
5149	Memo	N	User memo.
9277	RelatedMarketCenter	N	Related Market Center.

PATENT
REEL: 037821 FRAME: 0282

Tag	Tag Name	Req'd	Description
			Required on transaction reports submitted to the TRF relating to Intended Market Center D step-outs, reversals, Non-tape, and riskless principal transactions, the market where the underlying transaction was reported, as applicable. Blank A = NYSE MKT trade B = NASDAQ BX trade C = National Stock Exchange trade F = Foreign Market G = BATS Y Exchange trade H = BATS Exchange trade I = International Securities Exchange trade J = Direct Edge A Exchange trade K = Direct Edge X Exchange trade M = Chicago Stock Exchange trade N = New York Stock Exchange trade P = NYSE ARCA trade Q = NASDAQ Exchange trade W = Chicago Board Options Exchange trade X = NASDAQ PSX trade Q = Unknown Market Center U = Unspecified Multiple Market trades 0 = ADF 1 = FINRA/NASDAQ TRF 3 = FINRA/NYSE TRF **Tag may be sent only if tag 452 (Party Role) is "7" or system will process message as Executing Firm.**
9278	Advertisement Instruction	N	1 character field. Valid values: 1 = publish

PATENT
REEL: 037821 FRAME: 0283

Tag	Tag Name	Req'd	Description
			Default is to not publish.
9807	RegFeeFlag	N	For future use. 1 char field.
9822	ClearingPrice	N	Price inclusive of Explicit Fee.
9825	ReportingGUID	N	MPID of executing party's give-up firm associated with the trade
9826	NonReportingGUID	N	MPID of contra party's give-up firm associated with trade.
9854	OverrideFlag	Q	Valid values: Y = Override N = No override
9862	ContraTradePA	N	Valid values: P = Principal A = agent R = Riskless Principal
9863	ContraClearingAcct	N	The number of the clearing firm associated with the contra party. If you do not enter a number, then NASDAQ uses the default clearing number in the contra firm profile.
22018	TradeModifier4Time	N	Time associated with Prior Reference Price or Stopped Stock trade, (in **UTC/GMT**). Format: HH:MM:SS.sss ***If milliseconds are not populated, the system will append ".000" to the trade report timestamps.*** Required when Tag 277 TradeCondition contains N (Stopped Stock) or 9 (Prior Reference Price).

PATENT
REEL: 037821 FRAME: 0284

Tag	Tag Name	Req'd	Description
			Firms will receive a reject when: - A Trade Modifier of PRP or Stop Stock is entered without a Mod 4 Time - A Mod 4 Time is entered on a trade report where the Trade Modifier is not a PRP or Stop Stock - The Mod 4 Time is **not** more than 10 seconds before the execution time (Tag 60)
22033	TradeModifier2Time	N	Time associated with Intermarket sweep outbound trades, (in **UTC/GMT**). Format: HH:MM:SS.sss Firms will receive a reject when: - A Mod 2 Time is entered on a Trade Report that ***is not*** flagged as an Outbound ISO in Trade Modifier ***If milliseconds are not populated, the system will append ".000" to the trade report timestamps.*** Optional, may only be submitted when Tag 277 TradeCondition contains 3 (Intermarket sweep outbound).
	Standard Trailer		

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REEL: 037821 FRAME: 0285

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REEL: 037821 FRAME: 0286

4.3.2.10 Update Notification TTUD/CTUD

When a firm updates clearing information, all parties involved in the trade receive the updated clearing information via this message.

Pre- Reg NMS Message Format

Tag	Tag Name	Req'd	Description
	Standard Header		`MsgType` = 8
6	AvgPx	Y	Price of this fill.
11	ClOrdID	N	If this message is an ACK, then this tag contains the value indicated in the inbound message or "NA". If this message is a UM, then this tag is not returned.
14	CumQty	Y	Quantity bought/sold on this fill. Maximum 8 digits.
17	ExecID	Y	Contains the value indicated in the inbound message or 0 (zero).
20	ExecTransType	Y	Valid value: 0 = New
37	OrderID	Y	Contains the value indicated in the inbound message or 0 (zero).
39	OrdStatus	Y	0 (zero)
54	Side	Y	Valid values: 1 = buy 2 = sell 8 = cross Cross trades will not be supported for AGU or QSR trades beginning 2/29/16. Cross Trades will be rejected if designated as AGU or QSR.
55	Symbol	Y	This field will contain the base listed symbol only for listed securities. See `SymbolSfx` [65] field for additional information about the security.

Tag	Tag Name	Req'd	Description
58	Text	Q	Contains message name, either "TTUD" or "CTUD".
60	TransactTime	Q	Time of execution of a particular trade expressed in UTC. ***If milliseconds are not populated, the system will append ".000" to the trade report timestamps.***
65	SymbolSfx	N	This field will contain only the additional information about the security (e.g. preferred, warrants, etc.) for listed securities. This additional information must be in CQS or TMTR format. No delimiters are allowed in this tag. For example, security "OXYpB" would be formatted as follows: Symbol [55]: OXY SymbolSfx [65]: CQS format: pB TMTR format: .PRB
75	TradeDate	Q	Indicates date of trade referenced in this message in YYYYMMDD format.
81	ProcessCode	N	Indicates whether or not trade was entered as special. Valid values: 0 = regular (default) 3 = FINRA Step-out trade*** O = NASDAQ Step-Out 7 = Special trade 8 = Special and Step-out trade*** F = Nasdaq Sales Fee Transfer 2 = FINRA Step-in trade*** A = FINRA Special and step-in trade*** B = FINRA Step-out trade with fees*** C = FINRA Special and Step-out trade with fees*** D = FINRA Position Transfer M = Clearing Only/Non Regulatory*

PATENT
REEL: 037821 FRAME: 0287

Tag	Tag Name	Req'd	Description
			N = Special and Clearing Only/Non Regulatory* O = Clearing Copy** P = Special and Clearing Copy** *Clearing Only/Non Regulatory designations will be used in regards to FINRA Rule Filing Notice 2015-035 (effective on or about February 1, 2016 pending SEC approval) **Clearing Copy designation will be used for Nasdaq NextShares. (effective on or about February 1, 2016 pending SEC approval) *** As of 2/29/16, validations on proper step-in and step-out designations will begin. Any TRF trade designated as a step-out must be entered by the Executing Pary (MM). Any TRF trade designated as a step-in must be entered as a Contra Party (OE). On FINRA Step-Out transactions with fees (i.e. ProcessCode values of B and C): 1. Firms must set tag 852 (PublishTrdIndicator) to "N" (FINRA will assess the FINRA Section 3 fee) 2. Firms must have tag 577 (ClearingInstruction) set to "0"
107	SecurityDesc	Q	Valid values: N = Global Select or Global R = NASDAQ Capital Market C= CQS
109	ClientID	N	Sent only for clearing messages (CTUD), this field will

PATENT
REEL: 037821 FRAME: 0288

Tag	Tag Name	Req'd	Description
			contain the MMID on the trade.
150	ExecType	Y	Valid value: I = status
151	LeavesQty	Y	Valid value: 0 (zero)
277	TradeCondition	Q only if 828 is not present	NASDAQ will return either 277 or 828. Valid values: C = Cash B = Average Price or Stop Stock I = Late J = Next Day L = Seller's Option Z = Late appended by system
375	ContraBroker	Q	MPID of the other side. For clearing messages (CTUD) this will always contain the CPID.
423	PriceType	Q	Indicates whether the average price tag contains contract amount or trade price. This tag is used in conjunction with tag 6. Valid values: 98 = decimal unit price 99 = contract amount
440	ClearingAccount	N	4 digit numeric field. The number of the clearing firm associated with the executing party. If you do not enter a number, then NASDAQ uses the default clearing number in your firm profile.
528	OrderCapacity	Q	Valid values: P = Principal A = agent R = Riskless Principal

PATENT
REEL: 037821 FRAME: 0289

Tag	Tag Name	Req'd	Description
571	TradeReportID	Q	If this message is an ACK, then this tag contains the value indicated in the inbound message. If this message is a UM, then this tag contains a NASDAQ-defined, unique identification number for this message.
577	ClearingInstruction	Q	Eligibility of this trade for clearing and central counterparty processing. Valid values: 0 = clear 10 = FINRA AGU Lock-in 11 = QSR clear 97 = no clear 98 = QSR no clear 99 = ext. sys. locked-in
700	ReversalIndicator	N	Valid values: N = Not a reversal (default) Y = reversal reported through ACT K = reversal reported through ACT
828	TrdType	Q only if 277 is not present	NASDAQ will return either 277 or 828. Valid values: 0 = Regular 5 = .T 9 = Prior Reference price 98 = Late .T 99 = T appended by system
852	PublishTrdIndicator	N	Valid values: Y = Report to Tape (default) N = Do Not Report to Tape If tag 277 = 16, 17, or 18, then tag 852 must = N.
853	ShortSaleReason	N	Reason for short sale. Valid values: 0 = Dealer Sold Short

PATENT
REEL: 037821 FRAME: 0290

Tag	Tag Name	Req'd	Description
			2 = Selling Customer Sold Short 4 = Contra Side Sold Short 1 = Dealer Sold Short Exempt 3 = Selling Customer Sold Short Exempt 5 = Contra Side Sold Short Exempt
855	SecondaryTrdType	N	Number of days associated with tradeThis tag will be returned for ex-clearing transactions. Valid values: 02 04-60
856	TradeReportType	Q	Used to identify message type. The TTUD message will always contain this value: 4 = Addendum See Appendix A: Message Flow Scenarios.
880	TrdMatchID	Q	NASDAQ-assigned, unique control number, commonly known as the ACT control number.
939	TrdRptStatus	Q	Valid values: 0 = Accepted 82 = Broken 83 = Cancelled 84 = Declined 85 = Errored 87 = Trades forwarded as one-sided to DTCC 88 = A blockbuster or sizable trade being held pending clearing firm action or expiration of 15 minute held period 89 = A blockbuster or sizable trade that was inhibited from being locked in by the clearing firm. 90 = Sizable trade killed by NASDAQ at the end of the 15 minute held period

PATENT
REEL: 037821 FRAME: 0291

Tag	Tag Name	Req'd	Description
			91 = Automatic Locked-in trade (end of T+1) 92 = M1 Matched 93 = No/Was 94 = contra party entered trade 95 = Locked-in trades from other NASDAQ systems or QSR trades 97 = Trades entered for Ticker only 98 = Unanswered entry 99 = Trades purged from the trade reporting file The 86, 87, 91, 96, 99 statuses are assigned by the system during off-line processing will not be available during the on-line hours.
5080	AsOfIndicator	Q	Valid values: Y = As-of (T+1 to T+n) N = Original (T-day entry)
5149	Memo	N	User memo.
9822	ClearingPrice	N	Price inclusive of commissions.
9825	ReportingGUID	N	MPID of executing party's give-up firm associated with the trade
9826	NonReportingGUID	N	MPID of contra party's give-up firm associated with trade.
9854	OverrideFlag	Q	Valid values: Y = Override N = No override
9862	ContraTradePA	N	Valid values: P = Principal A = agent R = Riskless Principal
9863	ContraClearingAcct	N	The number of the clearing firm associated with the

PATENT
REEL: 037821 FRAME: 0292

Tag	Tag Name	Req'd	Description
			contra party. If you do not enter a number, then NASDAQ uses the default clearing number in the contra firm profile.
	Standard Trailer		

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REEL: 037821 FRAME: 0293

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REEL: 037821 FRAME: 0294

4.3.2.11 Update Notification TRUD/CRUD (previously called Reg NMS Message Format for TTUD/CTUD)

When a firm updates clearing information, all parties involved in the trade receive the updated clearing information via this message.

Reg NMS Message Format

Tag	Tag Name	Req'd	Description
	Standard Header		`MsgType` = 8
6	AvgPx	Y	Price of this fill.
11	ClOrdID	N	If this message is an ACK, then this tag contains the value indicated in the inbound message or "NA". If this message is a UM, then this tag is not returned.
14	CumQty	Y	Quantity bought/sold on this fill. Maximum 8 digits.
17	ExecID	Y	Contains the value indicated in the inbound message or 0 (zero).
20	ExecTransType	Y	Valid value: 0 = New
37	OrderID	Y	Contains the value indicated in the inbound message or 0 (zero).
39	OrdStatus	Y	0 (zero)
54	Side	Y	Valid values: 1 = buy 2 = sell 8 = cross Cross trades will not be supported for AGU or OSR trades beginning 2/29/16. Cross Trades will be rejected if designated as AGU or OSR.
55	Symbol	Y	This field will contain the base listed symbol only for listed securities. See `SymbolSfx` [65] field for

Tag	Tag Name	Req'd	Description
			additional information about the security.
58	Text	Q	Contains message name, either "TRUD" or "CRUD".
60	TransactTime	Q	Time of execution of a particular trade expressed in UTC. ***If milliseconds are not populated, the system will append ".000" to the trade report timestamps.***
65	SymbolSfx	N	This field will contain only the additional information about the security (e.g. preferred, warrants, etc.). No delimiters are allowed in this tag.
75	TradeDate	Q	Indicates date of trade referenced in this message in YYYYMMDD format.
81	ProcessCode	N	Valid values: 0 = regular (default) 3 = FINRA Step-out trade*** Q = NASDAQ Step-Out 7 = Special trade 8 = Special and Step-out trade*** F = Nasdaq Sales Fee Transfer 2 = FINRA Step-in trade*** A = FINRA Special and step-in trade*** B = FINRA Step-out trade with fees*** C = FINRA Special and Step-out trade with fees*** D = FINRA Position Transfer M = Clearing Only/Non Regulatory* N = Special and Clearing Only/Non Regulatory* O = Clearing Copy** P = Special and Clearing Copy**

PATENT
REEL: 037821 FRAME: 0295

Tag	Tag Name	Req'd	Description
			*Clearing Only/Non Regulatory designations will be used in regards to FINRA Rule Filing Notice 2015-035 (effective on or about February 1, 2016 pending SEC approval) **Clearing Copy designation will be used for Nasdaq NextShares. (effective on or about February 1, 2016 pending SEC approval) *** As of 2/29/16, validations on proper step-in and step-out designations will begin. Any TRF trade designated as a step-out must be entered by the Executing Pary (MM). Any TRF trade designated as a step-in must be entered as a Contra Party (OE). On FINRA Step-Out transactions with fees (i.e. ProcessCode values of B and C): 1. Firms must set tag 852 (PublishTrdIndicator) to "N" (FINRA will assess the FINRA Section 3 fee) 2. Firms must have tag 577 (ClearingInstruction) set to "0"
107	SecurityDesc	Y	Valid values: N = NASDAQ Global Select Market or NASDAQ Global Market R = NASDAQ Capital Market C= CQS

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REEL: 037821 FRAME: 0296

Tag	Tag Name	Req'd	Description
109	ClientID	N	Sent only for clearing messages (CRUD), this field will contain the MMID on the trade.
150	ExecType	Y	Valid value: I = status
151	LeavesQty	Y	Valid value: 0 (zero)
277	TradeCondition	Q	Space-delimited list of trade conditions. Valid values: 0 = regular B = Average Price trade C = Cash I = Late (Sold out of Sequence) J = Next Day L = Seller's Option N = Stopped Stock 1 = Pre/Post-market Sold out of Sequence 2 = FINRA Self Help Indicator 3 = Intermarket Sweep Outbound 4 = Derivatively Priced 5 = .T 6 = Intermarket Sweep Inbound 7 = Qualified Contingent Trade 8 = FINRA Subpenny Indicator 9 = Prior Reference Price 16 = Price unrelated to market 18 = OTC Option 19 = Error Correction 20 = Print Protection
375	ContraBroker	Q	MPID of the other side. For clearing messages (CRUD) this will always contain the CPID.
423	PriceType	Q	Indicates whether the average price tag contains contract amount or trade price. This tag is used in conjunction with tag 6. Valid values:

PATENT
REEL: 037821 FRAME: 0297

Tag	Tag Name	Req'd	Description
			98 = decimal unit price 99 = contract amount
440	ClearingAccount	N	4 digit numeric field. The number of the clearing firm associated with the executing party. If you do not enter a number, then NASDAQ uses the default clearing number in your firm profile.
528	OrderCapacity	Q	Valid values: P = Principal A = agent R = Riskless Principal
571	TradeReportID	Q	If this message is an ACK, then this tag contains the value indicated in the inbound message. If this message is a UM, then this tag contains a NASDAQ-defined, unique identification number for this message.
577	ClearingInstruction	Q	Eligibility of this trade for clearing and central counterparty processing. Valid values: 0 = clear 10 = FINRA AGU Lock-in 11 = QSR clear 97 = no clear 98 = QSR no clear 99 = ext. sys. locked-in
700	ReversalIndicator	N	Valid values: N = Not a reversal (default) Y = reversal reported through ACT K = reversal reported through ACT

PATENT
REEL: 037821 FRAME: 0298

Tag	Tag Name	Req'd	Description
829	TrdSubType	Y	Indicates whether the trade is exempt from the trade through rule or not. 0 = No Trade Through Exemption 1 = Trade Through Exemption
852	PublishTrdIndicator	N	Valid values: Y = Report to Tape (default) N = Do Not Report to Tape If tag 277 = 16, 17, or 18, then tag 852 must = N.
853	ShortSaleReason	N	Reason for short sale. Valid values: 0 = Dealer Sold Short 2 = Selling Customer Sold Short 4 = Contra Side Sold Short 1 = Dealer Sold Short Exempt 3 = Selling Customer Sold Short Exempt 5 = Contra Side Sold Short Exempt
855	SecondaryTrdType	N	For a Seller Option, Cash, or Next Day trade, use the respective assigned modifier and Number of days for delivery is tracked in the field, "Seller Days", allowed values are as follows: 00 For Sale Condition C – Cash 01 For Sale Condition N – Next Day 02, 04-60 For Sale Condition R – Seller.
856	TradeReportType	Q	Used to identify message type. The TRUD message will always contain this value: 4 = Addendum See Appendix A: Message Flow Scenarios.

PATENT
REEL: 037821 FRAME: 0299

Tag	Tag Name	Req'd	Description
880	TrdMatchID	Q	NASDAQ-assigned, unique control number, commonly known as the ACT control number.
939	TrdRptStatus	Q	Valid values: 0 = Accepted 82 = Broken 83 = Cancelled 84 = Declined 85 = Errored 87 = Trades forwarded as one-sided to DTCC 88 = A blockbuster or sizable trade being held pending clearing firm action or expiration of 15 minute held period 89 = A blockbuster or sizable trade that was inhibited from being locked in by the clearing firm. 90 = Sizable trade killed by NASDAQ at the end of the 15 minute held period 91 = Automatic Locked-in trade (end of T+1) 92 = M1 Matched 93 = No/Was 94 = contra party entered trade 95 = Locked-in trades from other NASDAQ systems or QSR trades 96 = 97 = Trades entered for Ticker only 98 = Unanswered entry 99 = Trades purged from the trade reporting file The 86, 87, 91, 96, 99 statuses are assigned by the system during off-line processing will not be available during the on-line hours.

PATENT
REEL: 037821 FRAME: 0300

Tag	Tag Name	Req'd	Description
5080	AsOfIndicator	Q	Valid values: Y = As-of (T+1 to T+n) N = Original (T-day entry)
5149	Memo	N	User memo.
9822	ClearingPrice	N	Price inclusive of commissions.
9825	ReportingGUID	N	MPID of executing party's give-up firm associated with the trade
9826	NonReportingGUID	N	MPID of contra party's give-up firm associated with trade.
9854	OverrideFlag	Q	Valid values: Y = Override N = No override
	ContraTradePA	N	Valid values: P = Principal A = agent R = Riskless Principal
9863	ContraClearingAcct	N	The number of the clearing firm associated with the contra party. If you do not enter a number, then NASDAQ uses the default clearing number in the contra firm profile.
	Standard Trailer		

PATENT
REEL: 037821 FRAME: 0301

4.3.2.12 M2 Trade Match Notification TCM2/CCM2

Note – As of November 2005, NASDAQ no longer supports an M2 matching process. The resulting TCM2 and CCM2 messages have therefore been deleted from these specifications.

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REEL: 037821 FRAME: 0302

PATENT
REEL: 037821 FRAME: 0303

4.3.2.13 Participant Authorization Indicator Message TCPI

At the start of day, NASDAQ sends this message to communicate all current clearing arrangements. You will receive one message for each relationship. This information can also be accessed via trader.

In addition to start of day messages, intraday messages will be sent to you when:

- the risk management state changes;
- the cap mark changes;
- a record (relationship) is added; and
- a record (relationship) is deleted.

Trader will be updated to reflect these intraday changes.

Message Format

Tag	Field Name	Req'd	Comments
	Standard Header	Y	`MsgType` = 8
6	AvgPx	Y	0 (zero)
14	CumQty	Y	0 (zero)
17	ExecID	Y	0 (zero)
20	ExecTransType	Y	Valid value: 0 = New
37	OrderID	Y	0 (zero)
39	OrdStatus	Y	0 (zero)
54	Side	Y	Valid value: 7 = unknown
55	Symbol	Y	This tag will always have the value, "N/A".
58	Text	Q	Contains message name, "TCPI".
60	TransactTime	Q	Indicates when this message was sent.
150	ExecType	Y	Valid value: I = status
151	LeavesQty	Y	0 (zero)

Tag	Field Name	Req'd	Comments
375	ContraBroker		MPID of the executing party associated with this message.
440	ClearingAccount	N	4 digit numeric field. The number of the executing party's clearing firm. If you do not enter a number, then NASDAQ uses the default clearing number in your firm profile.
571	TradeReportID	Q	Contains a NASDAQ-defined, unique identification number for this message.
856	TradeReportType	Q	Used to identify message type. The TCPI message will always contain this value: 95 = participant indicator See Appendix A: Message Flow ScenariosAppendix A: Message Flow Scenarios.
9824	ClearingBroker	Q	ID of the executing party's clearing broker.
9830	IntroBrokerInd	Q	The Introducing Broker gives-up another firm during the execution of the trade. If you enter a trade report that establishes a relationship between you and a give-up firm, then you are the introducing broker. Valid values: A = Active S = Suspended
9831	ExecBrokerInd	Q	The Executing Party "owns" the trade. If your trade entry does not create a give-up relationship, then you are the executing party. If your trade entry establishes a give-up relationship with your and another firm, then the give-up firm is the executing party. Valid values: A = Active S = Suspended

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PATENT
REEL: 037821 FRAME: 0304

Tag	Field Name	Req'd	Comments
9832	ClearBrokerInd	Q	The Clearing Broker clears the trade. Valid values: A = Active S = Suspended
9833	ResponsibilityInd	Q	Designates the party on each side of a trade that is responsible for trade reporting. This indicator tells NASDAQ if the give-up firm/executing party will act on its own behalf. If a trade involves a give-up on one or both sides, only one party from each side will be enabled to interface with ACT. If the give-up firm is responsible, only that firm can use the trade reporting query/update capabilities for its side. If the give-up firm is not responsible, only the introducing brokers will be allowed to interface with NASDAQ on behalf of its respective give-up firm. Valid values: Y = Yes N = No
9834	TradeRepAvailInd	Q	Indicates the extent of a firm's participation in trade reporting. Valid values: A = Available E = Effective Tomorrow N = Not ready U = Unavailable for technical reasons
9835	MajorClearingInd	Q	Signifies that the clearing broker ID in the message is the executing party's major clearing firm. A self-clearing firm will always be denoted as major. Valid values: M = Major N = not a major arrangement
9836	RiskMgmtInd	Q	Designates that the clearing relationship in this message is functionally active and assigns responsibility to the correspondent or the clearing firm for the entry of all T+2 to T+N entries. Valid

PATENT
REEL: 037821 FRAME: 0305

Tag	Field Name	Req'd	Comments
			values for self-clearing firms are A, M, and D. Valid values: A = Active & correspondent cannot enter As-of T+2 to T+N trades (except self-clearing) M = Active with Super-Cap Marker & correspondent cannot enter As-of T+2 to T+N trades (except self-clearing) Y = Active & correspondent can enter As-of T+2 to T+N trades (except self-clearing) N = Active with Super-Cap Marker, correspondent (non-self clearing) can enter As-of T+2 to T+N trades D = Deleted
	Standard Trailer	Y	

PATENT
REEL: 037821 FRAME: 0306

PATENT
REEL: 037821 FRAME: 0307

4.3.2.14 Blockbuster or Sizable Trade Notification TCBT/CCBT/TCST/CCST

A **blockbuster** trade is a correspondent trade with a contract amount equal to or greater than either the Blockbuster Trade Dollar Volume set by participant (currently set at $1 million) or the blockbuster amount set by the clearing firm.

Not subject to blockbuster validation:

- trades submitted to NASDAQ by one of NASDAQ's execution systems;
- QSR entries
- trade-report-only transactions; and
- trades in which the correspondent's risk management capmark is on.

Clearing firms will be notified of blockbuster trades. The trades will not be eligible for matching until either the clearing firm allows the trade or the 15-minute held period is over.

A drop copy TCBT (a TCB2) is available. Contact NASDAQ support to request it. Contact information is in section 1.2.

A **sizable** trade is a correspondent trade with a contract amount equal to or greater than either the Sizable Trade Dollar Volume set by participant (currently set at $200,000) or by the sizable value set by the clearing firm.

Not subject to sizable validation:

- trades executed in one of NASDAQ's execution systems;
- QSR entries; and
- trade-report-only transactions.

At least one of the executing parties must have the Risk Management Capmark set. If the correspondent's risk management capmark is on, the trade will be subject to sizable validation.

Clearing firms will be notified of sizable trades and the trades will not be eligible for matching until either the clearing firm allows the trade or the 15-minute held period is over. If the clearing firm does not allow the trade within 15 minutes, NASDAQ will inhibit the transaction, and it will not be eligible for NASDAQ's matching process. Clearing firms may set the default action to allow for trades if no response has been received after the 15- minute held period.

Message Format

Tag	Tag Name	Req'd	Description

Tag	Tag Name	Req'd	Description
	Standard Header		`MsgType` = 8
6	AvgPx	Y	0 (zero)
14	CumQty	Y	0 (zero)
17	ExecID	Y	0 (zero)
20	ExecTransType	Y	Valid value: 0 = New
37	OrderID	Y	0 (zero)
39	OrdStatus	Y	0 (zero)
54	Side	Y	Valid value: 7 = unknown
55	Symbol	Y	This tag will always have the value, "N/A".
58	Text	Q	Contains one of the following message names: TCBT CCBT TCST CCST
150	ExecType	Y	Valid value: I = status
151	LeavesQty	Y	0 (zero)
571	TradeReportID	Q	Contains a NASDAQ-defined, unique identification number for this message.
856	TradeReportType	Q	Used to identify message type. The TCBT/CCBT message will always contain this value: 96 = blockbuster The TCST/CCST message will always contain this value:

PATENT
REEL: 037821 FRAME: 0308

Tag	Tag Name	Req'd	Description
			97 = sizable See Appendix A: Message Flow Scenarios
880	TrdMatchID	Q	NASDAQ-assigned, unique control number, commonly known as the ACT control number.
939	Trade Status	Q	Valid values: 81 = CP entry trade - NASDAQ set the CP entry to O after H period expired or allowed by clearing firm 88 = held - NASDAQ automatically set H for 15 minutes pending clearing broker action 89 = inhibited - if clearing broker inhibited the BBT or sizable 90 = killed - NASDAQ set the entry to K after H period expired 98 = unanswered MM Entry - NASDAQ set the EP entry to U after H period expired or if allowed by clearing firm
9819	Inhibit Trade Indicator	Q	Valid values: A = one or both clearing firms have allowed the trade, as required B = buy side clearing firm inhibited the trade N = neither clearing firm has inhibited the trade S = sell side clearing firm inhibited the trade
9820	Blockbuster Sizable Start Time	Q	Entry time of the blockbuster or sizable trade.
9821	Blockbuster Sizable Action Time	Q	Time of receipt of action input or expiration of review period.
	Standard Trailer		

PATENT
REEL: 037821 FRAME: 0309

PATENT
REEL: 037821 FRAME: 0310

4.3.2.15 Net Trade Threshold Notification TTNT/TTNP

This message notifies firms that the dollar value of this trade increased the Net Amount Traded (NAT) resulting in the Net Trade Threshold (NTT) being exceeded. This threshold alert message shall be forwarded to each party of the trade whose NTT is exceeded and to associated clearing firms.

An identical Pre-Alert Trade Threshold message (TTNP) for correspondents and their clearing firms will be sent if the dollar value of trades exceeds the trade threshold percent established by FINRA.

Message Format

Tag	Field Name	Req'd	Comments
	Standard Header	Y	`MsgType` = 8
6	AvgPx	Y	As per trade entry.
14	CumQty	Y	As per trade entry.
17	ExecID	Y	Contains the value indicated in the inbound message or 0 (zero).
20	ExecTransType	Y	Valid value: 0 = New
37	OrderID	Y	Contains the value indicated in the inbound message or 0 (zero).
39	OrdStatus	Y	0 (zero)
54	Side	Y	As per trade entry.
55	Symbol	Y	As per trade entry.
58	Text	Q	Contains message name, either "TTNT" or "TTNP".
60	TransactTime	Q	As per trade entry.
65	SymbolSfx	N	As per trade entry.
75	TradeDate	Q	As per trade entry.
81	ProcessCode	N	As per trade entry.
107	SecurityDesc	Q	As per trade entry.

Tag	Field Name	Req'd	Comments
150	ExecType	Y	Valid value: I = status
151	LeavesQty	Y	Valid value: 0 (zero)
277	TradeCondition	Q only if 828 is not present	As per trade entry.
375	ContraBroker	Q	As per trade entry.
423	PriceType	Q	As per trade entry.
440	ClearingAccount	N	As per trade entry.
528	OrderCapacity	Q	As per trade entry.
571	TradeReportID	Q	Contains a NASDAQ-defined, unique identification number for this message.
577	ClearingInstruction	Q	As per trade entry.
700	ReversalIndicator	N	As per trade entry.
828	TrdType	Q only if 277 is not present	As per trade entry.
852	PublishTrdIndicator	N	As per trade entry.
853	ShortSaleReason	N	As per trade entry.
855	SecondaryTrdType	N	As per trade entry.

PATENT
REEL: 037821 FRAME: 0311

Tag	Field Name	Req'd	Comments
856	TradeReportType	Q	Used to identify message type. The TTNT/TTNP message will always contain this value: 98 = net trade threshold See Appendix A: Message Flow Scenarios~~Appendix A: Message Flow Scenarios~~
880	TrdMatchID	Q	NASDAQ-assigned, unique control number, commonly known as the ACT control number.
5080	AsOfIndicator	Q	As per trade entry.
5149	Memo	N	As per trade entry.
9822	ClearingPrice	N	As per trade entry.
9823	NetTradeLimitInd	Q	Contains "M" when the dollar amount of this trade contributes to the market maker's Net Amount Traded (NAT) so as to exceed the EP's Net Trade Limit (NTL), or "O" when the dollar amount of this trade contributes to the contra party firm's NAT so as to exceed the contra party firm's NTL. M = exceeds executing party trade Limit O = exceeds contra party firm trade Limit
9825	ReportingGUID	N	As per trade entry.
9826	NonReportingGUID	N	As per trade entry.
9854	OverrideFlag	Q	As per trade entry.
9860	ContraBranchSeqNbr	N	As per trade entry.
9862	ContraTradePA	N	Valid values: P = Principal A = agent

PATENT
REEL: 037821 FRAME: 0312

Tag	Field Name	Req'd	Comments
			R = Riskless Principal
9863	ContraClearingAcct	N	As per trade entry.
	Standard Trailer	Y	

PATENT
REEL: 037821 FRAME: 0313

PATENT
REEL: 037821 FRAME: 0314

4.3.2.16 Net Trade Threshold Fallback Notification TTFB/TTFP

This message notifies firms that the dollar value of this trade decreased the Net Amount Traded (NAT), so that the Net Trade Threshold (NTT) is no longer exceeded. This threshold fallback message shall be forwarded to the parties of the trade whose NAT is now within its NTT limit and to its associated clearing firm.

An identical Pre-Alert Trade Threshold message (TTNP) for correspondents and their clearing firms will be sent if the dollar value of trades exceeding the trade threshold percent established by the participant decreases (due to a trade correction or threshold adjustment).

Message Format

Tag	Field Name	Req'd	Comments
	Standard Header	Y	`MsgType` = 8
6	AvgPx	Y	As per trade entry.
14	CumQty	Y	As per trade entry.
17	ExecID	Y	Contains the value indicated in the inbound message or 0 (zero).
20	ExecTransType	Y	Valid value: 0 = New
37	OrderID	Y	Contains the value indicated in the inbound message or 0 (zero).
39	OrdStatus	Y	0 (zero)
54	Side	Y	As per trade entry.
55	Symbol	Y	As per trade entry.
58	Text	Q	Contains message name, either "TTNT" or "TTNP".
60	TransactTime	Q	As per trade entry.
65	SymbolSfx	N	As per trade entry.
75	TradeDate	Q	As per trade entry.
81	ProcessCode	N	As per trade entry.

Tag	Field Name	Req'd	Comments
107	SecurityDesc	Q	As per trade entry.
150	ExecType	Y	Valid value: I = status
151	LeavesQty	Y	Valid value: 0 (zero)
277	TradeCondition	Q only if 828 is not present	As per trade entry.
375	ContraBroker	Q	As per trade entry.
423	PriceType	Q	As per trade entry.
440	ClearingAccount	N	As per trade entry.
528	OrderCapacity	Q	As per trade entry.
571	TradeReportID	Q	Contains a NASDAQ-defined, unique identification number for this message.
577	ClearingInstruction	Q	As per trade entry.
700	ReversalIndicator	N	As per trade entry.
828	TrdType	Q only if 277 is not present	As per trade entry.
852	PublishTrdIndicator	N	As per trade entry.
853	ShortSaleReason	N	As per trade entry.
855	SecondaryTrdType	N	As per trade entry.

PATENT
REEL: 037821 FRAME: 0315

Tag	Field Name	Req'd	Comments
856	TradeReportType	Q	Used to identify message type. The TTFB/TTFP message will always contain this value: 99 = net trade threshold fallback See Appendix A: Message Flow Scenarios~~Appendix A: Message Flow Scenarios~~
880	TrdMatchID	Q	NASDAQ-assigned, unique alphanumeric control number. This is commonly known as the ACT Control Number.
5080	AsOfIndicator	Q	As per trade entry.
5149	Memo	N	As per trade entry.
9822	ClearingPrice	N	As per trade entry.
9823	NetTradeLimitInd	Q	Contains "M" when the dollar amount of this trade contributes to the executing party's Net Amount Traded (NAT) so as to restore the market maker's Net Trade Limit (NTL). Contains "O" when the dollar amount of this trade contributes to the contra party firm's NAT so as to restore the contra party firm's NTL. M = restores executing party trade limit O = restores contra party firm's trade limit
9825	ReportingGUID	N	As per trade entry.
9826	NonReportingGUID	N	As per trade entry.
9854	OverrideFlag	Q	As per trade entry.
9860	ContraBranchSeqNbr	N	As per trade entry.
9862	ContraTradePA	N	Valid values: P = Principal A = agent

PATENT
REEL: 037821 FRAME: 0316

Tag	Field Name	Req'd	Comments
			R = Riskless Principal
9863	ContraClearingAcct	N	As per trade entry.
	Standard Trailer	Y	

PATENT
REEL: 037821 FRAME: 0317

PATENT
REEL: 037821 FRAME: 0318

5 Reject Messages

Rejects fall into one of three categories: session, business, and application.

Type	Number
Session	0001-0199
Business	0200-0299
Application	4000

5.1 Session

Sometimes, messages that are inbound to NASDAQ FIX are rejected directly, resulting in session level rejects. In these cases, you will receive a reject message (35=3) that includes the reject reason (tag 373) and detailed, specific causes of the reject (tag 58).

Tag	Field Name	Req'd	Comments
	Standard Header		`MsgType` = 3
45	RefSeqNum	Y	`MsgSeqNum` of Rejected message
58	Text	Q	Where possible, coded message that includes an indicator and text to explain reason for rejection. See the following table.
371	RefTagId	N	The tag number, if appropriate, being referenced in tag 373.
372	RefMsgType	N	The message type (35=?) of the FIX message being referenced.
373	SessionRejectReason	Q	As per FIX specifications, the reason for the reject: Valid values: 0 = Invalid tag number 1 = Required tag missing 2 = Tag not defined for this message type 3 = Undefined Tag

Tag	Field Name	Req'd	Comments
			4 = Tag specified without a value 5 = Value is incorrect (out of range) for this tag 6 = Incorrect data format for value 7 = Decryption problem 8 = Signature problem 9 = CompID problem 10 = SendingTime accuracy problem 11 = Invalid MsgType
	Standard Trailer		

Tag 58
0001 Invalid tag number
0002 Required tag missing
0003 Tag not defined for this message type
0004 Undefined Tag
0005 Tag specified without a value
0006 Value is incorrect (out of range) for tag
0007 Incorrect data format for value
0009 Signature problem
0010 Tag CompID problem
0011 SendingTime accuracy problem
0012 Invalid value for MsgType tag

5.2 Business

Messages can also be rejected when tag content validation fails, resulting in business level rejects. In these cases, you will receive a reject message (35=8) that includes the reject reason (tag 751), a detailed, specific causes of the reject (tag 58), and a trade report status of rejected (tag 939 = 1).

PATENT
REEL: 037821 FRAME: 0319

Tag	Field Name	Req'd	Comments
	Standard Header		MsgType = 8
6	AvgPx	Y	Price of this fill for Trade Entry and No/Was messages. 0 (zero) for Accept, Break, Cancel, Decline, and Error messages.
11	ClOrdID	N	This tag will contain the value indicated in the inbound message or "NA".
14	CumQty	Y	Quantity bought/sold on this fill for Trade Entry and No/Was messages. 0 (zero) for Accept, Break, Cancel, Decline, and Error messages.
17	ExecID	Y	Contains the value indicated in the inbound message or 0 (zero).
20	ExecTransType	Y	Valid value: 0 = New
37	OrderID	Y	Contains the value indicated in the inbound message or 0 (zero).
39	OrdStatus	Y	0 (zero)
54	Side	Y	Valid values: For Trade Entry and No/Was messages: 1 = buy 2 = sell 8 = cross For Accept, Break, Cancel, Decline, and Error messages: 7
55	Symbol	Y	For Trade Entry and No/Was messages, this field will contain the base listed symbol only for listed securities. See `SymbolSfx` [65] field for additional information about the security.

PATENT
REEL: 037821 FRAME: 0320

Tag	Field Name	Req'd	Comments
			For Accept, Break, Cancel, Decline, and Error messages, this tag will contain the value, "N/A".
58	Text	Q	Where possible, coded message that includes an indicator and text to explain reason for rejection. See the following table.
65	SymbolSfx	N	This field will contain only the additional information about the security (e.g. preferred, warrants, etc.) for listed securities. This additional information must be in CQS or TMTR format . No delimiters are allowed in this tag. For example, security "OXYpB" would be formatted as follows: Symbol [55]: OXY SymbolSfx [65]: CQS format: pB TMTR format: .PRB
150	ExecType	Y	Valid value: I = status
151	LeavesQty	Y	Valid value: 0 (zero)
571	TradeReportID	Q	Contains the value indicated in the inbound trade entry message.
751	TradeReportRejectReason	Q	Reason Trade Capture Request was rejected. Valid values: 1 = Invalid party information 2 = Unknown instrument 3 = Unauthorized to report trades 4 = Invalid trade type 6 = Incorrect data format for value 99 = Other
939	TrdRptStatus	Q	1 = Rejected
	Standard Trailer		

PATENT
REEL: 037821 FRAME: 0321

The following table lists the application error codes that will populate tag 58.

Tag 58
REJ - SYSTEM NOT AVAILABLE
REJ – TEMPORARILY NOT AVAILABLE
0200 Client Order ID (ClOrdID) exceeds the NASDAQ specified 20-character limit
0202 Unknown Client Order ID (ClOrdID)
0206 Invalid SenderSubID
0216 Non-supported Side Value
0224 No Client Order ID (ClOrdID)/Invalid ClOrdID provided
0226 Invalid TargetSubID
0232 Transaction Time is Missing
0233 PossDup Flag Must be Y or N or None
0234 PossResend Flag Must be Y or N or None
0236 Error UM has been processed - Possible Duplicate
0241 Client Order ID must be Alphanumeric
0304 Not Within Allowable Time
0305 MPID Not Authorized
0306 Size Over Limit
0319 Action Rejected
0501 Invalid Quantity
0503 Internal Error Unable to Process Message
0504 Error Duplicate CLORDID
0505 Error MsgType Not Supported
0506 Illegal character(s) in ClOrdID
0507 Error Layer6 CLORDID not found
0508 Error Outbound NSMP Message I1I2 Invalid

PATENT
REEL: 037821 FRAME: 0322

5.3 Application

Messages can also be rejected by the application. In these cases, you will receive a reject message (35=8) that includes the reject reason (tag 751), a detailed, specific causes of the reject (tag 58), and a trade report status of rejected (tag 939 = 1).

Tag	Field Name	Req'd	Comments
	Standard Header		MsgType = 8
6	AvgPx	Y	0
11	ClOrdID	N	Contains the value indicated in the inbound message for Trade Entry and No/Was messages or 0 (zero) for Accept, Break, Cancel, Decline, and Error messages.
14	CumQty	Y	0
17	ExecID	Y	Contains the value indicated in the inbound message for Trade Entry and No/Was messages or 0 (zero) for Accept, Break, Cancel, Decline, and Error messages.
20	ExecTransType	Y	Valid value: 0 = New
37	OrderID	Y	Contains the value indicated in the inbound message or 0 (zero) for Accept, Break, Cancel, Decline, and Error messages.
39	OrdStatus	Y	0 (zero)
54	Side	Y	Valid values: For Trade Entry and No/Was messages: 1 = buy 2 = sell 8 = cross For Accept, Break, Cancel, Decline, and Error messages: 7

PATENT
REEL: 037821 FRAME: 0323

Tag	Field Name	Req'd	Comments
55	Symbol	Y	For Trade Entry and No/Was messages, this field will contain the base listed symbol only for listed securities. See `SymbolSfx` [65] field for additional information about the security. For Accept, Break, Cancel, Decline, and Error messages, this tag will contain the value, "N/A".
58	Text	Q	"4000" followed by reject text to explain reason for rejection. Please see the table below.
65	SymbolSfx	Y	This field will contain only the additional information about the security (e.g. preferred, warrants, etc.) for listed securities. This additional information must be in CQS or TMTR format . No delimiters are allowed in this tag. For example, security "OXYpB" would be formatted as follows: Symbol [55]: OXY SymbolSfx [65]: CQS format: pB TMTR format: .PRB
150	ExecType	Y	Valid value: I = status
151	LeavesQty	Y	Valid value: 0 (zero)
571	TradeReportID	Q	Contains the value indicated in the inbound trade entry message.
751	TradeReportRejectReason	Q	Reason Trade Capture Request was rejected. Valid values: 1 = Invalid party information 2 = Unknown instrument 3 = Unauthorized to report trades 4 = Invalid trade type 99 = Other
939	TrdRptStatus	Q	1 = Rejected
	Standard Trailer		

PATENT
REEL: 037821 FRAME: 0324

PATENT
REEL: 037821 FRAME: 0325

The following table lists the application error codes that will populate tag 58. Each of these rejects will be preceded by "4000".

Tag 58
ACCEPT
ACCEPT - CONTRA NOT READY
ACCEPT - NOT CLEARING ELIGIBLE
ACT ENTRY SUSPENDED
ALL BLOCKBUSTER LESS THAN DEFAULT MKT BLOCKBUSTER
ALL BLOCKBUSTER LESS THAN MKT BLOCKBUSTER
ALL SIZEABLE LESS THAN DEFAULT MKT SIZEABLE
ALL SIZEABLE LESS THAN MKT SIZEABLE
ALL SUPERCAP LESS THAN DEFAULT MKT SUPERCAP
ALL SUPERCAP LESS THAN MKT SUPERCAP
BLOCKBUSTER BELOW MINIMUM AMOUNT
BLOCKBUSTER EXCEEDS DEFAULT MKT SUPERCAP Blank – may be used
BLOCKBUSTER EXCEEDS MKT SUPERCAP
BLOCKBUSTER LESS THAN SIZEABLE AMT
BRANCH SEQ# REQUIRED
CANNOT CHANGE TO NON-MEDIA TRADE
CHANGE NOT ALLOWED - TRADE ALREADY SENT TO CLEARING
CONTRA FIRM NOT AUTHORIZED
ENTRY REQUIRED
EXCEEDS MAXIMUM CONTRACT AMOUNT
EXECUTION TIME GREATER THAN TRADE REPORT TIME
EXECUTION TIME REQUIRED
FIRM NOT AUTHORIZED

Tag 58
FIRM REQUIRED
IMPROPER FORM T TRADE
INTERNAL ERROR
INVALID ACT ENTRY
INVALID AMOUNT
INVALID AS-OF
INVALID B/A INDICATOR
INVALID B/S
INVALID BLOCKBUSTER ACTION
INVALID BLOCKBUSTER AMOUNT
INVALID BRANCH SEQ #
INVALID CAP MARK
INVALID CLEARANCE ENTRY
INVALID CLEARING ACCT #
INVALID CLEARING NUMBER
INVALID CONTRA BRANCH SEQUENCE
INVALID CONTRA P/A
INVALID CONTRA PARTY
INVALID CONTROL NUMBER
INVALID DATE
INVALID ENTRY
INVALID FIRM
INVALID FORMAT
INVALID FUNCTION CODE
INVALID GIVEUP CODE
INVALID MAKE DEF VALUE
INVALID MARKET ID

PATENT
REEL: 037821 FRAME: 0326

Tag 58
INVALID MARKET TYPE
INVALID MEMO FIELD
INVALID EP GIVE-UP
INVALID CP GIVE-UP
INVALID CPID
INVALID P/A
INVALID PRICE
INVALID PRICE OVERRIDE
INVALID PRICE/CONTRACT INDICATOR
INVALID QSR ENTRY
INVALID REFERENCE NUMBER
INVALID RISK MANAGEMENT
INVALID SECURITY CLASS
INVALID SECURITY ID
INVALID SELECTION
INVALID SELLER DAYS
INVALID SHORT SALE INDICATOR
INVALID SIZEABLE ACTION
INVALID SIZEABLE AMOUNT
INVALID SPECIAL TRADE IND
INVALID STATUS ENTRY
INVALID SUPERCAP AMOUNT
INVALID SYSTEM DESIGNATION
INVALID TIME
INVALID TIME COMBINATION
INVALID TRADE MODIFIER
INVALID TRADE REPORT FLAG

PATENT
REEL: 037821 FRAME: 0327

Tag 58
INVALID TRADE REPORT OVERRIDE
INVALID TRADE-THROUGH EXEMPT
INVALID TRADE TYPE
INVALID TRADING DIGIT
INVALID TYPE
INVALID UPDATE
INVALID VOLUME
ISSUE NOT ACT AUTHORIZED
LAST SALE OK - CLEARING REJECT
LAST SALE OK - NOT CLEARING ELIGIBLE
LAST SALE OK -NO CLEARING
MEMO FIELD CANNOT BE CHANGED
MKT BLOCKBUSTER EXCEEDS ALL BLOCKBUSTER
MKT BLOCKBUSTER EXCEEDS DEFAULT ALL BLOCKBUSTER
MKT SIZEABLE EXCEEDS ALL SIZEABLE
MKT SIZEABLE EXCEEDS DEFAULT ALL SIZEABLE
EP NOT ACT AUTHORIZED
EPCLR NOT ACT AUTHORIZED
EPGU NOT ACT AUTHORIZED
EPID REQUIRED
MOD SLD REQUIRED
MOD T NOT ALLOWED
MOD T REQUIRED
NO CLEARING RELATION WITH THIS EXECUTION BROKER
NO CONTROL NUMBER
NO ENTRY DATA WAS UPDATED
NO MORE DATA FOR SELECTION CRITERIA

PATENT
REEL: 037821 FRAME: 0328

Tag 58
NO MORE RECORDS
NO MORE RECORDS FOR CLEARING FIRM
NO NEW DATA ENTERED
NO NO/WAS FOR AS-OF TRADES
NO NO/WAS FOR MOD T TRADES
NO NO/WAS FOR NON-MEDIA TRADES
NO OTHER UPDATE WHEN STATE IS D
NO RECORDS FOUND
NO SECID CHANGE IN NO/WAS
NO STATISTICS AVAILABLE
NO UPDATES AFTER LAST SALE END TIME
NOT A REPORTABLE OPEN TRADE
NOT AN OPEN TRADE
NOT AUTHORIZED
NOT CROSS TRADE
NOT WITHIN ALLOWABLE TIME
CP NOT ACT AUTHORIZED
CPCLR NOT ACT AUTHORIZED
CPGU NOT ACT AUTHORIZED
CPID REQUIRED
ONLY EP MAY CORRECT THIS TRADE
POTENTIAL VOL ERR
POTENTIAL VOLUME ERROR
PRICE OUT OF OVERRIDE RANGE
PRICE OUT OF RANGE
REVERSAL NOT ALLOWED
SECURITY HALTED

PATENT
REEL: 037821 FRAME: 0329

Tag 58
SIZEABLE BELOW MINIMUM AMOUNT
SIZEABLE EXCEEDS DEFAULT MKT BLOCKBUSTER AMT
SIZEABLE EXCEEDS MKT BLOCKBUSTER AMT
SUPER CAP STILL EXCEEDED
SUPERCAP EXCEEDS ALL VALUE
SUPERCAP EXCEEDS DEFAULT ALL VALUE
SUPERCAP LESS THAN BLOCKBUSTER
SUPERCAP LESS THAN DEFAULT BLOCKBUSTER
TERMINAL NOT AUTHORIZED
TIME FIELD REQUIRED
TRADE ALREADY CANCELLED, ERRORED, OR CORRECTED
TRADE ALREADY LOCKED-IN
TRADE DETAIL MUST BE UPDATED
TRADE STATUS INVALID FOR ACTION
TRDE HELD
UPDATE OF FIELD REQUIRED

PATENT
REEL: 037821 FRAME: 0330

PATENT
REEL: 037821 FRAME: 0331

6 Appendix A: Message Flow Scenarios

Because `MsgType` = 8 is being used for all submissions, tag 856, TradeReportType, is used to identify message type. The scenarios below not only provide an overview of message flow, but also provide the values you should expect in tag 856.

Tag 856, TradeReportType:

- 0 = submit
- 1 = alleged
- 2 = accept
- 3 = decline
- 4 = addendum
- 5 = no/was
- 6 = trade report cancel
- 7 = locked-in trade break
- 8 = error

6.1 Cross Trades

You enter this...	you get this in response...		your clearing firm gets this...	
Trade Entry (Function V) 856 = 0	TTEN 856 = 0		CTEN 856 = 0	

PATENT
REEL: 037821 FRAME: 0332

6.2 QSR Submitted Trades

You (AGU or QSR) enter this...	you get this in response...	contra firm gets this...	your clearing firm gets this...	contra's clearing firm gets this...
Trade Entry (Function V) 856 = 0	TTEN 856 = 0	TTAL* 856 = 1	CTEN* 856 = 0	CTAL* 856 = 1

*returned with a status of locked-in

6.3 AGU Submitted Trades

You (AGU or QSR) enter this...	you get this in response...	contra firm gets this...	your clearing firm gets this...	contra's clearing firm gets this...
Trade Entry (Function V) 856 = 0	TTEN 856 = 0		CTEN * 856 = 0	

*returned with a status of locked-in

6.4 Clearing Broker Fails after NASDAQ Market Center-originated Trade Report

	sell side gets this in response...	contra firm gets this...	sell side's clearing firm gets this...	contra's clearing firm gets this...
At 11:07 a.m., SUMO executes trade	TTEN	TTAL*	CTEN* 856 = 0	CTAL* 856 = 1
At 3:20 p.m., the sell side's clearing broker fails	TTUD anonymity exposed	TTUD anonymity exposed	CTUD anonymity exposed	CTUD anonymity exposed

*returned with a status of locked-in

PATENT
REEL: 037821 FRAME: 0333

6.5 Trade Entry Accepted

You enter this...	you get this in response...	contra firm gets this...	your clearing firm gets this...	contra's clearing firm gets this...
Trade Entry (Function V) 856 = 0	TTEN 856 = 0	TTAL 856 = 1	CTEN 856 = 0	CTAL 856 = 1
Then, contra...	**you get this in response...**	**contra firm gets this...**	**your clearing firm gets this...**	**contra's clearing firm gets this...**
Accept (Function A) 856 = 2	TCLK 856 = 2	TCLK 856 = 2	CCLK 856 = 2	CCLK 856 = 2

6.6 Trade Entry Matched

You enter this...	you get this in response...	contra firm gets this...	your clearing firm gets this...	contra's clearing firm gets this...
Trade Entry (Function V) 856 = 0	TTEN 856 = 0	TTAL 856 = 1	CTEN 856 = 0	CTAL 856 = 1
Contra enters this...	**you get this in response...**	**contra firm gets this...**	**your clearing firm gets this...**	**contra's clearing firm gets this...**
Trade Entry (Function W) 856 = 0	TTAL 856 = 1	TTEN 856 = 0	CTAL 856 = 1	CTEN 856 = 0
If...	**you get this in response...**	**contra firm gets this...**	**your clearing firm gets this...**	**contra's clearing firm gets this...**
M1 Match	TCLK 856 = 2	TCLK 856 = 2	CCLK 856 = 2	CCLK 856 = 2

PATENT
REEL: 037821 FRAME: 0334

6.7 Trade Entry Accepted then Broken by Contra Party

You enter this...	you get this in response...	contra firm gets this...	your clearing firm gets this...	contra's clearing firm gets this...
Trade Entry (Function V) 856 = 0	TTEN 856 = 0	TTAL 856 = 1	CTEN 856 = 0	CTAL 856 = 1
Then, contra...	**you get this in response...**	**contra firm gets this...**	**your clearing firm gets this...**	**contra's clearing firm gets this...**
Accept (Function A) 856 = 2	TCLK 856 = 2	TCLK 856 = 2	CCLK 856 = 2	CCLK 856 = 2
Then, contra...	**you get this in response...**	**contra firm gets this...**	**your clearing firm gets this...**	**contra's clearing firm gets this...**
Break (Function B) 856 = 7	TCBK 856 = 7	TCBK 856 = 7	CCBK 856 = 7	CCBK 856 = 7
Then, you...	**you get this in response...**	**contra firm gets this...**	**your clearing firm gets this...**	**contra's clearing firm gets this...**
Break (Function B) 856 = 7	TCBK 856 = 7	TCBK 856 = 7	CCBK 856 = 7	CCBK 856 = 7

6.8 Trade Entry Cancelled by Executing Party

You enter this...	you get this in response...	contra firm gets this...	your clearing firm gets this...	contra's clearing firm gets this...
Trade Entry (Function V) 856 = 0	TTEN 856 = 0	TTAL 856 = 1	CTEN 856 = 0	CTAL 856 = 1
Then, you...	**you get this in response...**	**contra firm gets this...**	**your clearing firm gets this...**	**contra's clearing firm gets this...**
Cancel (Function C) 856 = 6	TCAN 856 = 6	TCAN 856 = 6	CCAN 856 = 6	CCAN 856 = 6

PATENT
REEL: 037821 FRAME: 0335

6.9 Locked-In Trade Entry Cancelled

You enter this...	you get this in response...	contra firm gets this...	your clearing firm gets this...	contra's clearing firm gets this...
Trade Entry (Function V) 856 = 0	TTEN 856 = 0	TTAL 856 = 1	CTEN 856 = 0	CTAL 856 = 1
IF QSR Then, you...	**you get this in response...**	**contra firm gets this...**	**your clearing firm gets this...**	**contra's clearing firm gets this...**
Cancel (Function C) 856 = 6	TCAN 856 = 6	TCAN 856 = 6	CCAN 856 = 6	CCAN 856 = 6
IF NOT QSR Then, you...	**you get this in response...**	**contra firm gets this...**	**your clearing firm gets this...**	**contra's clearing firm gets this...**
Break (Function B) 856 = 7	TCBK 856 = 7	TCBK 856 = 7	CCBK 856 = 7	CCBK 856 = 7
IF NOT QSR Then, contra...	**you get this in response...**	**contra firm gets this...**	**your clearing firm gets this...**	**contra's clearing firm gets this...**
Break (Function B) 856 = 7	TCBK 856 = 7	TCBK 856 = 7	CCBK 856 = 7	CCBK 856 = 7

PATENT
REEL: 037821 FRAME: 0336

6.10 Trade Entry Cancelled by Executing Party Clearing Firm

You enter this...	you get this in response...	contra firm gets this...	your clearing firm gets this...	contra's clearing firm gets this...
Trade Entry (Function V) 856 = 0	TTEN 856 = 0	TTAL 856 = 1	CTEN 856 = 0	CTAL 856 = 1
Then, you...	**you get this in response...**	**contra firm gets this...**	**your clearing firm gets this...**	**contra's clearing firm gets this...**
Cancel (Function C) 856 = 6	TCAN 856 = 6	TCAN 856 = 6	CCAN 856 = 6	CCAN 856 = 6

6.11 Trade Entry Declined

You enter this...	you get this in response...	contra firm gets this...	your clearing firm gets this...	contra's clearing firm gets this...
Trade Entry (Function V) 856 = 0	TTEN 856 = 0	TTAL 856 = 1	CTEN 856 = 0	CTAL 856 = 1
Then, contra...	**you get this in response...**	**contra firm gets this...**	**your clearing firm gets this...**	**contra's clearing firm gets this...**
Decline (Function D) 856 = 3	TCDE 856 = 3	TCDE 856 = 3	CCDE 856 = 3	CCDE 856 = 3

PATENT
REEL: 037821 FRAME: 0337

6.12 Trade Entry Errored

You enter this...	you get this in response...	contra firm gets this...	your clearing firm gets this...	contra's clearing firm gets this...
Trade Entry (Function V) 856 = 0	TTEN 856 = 0	TTAL 856 = 1	CTEN 856 = 0	CTAL 856 = 1
Then, you...	**you get this in response...**	**contra firm gets this...**	**your clearing firm gets this...**	**contra's clearing firm gets this...**
Error (Function E) 856 = 6	TCER 856 = 8	TCER 856 = 8	CCER 856 = 8	CCER 856 = 8

6.13 Trade Entry Reversed

You enter this...	you get this in response...	contra firm gets this...	your clearing firm gets this...	contra's clearing firm gets this...
Trade Entry (Function V) 856 = 0	TTEN 856 = 0	TTAL 856 = 1	CTEN 856 = 0	CTAL 856 = 1
Then, you...	**you get this in response...**	**contra firm gets this...**	**your clearing firm gets this...**	**contra's clearing firm gets this...**
Reversal (Function V) 856 = 6	TTEN 856 = 0	TTAL 856 = 0	CTEN 856 = 0	CTAL 856 = 0

PATENT
REEL: 037821 FRAME: 0338

6.14 (Scenario removed)

You enter this...	you get this in response...	contra firm gets this...	your clearing firm gets this...	contra's clearing firm gets this...
Then, you...	**you get this in response...**	**contra firm gets this...**	**your clearing firm gets this...**	**contra's clearing firm gets this...**

6.15 Trade Entry Updated (price)

You enter this...	you get this in response...	contra firm gets this...	your clearing firm gets this...	contra's clearing firm gets this...
Trade Entry (Function V) 856 = 0	TTEN 856 = 0	TTAL 856 = 1	CTEN 856 = 0	CTAL 856 = 1
Then, you...	**you get this in response...**	**contra firm gets this...**	**your clearing firm gets this...**	**contra's clearing firm gets this...**
Update new ctrl # (Function X) 856 = 5	TTNW 856 = 5	TTNW 856 = 5	CTNW 856 = 5	CTNW 856 = 5

PATENT
REEL: 037821 FRAME: 0339

6.16 Trade Entry Contra Broker Updated

You enter this...	you get this in response...	contra firm gets this...	your clearing firm gets this...	contra's clearing firm gets this...
Trade Entry (Function V) 856 = 0	TTEN 856 = 0	TTAL 856 = 1	CTEN 856 = 0	CTAL 856 = 1
Then, you...	**you get this in response...**	**original contra firm gets this...**	**your clearing firm gets this...**	**original contra's clearing firm gets this...**
Update new ctrl # (Function X) 856 = 5	TTNW 856 = 5	TCER 856 = 8	CTNW 856 = 5	CCER 856 = 8
and...		**new contra firm gets this...**		**new contra's clearing firm gets this...**
		TTAL 856 = 1		CTAL 856 = 1

6.17 Trade Entry Capacity/BrSeqNbr Updated

You enter this...	you get this in response...	contra firm gets this...	your clearing firm gets this...	contra's clearing firm gets this...
Trade Entry (Function V) 856 = 0	TTEN 856 = 0	TTAL 856 = 1	CTEN 856 = 0	CTAL 856 = 1
Then, you...	**you get this in response...**	**contra firm gets this...**	**your clearing firm gets this...**	**contra's clearing firm gets this...**
Update new ctrl # (Function X) 856 = 5	TTNW 856 = 5	TTNW 856 = 5	CTNW 856 = 5	CTNW 856 = 5

6.18 Trade Entry Clearing Firm Updated

You enter this...	you get this in response...	contra firm gets this...	your clearing firm gets this...	contra's clearing firm gets this...
Trade Entry (Function V) 856 = 0	TTEN 856 = 0	TTAL 856 = 1	CTEN 856 = 0	CTAL 856 = 1
Then, you...	**you get this in response...**	**contra firm gets this...**	**your clearing firm gets this...**	**contra's clearing firm gets this...**
Update new ctrl # (Function X) 856 = 5	TTNW 856 = 5	TTNW 856 = 5	CCER 856 = 8	CTNW 856 = 5
and...			**your new clearing firm gets this...**	
			CTEN 856 = 0	

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7 Appendix B: Step Out/Step-in Matching Criteria

Matching Criteria

ProcessCode	*Matches*
NONE (on an MM trade)	NONE
NONE (on an OE trade)	NONE or CLEARING_ONLY_NON_REG
SPECIAL (on an MM trade) (7)	SPECIAL (7)
SPECIAL (on an OE trade) (7)	SPECIAL (7) or SPECIAL_CLEARING_ONLY_NON_REG
STEPOUT_EXCH (Q)	STEPOUT_EXCH (Q)
FEE_XFER_EXCH (F)	FEE_XFER_EXCH (F)
POSITION_TRANSFER (D)	POSITION_TRANSFER (D)
STEPOUT (3)	STEPIN (2)
SPECIAL_STEPOUT (8)	SPECIAL_STEPIN (A)
STEPOUT_WITH_FEES (B)	STEPIN (2)
SPECIAL_STEPOUT_WITH_FEEE (C)	SPECIAL_STEPIN (A)
STEPIN (2)	STEPOUT (3) or STEPOUT_WITH_FEES (B)
SPECIAL_STEPIN (A)	SPECIAL_STEPOUT (8) or SPECIAL_STEPOUT_WITH_FEES (C)
CLEARING ONLY/NON REGULATORY (M)	NONE
SPECIAL CLEARING ONLY/NON REGULATORY (N)	SPECIAL (7)
CLEARING COPY (O)	CLEARING COPY (O)
SPECIAL CLEARING COPY (P)	SPECIAL CLEARING COPY (P)

PATENT
REEL: 037821 FRAME: 0341

AN IMPROVED CLIMATE FOR IPOS FOR SWEDEN'S GROWTH

PROBLEM ANALYSIS AND PROPOSED ACTION

September 2013

NASDAQ OMX

TABLE OF CONTENTS

Background and summary 2

Proposed measures 7

Attractiveness of the Stock Exchange 7

Enhanced research and data regarding the importance of the Stock Exchange to companies and the national economy 7

Improved information and transparency vis-à-vis the media and retail investors 8

Active vs. passive management 9

The road to the Stock Exchange 10

Advance rulings 10

Reduced imbalance in knowledge about companies, public vs. non-public investments 11

'Free float' requirement 13

Life as a listed company 14

Quarterly reports 14

Restrictions on high-frequency trading 15

Increasing liquidity in small cap shares 16

Steering group for SMEs 17

Incentives for analysis 18

Tax relief on investment in small companies 19

Funds should be able to invest more in companies on emerging markets 20

Simplifications for increasing or reducing share capital 22

Identical tax position for financing through loans and private equity 23

Corporate governance – special treatment of listed companies 24

This is a translation of the Swedish report "Ett förbättrat börnoteringsklimat för Sveriges tillväxt – Problemanalys och förslag till åtgärder". In the event of any conflict between the Swedish original and the English translation, the Swedish original shall prevail.

PATENT
REEL: 037821 FRAME: 0343

BACKGROUND AND SUMMARY

NASDAQ OMX Stockholm AB ("NASDAQ OMX" or the "Stock Exchange") has a unique infrastructure for raising capital and therefore serves a key function in society. The Stock Exchange contributes to increased growth and more jobs. This is the reason why, during the first six months of 2013, the Stock Exchange has conducted broad discussions with representatives of the business community aimed at producing a problem analysis enjoying broad support and a list of measures to improve the climate for IPOs in Sweden.

There is a substantial societal value in making it easier to invest in small companies. The growth of new Swedish small and medium-sized enterprises ("SMEs") is of fundamental importance for Sweden's future growth and capacity to create jobs.

SMEs have gradually increased in importance to the Swedish economy, and the creation of jobs in the sector has been very important for the Swedish employment market since the early 1990s. In the last 10 years, around 80% of all new jobs in Sweden have been created in companies with fewer than 50 employees. Sweden's large companies are, of course, still of fundamental importance for growth and job creation in Sweden. The flow of capital from the banking sector to SMEs has deteriorated since the financial crisis due to the new Basel III (CRD IV) rules, which have resulted in greater costs for the banks' own financing. An increase in the flow of capital to SMEs means improved possibilities for growth and the creation of new jobs. According to statistics from Statistics Sweden, over 99% of Sweden's companies are defined as SMEs. One of the Stock Exchange's primary functions is to make it easier for companies to raise capital.

The ultimate goal is to create an ecosystem for raising capital in which the Stock Exchange, private equity firms, retail investors, institutional owners, investment funds, and private owners and families together provide companies with the best possible conditions to finance growth and create new jobs.

In light of the above, in cooperation with a number of market participants, NASDAQ OMX has held a consultation process with a large number of stakeholders aimed at producing a problem analysis enjoying broad support and a list of measures to improve the climate for IPOs in Sweden. The consultation with stakeholders has been constructive and is valuable to the Stock Exchange in its work to provide a well-functioning and attractive marketplace for raising capital. This document constitutes the Stock Exchange's summary of these discussions and the conclusions that have been drawn.

Initially, five primary areas of focus were identified:

- Corporate Governance and Rulebook for Issuers of Shares
- Corporate Finance and Analysis
- Share Trading
- Owners: Structure and Rules
- Institutional Owners

PATENT
REEL: 037821 FRAME: 0344

Based on these areas, groups of approximately 15 stakeholders from different parts of the market discussed problems and proposed measures.

These discussions have resulted, among other things, in a number of measures which the Stock Exchange intends to implement, while at the same time it is also clear that there are no simple, quick fixes which individually can improve the climate for IPOs in Sweden.

To begin with, one of the conclusions which bears emphasising is that one of the underlying causes which was often mentioned in the debate, namely the regulatory burden on listed companies, is important but cannot be considered the crucial problem. The fact that a company's market capitalisation is often lower than its valuation in a private setting also appears to be a problem area, as is equally inefficiency in raising capital.

Consequently, based on the fundamental analysis, it is clear that there are certain problems and measures which NASDAQ OMX can and should address, primarily with respect to the rulebook and transparency. There are also a number of potential measures which need to be discussed with market participants, public authorities and legislators. It is also clear that some of these measures can be implemented relatively quickly while others require a more long-term process.

Measures which the Stock Exchange can implement in the short term include:

- More flexible rules for quarterly reporting to reduce the administrative burden on companies.
- Reducing the number of orders per trade through price structure changes aimed at strengthening public confidence in the Stock Exchange.
- Introducing an auction procedure during the trading day to increase trading and interest in infrequently traded shares.
- Creating a steering group for SMEs to safeguard the interests of this group.
- Creating conditions for a simpler and quicker listing process.

One issue which the Stock Exchange needs to discuss further and investigate together with market participants is how the evaluation between investing in public and private companies can be balanced. Questions must be analysed such as whether having the opportunity to carry out a fundamental analysis prior to an investment decision is a decisive factor, and whether the declining number of analysts and analyses is a contributory cause. If this proves to be the case, the Stock Exchange should consider what can be done to improve this situation.

Similarly, public authorities and legislators must also be invited to the discussion table. For example, what must and can be done in the area of tax? The government's proposed tax relief on investments by retail investors in SMEs is a good one, but we are inclined to believe that tax relief on investment in SMEs should apply to more types of investors who are prepared to invest in the long-term. It should also be considered whether to change the rules regarding investments by funds in SMEs.

Statistics based on IPOs on First North between 2006 and 2012 indicate that companies that listed their shares on First North on average increased their workforce by 36.5% annually after the IPO, as compared with average annual job growth of 1.5% for all private companies in Sweden. In the

PATENT
REEL: 037821 FRAME: 0345

United States, scientific studies have found that fast-growing start-up companies account for 10% of all new jobs created in the United States, despite the fact that they represent only 1% of all companies. Another study found that 92% of all jobs created in US companies occurred after the IPO of the company. Therefore, there is a substantial societal value in making it easier to invest in SMEs in a controlled and transparent manner. It is also important to note that the Stock Exchange's growth market, First North, has experienced positive listing activity. 106 companies have floated on First North since its launch in 2006, 18 of which were in 2011, 8 in 2012, and 10 to date in 2013.

First North was founded with the objective of acting as a springboard to the Stock Exchange for small growth companies, where they can be listed under somewhat simpler requirements and subsequently grow and transfer to the main market. Since its launch, nearly 30 companies have moved from First North to the main market. The conclusion that can be drawn is that the desire to float on the Stock Exchange is there, but that an increased inclination to invest is needed to achieve the desired interplay. The Stock Exchange also notes that when companies choose external financing, from a tax perspective share capital is disadvantaged in comparison with loans.

We are convinced that the Stock Exchange must continue to be a key infrastructure for raising capital. There are several reasons for this. The Stock Exchange offers independent financing and thereby the possibility to develop in one's own way. An IPO enables all institutional investors and retail investors to get involved. It creates engagement and loyalty. The Stock Exchange provides transparency, both for investors and the companies' customers.

We hope that the fruitful discussions we initiated can continue in a new phase in 2013, and that they will also include public authorities, legislators and other stakeholders. The discussions can then lead to a number of further measures to improve the climate for IPOs and thereby create better conditions for growth in Sweden.

A table is included as an appendix to this document which provides an overview of measures to be taken, specifies the party who is responsible for taking the measure, and specifies the date for implementation.

PATENT
REEL: 037821 FRAME: 0346

What is happening on other markets?

The decline in the attractiveness of the public environment has also been noted at global level. On many markets, measures have been initiated and, in some cases, implementation has also begun. The lowest common denominator for these initiatives is the conclusion that the public market has an important function for the future growth potential of companies by acting as a key instrument for the necessary raising of capital.

The following are examples of this:

- The European Commission's proposal in MiFID II concerning the harmonisation and quality assurance of SME markets and the revision of the Transparency Directive, aimed at reducing the administrative burden on SMEs.
- The Jobs Act in the United States, primarily aimed at promoting job creation by making it easier for growth companies to raise capital without having to fulfil all of the requirements attendant on being a listed company.
- The London Stock Exchange setting up a High Growth Segment, aimed at making it easier for growth companies in the technology sector to raise capital on the stock exchange without fulfilling all of the listing requirements applicable on the stock exchange otherwise regarding e.g. the company's financial history, the requirement for free float and number of shareholders, and corporate governance.
- Euronext's work on introducing what is referred to as the "Entrepreneurial Exchange".

PATENT
REEL: 037821 FRAME: 0347

PROPOSED MEASURES

Attractiveness of the Stock Exchange

Enhanced research and data regarding the importance of the Stock Exchange to companies and the national economy

Background/Analysis

The Stock Exchange has been around for 150 years. A considerable portion of Sweden's welfare is based on large companies that were able to grow thanks to the opportunity they were afforded to raise capital on the Stock Exchange. In spite of this, there is a very limited amount of research and data available regarding the importance of the Stock Exchange and IPOs to Swedish companies and the Swedish economy.

Furthermore, the world has changed and the companies we see growing today have requirements and needs that are completely different to those of large companies. Therefore, what is needed is further research into how the Stock Exchange will be able to satisfy these needs, both now and in the future.

In the United States, considerably more research has been carried out concerning the importance of the stock exchange. Among other things, NASDAQ OMX has provided funding and access to databases in several large-scale projects which have produced the data set out in the introduction to this document.

It is also important that the research follows and evaluates the new initiatives launched in various parts of the world, such as the Jobs Act in the United States.

Possible solution:

The Nordic Foundation[1] focuses on providing support (through funding) to research relating to the importance of the stock exchange to the raising of capital by public companies and their growth.

[1] The NASDAQ OMX Nordic Foundation (*NASDAQ OMX Nordiska Börsstiftelsen*) was set up by NASDAQ OMX Stockholm AB, NASDAQ OMX Copenhagen A/S and NASDAQ OMX Helsinki Oy to promote the development of the financial markets in Sweden, Denmark and Finland by providing support to research, development and other initiatives. All penalties imposed on companies or members are transferred to the Foundation.

PATENT
REEL: 037821 FRAME: 0348

Backgrund/Analysis

Many companies have felt that their relationship with the media has become more difficult to deal with after an IPO. They are uncertain as to what they should say and not say, and in some cases this has resulted in their completely avoiding talking to the media. This uncertainty has further increased due to a number of highly publicized trading halts.

Furthermore, the media has reacted to the trading halts, complaining that they restrict freedom of expression. Both groups regard a trading halt as a sanction and not as a measure to restore equality of access to information to ensure a fair market.

Surveillance of listed companies and implementation of trading halts by the Stock Exchange are governed by statute and regulations which, in our opinion, essentially work well. However, better information and guidance is required as to how the trading halts should be interpreted and what they mean for the relationship with the media.

Possible solution:

- The Stock Exchange can further develop customised training programmes for listed companies and journalists, primarily for senior company management, and an area of particular importance is trading halts. The rules and procedures need to be explained to ensure that companies understand why the Stock Exchange implements trading halts and how they should act towards the media.

- The Stock Exchange will produce a checklist which can be used by senior management as guidance when managing the provision of information in contacts with the media and analysts.

- Certain aspects of the Stock Exchange's advice on the Rulebook for Issuers of Shares have been misinterpreted, namely that selective information can be given to analysts. Therefore, the Stock Exchange has made certain clarifications to the wording concerning contacts with analysts. The Stock Exchange clarifies that the whole section relates to contacts with analysts and the media, and deletes the subsection which provides that "good arguments" can be provided selectively.

- One of the reasons trading halts have occasionally given rise to uncertainty has been that the Stock Exchange and companies have not always managed to establish contact as quickly as they wanted to. To ensure accessibility, the Stock Exchange has extended the hours of service of its surveillance hotline. The hotline is now staffed 24 hours a day. The Stock Exchange has also asked companies to ensure that they are contactable at all times.

PATENT
REEL: 037821 FRAME: 0349

Background/Analysis

An increasing number of funds currently apply an investment strategy which is based on tracking an index. The performance of the fund manager is deemed to be based on the same index, which means that fund managers optimise their investment strategy by replicating the composition of the index in their portfolio. This reduces the opportunities for new companies to attract investors, since, when the company is floated, it is not directly connected to a major index or is quite simply not big enough to have any impact on a particular index. Funds that are more active on the stock exchange and do not have an index as their primary benchmark are more inclined to support new companies at an early stage in the listing process, but these funds are in a minority.

Another development, which, to a certain extent, is also due to the rise in the increasing investment strategy of tracking indices, is for funds to invest less and less in SMEs and focus instead on companies listed on the Stock Exchange's Large Cap. As stated above, it is primarily SMEs that create jobs. This further reduces the investor universe for a majority of the new companies which are floated on the Stock Exchange. Globalisation has also influenced how funds allocate their capital, with more capital being allocated to global investment funds managed by international funds, which means of course that less capital is allocated to promoting the growth of Swedish companies, and thereby the creation of jobs in Sweden.

In summary, due to the above, there is a risk that the capital allocation function of the marketplace will become ineffective because the capital is allocated based on the composition of an index instead of on the companies' anticipated return and risk.

Possible solution:

It is fundamental that fund managers make more active decisions and invest in smaller companies. This may require changes to regulations that restrict the freedom of action for managers. We would also like to open up the possibility for a discussion and analysis as to changes in how fund managers are graded and remunerated.

The proposal regarding the AP funds in the pension system[2] is troubling in this respect. The Report proposes the removal of the investment cap for unlisted shares, which is reasonable. However, this should be supplemented with the removal of the investment restriction of a low 2% for an individual listed company.

During the autumn, the Stock Exchange will be initiating a study with a global focus to identify measures to promote active management in preference to passive management. The study can then form the basis of continued discussions and possible action.

[2] Swedish Government Official Reports 2012:53

PATENT
REEL: 037821 FRAME: 0350

The road to the Stock Exchange

Advance rulings

Background/Analysis

Transparency and predictability in the listing process are essential to confidence in the market and among market participants. During the listing process, assessment questions sometimes arise as to the application of relevant rules and regulations and the principles on which the rules and regulations are based. These questions can, in individual cases, be difficult to answer clearly, for example due to the absence of any common practice in the particular area. Companies that apply for a listing on the Stock Exchange, and their advisers, need to know - as at early a stage as possible in the process - whether the listing requirements will be fulfilled.

Possible solution:

The Stock Exchange wants to introduce the possibility for applicant companies to request an advance ruling on substantive questions which are of material importance to the assessment of the satisfaction of applicable listing requirements. Providing for the possibility to receive an advance ruling will make the listing process more efficient.

Next step/procedure

The Stock Exchange will be initiating a procedure for introducing the possibility to obtain an advance ruling in a listing process. The aim is to introduce this on 1 January 2014. During the autumn, the Stock Exchange will make proposals for necessary changes to the rules and regulations. These proposals will then be the subject of consultation with the Listed Companies Association (*Aktiemarknadsbolagens förening*).

PATENT
REEL: 037821 FRAME: 0351

Backgrund/Analysis

The transition from the unlisted to the listing environment entails an adjustment for many companies. This is the case both for the company and for potential investors who are to buy shares in the company in the IPO. In a traditional IPO process, investors often have a limited amount of time to form an opinion of the company and its potential, while investors in unlisted companies are in some cases given the opportunity to carry out a more detailed analysis of the company, known as due diligence, as compared with a standard IPO. Due diligence provides a sound basis for discussions with the company's management. In an IPO, a lot of time is spent on what are referred to as book building and road shows, where the senior management of the company present the company to potential investors. Since these aspects of the IPO process are lengthy, drawn-out affairs, there is a greater risk of a less successful IPO. Furthermore, the focus of senior management is detracted from the core business over an extended period of time.

Due to the more limited analysis carried out on the company which is for sale via an IPO, a potential buyer may not be prepared to pay as much as a more well-informed buyer would pay, given the risk involved in having less knowledge about the company. There are no statutory rules preventing potential buyers from acquiring the same information about the target company irrespective of whether or not the company is to be listed or sold privately.

Possible solution

The traditional listing process can sometimes be insufficient to create the best conditions to enable the seller and the buyer to agree upon a mutually acceptable valuation of the company. What is required, therefore, is greater focus and awareness from all parties in order to improve communication on this issue.

Financial advisers should adapt the listing process to create conditions to ensure that, as far as possible, a selection of institutional investors obtain access to the same type of information as potential buyers of the entire company in a private environment. The provisions of Article 15(5) of the Prospectus Directive concerning selective material information about the issuer must be taken into consideration in this context. It is also important that the structures for the listing process are such as to increase the likelihood of a rise in the share price following the IPO.

The Stock Exchange intends to investigate the possibility of assisting SMEs at different stages with knowledge and tools in order to become more visible. This includes assistance in organising communication and corporate governance structures in a way that creates confidence and gives a stamp of approval similar to that of a listed company. The Stock Exchange will make premises and networks available to SMEs to meet investors on a regular basis. This might include regular meetings in cooperation with the private equity industry, where portfolio companies and potential investors can meet, to help build up knowledge and transparency gradually pending an IPO. This may include cooperation with, for example, *Företagarna* or *Aktiesparama* (the Swedish

PATENT
REEL: 037821 FRAME: 0352

Shareholders' Association) to reach companies at an earlier stage and to reach investors throughout the entire country.

For the above to have any tangible effect, large institutional investors also need to take active responsibility for acquiring further knowledge, and also reviewing how they can invest more in SMEs within the scope of their overall mandate.

Next step/procedure

The Stock Exchange will initiate discussions with representatives of private equity firms, *Aktiesparama* and *Företagarna* in order, in the autumn, to present a proposed format and structure for cooperation as outlined above.

PATENT
REEL: 037821 FRAME: 0353

Backgrund/Analysis

The Nordic region currently imposes a somewhat more restrictive free float and minimum number of shareholders requirement (i.e. the minimum percentage of shares that must be in public hands and the minimum number of shareholders a company must have in order to have its shares listed on a stock exchange) as compared with certain other European countries. It is a standard requirement in Europe that 25% of a company's shares must be in public hands in conjunction with an IPO. However, there are examples of stock exchange segments with lower free float requirements, such as the London Stock Exchange's High Growth Segment, which requires that 10% of shares be in public hands. As a rule of thumb, the Stock Exchange applies a 25% free float requirement provided there are at least 500 shareholders at the time of the IPO and each shareholder owns shares worth €1,000. Historically, the general public's interest in and demand for IPOs has been strong and has complemented institutional demand well. However, for small companies, the costs and efforts required to involve a larger group of investors can be considerable. Another aspect is that the lead time involved in marketing an IPO can be reduced if a larger group of investors is not involved, which can be a good thing in a volatile market. The Stock Exchange believes that most companies will continue to choose to involve a larger group of investors in the listing process, but recommends flexibility so that companies don't have to do so in certain cases. The trading in a new share is important and there are complements to including a larger group of investors. For example, the company can appoint a market maker to ensure there is orderly trading at all times.

Possible solution:

- The 25% requirement should remain, but it should be clarified that there are exceptions to this rule if the Stock Exchange believes that circumstances are such that appropriate trading can take place within a limited period in the future.

- The general rule requiring at least 500 shareholders should be removed as of 1 January 2014 to ensure that an offer can be made to a smaller group of investors.

- The use of market makers should be encouraged by the Stock Exchange. The Stock Exchange should adopt a policy, as of 1 January 2014, relating to the setting of prices by market makers aimed at promoting liquidity, among other things.

PATENT
REEL: 037821 FRAME: 0354

Life as a listed company

Quarterly reports

Background/Analysis

The overhaul of what is referred to as the Transparency Directive has brought up the issue of the requirement for listed companies to produce quarterly reports. In the revised Transparency Directive, the requirement to submit interim reports and/or quarterly reports has been removed for listed companies. However, under domestic law Member States can make it mandatory to submit quarterly or interim reports but subject to certain restrictions, for example the requirements must not be disproportionate and it must be investigated how they impact on the possibilities for SMEs to carry out an IPO. There is nothing to prevent stock exchanges imposing their own requirements in their rules. One of the aims of the overhaul of the Transparency Directive was to reduce the disproportionate administrative burden on listed companies, particularly SMEs.

Many companies have said that it is too burdensome to produce quarterly reports. Equally, investors, not least retail investors, think that the reports are necessary. For the Stock Exchange, transparency is fundamental. Therefore, it is crucial to find the right balance between transparency (which gives value to investors) and what can be considered a reasonable workload for companies. The Stock Exchange is convinced that the frequency (quarterly reporting) is good for most listed companies, including from liquidity and insider dealing perspectives. However, it has come to light in discussions with representatives of listed companies that a sort of unofficial template has been created as to how a quarterly report should be drafted, other than the parts required by law. This has given rise to a perception that boards of directors and senior management are, in some cases, expected to expend disproportionate resources on producing quarterly reports. The Stock Exchange is of the opinion that it is in the interests of companies to provide clear and accurate information to the market. If this can be done in a more time-efficient and cost-efficient way than is currently the case, the Stock Exchange would welcome this development.

On 1 July 2013, the Stock Exchange implemented amendments to the third chapter of the Rulebook for Issuers of Shares to make it easier and simpler for companies to assess when the market must be informed about events occurring between two reporting occasions. Briefly, the amendments provide that a change in the earnings or financial position of a company that does not issue forecasts should only be announced to the market if the event is so material that it is considered price sensitive.

Possible solution:

The Stock Exchange proposes that the same model for interim reports which is currently applied in the United Kingdom and Denmark (among others) be implemented for the Swedish market as well. Naturally, the rules should not prevent companies from providing a more detailed report to the market. In short, an interim report should contain an explanation of material events for the relevant period and their effect on the issuer, as well as a description of the issuer's financial position and earnings.

During the autumn, the Stock Exchange will propose necessary changes to the rules. The changes to the rules will be the subject of consultation with market participants, and the Stock Exchange's aim is that the revised rules might take effect on 1 January 2014.

PATENT
REEL: 037821 FRAME: 0355

Restrictions on high-frequency trading

Background/Analysis

High-frequency trading has increased in recent years and, as a result, the number of orders per trade has increased at the same rate. The debate concerning high-frequency trading has damaged confidence in the Stock Exchange. Many people are worried, among other things, by the high number of orders per trade. The main reason for the greater frequency of orders is that there are now around 40 marketplaces on which the orders are placed simultaneously. This development is a consequence of the implementation of MiFID at the end of 2007.

Research shows that high-frequency trading is, to a large extent, a form of trading that provides additional liquidity in the market and promotes low volatility, but some characteristics of high-frequency training should not be rewarded. It is fundamental that the Stock Exchange continues to ensure neutral access to the marketplace and invests in technology and expertise to monitor trading behaviour, including high-frequency trading.

In order to maintain, and improve further, market quality, the Stock Exchange has introduced a charge on excessive order placements which will take effect on 1 July 2011.

Possible solution:

Based on comments made by market participants and based on studies of the effect of a large number of orders per trade over a long period of time, in December the Stock Exchange will be revising the model for calculating the number of orders per trade as follows:

Currently, the Stock Exchange imposes a higher charge for orders exceeding 250 orders per trade. The charge is EUR 0.01 per order on the Finnish market, DKK 0.07 on the Danish market, and SEK 0.09 on the Swedish market. The Stock Exchange now intends to introduce a higher charge already on orders exceeding 100 orders per trade.

PATENT
REEL: 037821 FRAME: 0356

Background/Analysis

In order for an investor to dare to invest in a share, there must be good liquidity in the share, there must always be a buyer and a seller, and investors must thereby be able to increase or reduce their holding at any given time. For many SMEs, the liquidity is too low to achieve this security for investors. Therefore, the Stock Exchange wishes to introduce an auction process for shares with poor liquidity. The main purpose of the auction is to concentrate liquidity on relevant shares and establish a price. The Stock Exchange currently holds some 20 auctions a day in connection with market openings, closings and circuit breakers. Similar measures have been introduced in Germany, with the desired effect.

Possible solution

The Stock Exchange intends to introduce this year daily auctions for small cap shares in order to stimulate trading and liquidity. The auctions will take place in the middle of the trading day. Trading will be continuous before and after the auction. The Stock Exchange will not be able to successfully introduce this change unless market participants, primarily those who quote prices in the shares, support the proposal and its implementation.

PATENT
REEL: 037821 FRAME: 0357

Background/Analysis

SMEs are of crucial importance for growth in the Swedish economy and the creation of jobs. The primary task of the Stock Exchange is to make it easier for companies to raise capital. In this respect, in December 2012 the Stock Exchange launched the First North Bond Market ("FNBM"). The Stock Exchange's aim in setting up the FNBM is to develop the First North market, with rules and regulations adapted to small, medium-sized and private companies, in order to increase the possibility for SMEs to raise capital on the bond market.

Possible solution:

To safeguard the interests of SMEs when carrying out an IPO and during the period in which the SME is listed, it is proposed that the Stock Exchange, in cooperation with the Listed Companies Association, sets up a steering group for SMEs. This group should include representatives of SMEs, advisers, investors and academics. The steering group should hold regular meetings and produce proposals to make it easier for SMEs to raise capital.

Next step/procedure

The Stock Exchange will contact the Listed Companies Association and begin work on the solutions proposed above. The aim is to set up the steering group before the end of the year.

PATENT
REEL: 037821 FRAME: 0358

INCENTIVES FOR ANALYSTS

Background/Analysis

Reduced knowledge and transparency have a negative impact on the valuation of a company. It is therefore a worrying trend that the number of analysts is decreasing and the monitoring of companies is ceasing or waning. This is primarily a problem for SMEs.

To some extent, this development is a result of the reduced margins in investment brokerage operations of banks and stock brokers and the reduced influx of new IPOs. As a result, there has been a reduction in investments in, and resources for, analysis activities.

Possible solution

The conditions must be created for analysis services to become reasonably profitable again in the long-term. Other stock exchanges in Europe have tried to support the business model for analysis services by, for example, creating a network of independent analysts who offer listed SMEs analysis services (as the Spanish stock exchange has). Another way to try to promote greater coverage of SMEs is for the stock exchange to provide its members, through its pricing, with an incentive to undertake to provide SMEs with analysis services.

From a long-term perspective, it can be debated how the analysis services are to be remunerated. Is the model of paying for analysis via broker commission sustainable in today's online order system? For this model to be sustainable in the long-term, there must be no uncertainty that, as in other EU countries, Swedish law and regulations allow analysis to be paid via broker commission. Maybe some other form of subscription model should also be discussed.

Next step/procedure

During the autumn, the Stock Exchange will be producing a tangible proposal for consultation with market participants regarding a price incentive structure to promote analysis services for SMEs.

PATENT
REEL: 037821 FRAME: 0359

Background/Analysis

SMEs are of crucial importance to growth in the Swedish economy and the creation of jobs. This has been found to be the case in the Nordic region, Europe and the United States. Therefore, there is a substantial societal value in making it easier to invest in SMEs in a controlled and transparent manner. Studies show that listed companies in Europe enjoy a higher growth in turnover than other forms of ownership and that the public form of ownership creates more jobs than other forms of ownership.[3]

As stated above, it is currently difficult for SMEs to gain access to capital for continued growth. Therefore, tax incentives for investing in SMEs should be considered to promote long-term investment in SMEs and their future growth.

Possible solution

The Stock Exchange proposes that retail investors, institutions and other investors who invest share capital in SMEs and hold the shares for a lengthy period, be subject to a lower tax rate on future capital gains and more far-reaching possibilities to make deductions for any future capital losses. The proposal is in line with the proposal made by ESMA's group of experts in its report dated 12 October 2012.[4] It is also in line with the proposals presented by the Swedish government on 6 September to promote more jobs in competitive companies.[5] However, a careful analysis should be made as to the effect a tax incentive of this nature, with a requirement for a long-term holding, would have on liquidity. As stated above, good liquidity is important for attracting investors to listed companies.

[3] White Paper by Ernst & Young "Funding the future", 30 May 2012 and "Return Attribution in Mid-Market Buy-Out Transactions – New Evidence from Europe" by Professor Christoph Kaserer, Center for Entrepreneurial and Financial Studies at the Technische Universität Munchen

[4] Securities and Markets Stakeholder Group – Report on Helping Small and Medium Sized Companies Access Funding ESMA/2012/SMSG/59

[5] http://www.regeringen.se/sb/d/17757/a/222918

PATENT
REEL: 037821 FRAME: 0360

Background/Analysis

Sweden currently interprets the EU rules on investment limits for funds such that only 10% of the fund's assets may be invested in securities listed on trading venues such as First North[6]. In other countries, this limit is not considered to apply to similar markets.

SMEs currently have few possibilities to obtain funding via the capital markets and are more dependent on the banking system. Since the financial crisis, the banking system has ramped up the prices of loans, partly due to new capital rules but also due to demands imposed by the banks' shareholders for a higher return and because the banks' own borrowing has become more expensive. Like large companies, SMEs thus need to widen their financing options and to use the stock exchange as an alternative to bank loans. In light of this, in December 2012 the Stock Exchange launched the First North Bond Market ("FNBM"), which is adapted to SMEs that are unable to issue bonds on the regulated market.

Credit funds are very important for the functioning of a credit market and, based on the existing interpretation of the UCITS Directive, most are excluded from the First North Bond Market. The consequence of this is that the investment capacity and know-how possessed by the funds within this segment is not used effectively. The absence of one of the investor categories which is most well-informed about credits from the primary and the secondary market also has a psychologically negative effect on other investors. Also, the UCITS regulations influence the investment rules of many other investors active in the credit market.

The Stock Exchange is of the opinion that First North is sufficiently regulated to qualify as "another regulated market" within the meaning of the UCITS Directive. The Stock Exchange believes that First North is, in many respects, regulated to an equivalent standard as a regulated market. The consequence of this is that credit funds which are subject to UCITS regulations should be able to invest 100% of the fund's assets in financial instruments admitted to trading on First North, compared with the current maximum 10%. The so-called 10% allocation for credit funds is often fully-invested and, in practice, excludes credit funds from First North. The UCITS Directive opens the way for a broader market classification than MiFID because of its definition of other regulated markets. This would render possible substantially improved financing possibilities for SMEs.

[6] The legislative history to Chapter 5, section 3, paragraph 2 of the Investment Funds Act (2004:46) states that a trading venue is *not* to be considered what is referred to in Article 19(1)(b) of the UCITS Directive (85/611/EEC) as "another market which is regulated and open to the public" and in which a common fund may invest assets (Government Bill 2006/07:115, p. 672 *et seq*).

PATENT
REEL: 037821 FRAME: 0361

Possible solution

The Stock Exchange has initiated discussions with the Financial Supervisory Authority and the Ministry of Finance to try to bring about a change to the current interpretation of the investment rules applicable to UCITS funds in order to increase the attractiveness of investing in SMEs. It is important that relevant market participants clearly express their support for the proposal that First North be considered to be regulated to an equivalent standard as a regulated market.

Next step/procedure

The Stock Exchange has submitted a proposal to the Financial Supervisory Authority and the Ministry of Finance. In the proposal, it is argued that First North is to be equated with a regulated market both in terms of shares and corporate bonds.

PATENT
REEL: 037821 FRAME: 0362

Background/Analysis

Listed companies need to raise new capital quickly and efficiently to guarantee their future growth. A number of market participants have stated that raising capital by means of a rights issue is a very costly process for listed companies. Furthermore, it takes a long time to carry out a rights issue, specifically around two months (longer if one takes into account the work involved in producing the prospectus, etc. and shorter if one only takes into account the subscription period). The Swedish Companies Act allows for rights issues to be carried out in a shorter time by virtue of authorisation; however, market practice limits the use of the provisions of the Companies Act in this respect. The lengthy period for implementation of a rights issue exposes the issuer to risks in the form of, for example, macroeconomic events that can have a negative impact on the implementation and costs of the rights issue. As regards private placements, in certain respects there is uncertainty regarding the rules. Taken as a whole, this entails disadvantage as regards the possibilities for listed companies to raise capital effectively.

In April 2010, *Regeringskansliet* (The Government Offices of Sweden) engaged Rolf Skog to investigate the above matter, and evaluate and propose possible amendments to the Companies Act aimed at ensuring that listed companies can expeditiously and competitively raise capital on the capital markets, particularly through rights issues (the "Committee Report").[7]

Possible solution

The Committee Report has put forward a number of proposals addressing the problem areas referred to above. It is proposed, among other things, that it be clarified in the Companies Act that private placements to shareholders are permitted and that the Swedish Corporate Governance Board take the initiative for a recommendation regarding issues of shares etc. where shareholders' pre-emption rights are disapplied. The amendments to the Companies Act would take effect on 1 January 2014. The measures proposed in the Committee Report would make it easier in the short-term for listed companies to raise capital and the measures should therefore be implemented in line with the proposal. Equally, a recommendation from the Swedish Corporate Governance Board might make it easier for listed companies to raise capital by disapplying shareholders' pre-emption rights. Such a recommendation should, therefore, be produced as soon as possible.

Next step/procedure

The Stock Exchange will convey to the Ministry of Finance and the Swedish Corporate Governance Board its clear support for the proposals in the Committee Report and the importance of introducing the amendments as soon as possible and for considering simplification of the rules governing rights issues.

[7] Ds 2012:37

PATENT
REEL: 037821 FRAME: 0363

Background/Analysis

SMEs have limited access to loan financing.[8] Share capital is often the only source of financing available to SMEs. The legislation currently in force is discriminatory in so far as from a tax perspective it is more efficient to finance the business through loans since the loan costs are deductible in the business before tax, while the costs of share capital are not. Thus, this discrimination provides an incentive for SMEs to finance the business through borrowed capital, to the extent this capital is available to the companies.

The Committee Terms of Reference regarding a Review of Corporate Taxation state, among other things, that the taxation of companies is of key importance to investment and growth in Sweden.[9] Taxation is of greatest importance to the competitiveness of Swedish companies. The financial crisis and the reforms carried out in its wake have demonstrated the strength of shareholders' equity in the corporate sector.

Possible solution

The discrimination between the sources of financing (loans vs. shareholders' equity) must come to an end. It is therefore important that the Corporation Tax Committee produce a proposal which ensures neutrality between these sources of financing. Therefore, the proposal should be implemented as soon as possible. In light of the advantages which financing through shareholders' equity actually brings to companies and the national economy in general, it should also be considered whether the proposal presented in the Tax Incentive Committee Report in 2009 should not be resurrected.[10] However, since the marketplaces for listed growth companies have developed considerably in recent years, any proposal regarding tax relief should apply not only to unlisted companies but also to listed growth companies.

Next step/procedure

The Stock Exchange intends to clarify shortly to the Ministry of Finance and the Corporate Taxation Committee that the discrimination between the sources of financing (loans vs. shareholders' equity) must be removed.

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[8] See, for example, the ECB's report from April 2013 (http://www.ecb.int/press/pr/date/2013/html/pr130426.en.html)

[9] Dir 2011:1, dated 13 January 2011

[10] Swedish Government Official Reports 2009:33, "Tax Rebate for Share Acquisitions and Dividends"

PATENT
REEL: 037821 FRAME: 0364

Backgrund/Analysis

Sound corporate governance is about ensuring that companies are managed as efficiently as possible in the interests of the shareholders. This creates confidence in companies and markets, which is good for investment and economic growth, and thus for jobs and welfare.

Corporate governance in Swedish listed companies is regulated through a combination of rules and regulations and market practice. The rules and regulations comprise essentially the Swedish Companies Act, but also the Swedish Corporate Governance Code (the "Code") and the Stock Exchange's rules.

The Code complements the Companies Act by imposing more stringent requirements in some areas, whilst at the same time enabling companies to derogate from these requirements if, in a particular case, this is deemed to result in better corporate governance (the "comply or explain principle").

The European Commission has previously drawn the conclusion that standardised corporate governance rules in the EU could not be successful. Corporate governance rules have developed to resolve various shortcomings in domestic company law regimes in light of different ownership structures and legal traditions in the Member States.

The Stock Exchange is of the opinion that the "comply or explain principle" works well for Swedish conditions. However, the Stock Exchange has noted that, after the financial crisis, the European Commission altered its position on corporate governance issues. Deficient corporate governance at certain banks has served as the pretext for the introduction of standardised and detailed rules applicable to all European listed companies. In addition, the European Commission has advocated legislation in all countries and thereby less self-regulation. The regulation offensive comprises, among other things:

- More stringent rules and detailed requirements regarding remuneration to directors and senior management
- Detailed rules regarding auditors, audits and audit committees in boards of directors
- Detailed rules regarding the composition of boards of directors and the work they perform
- Gender quotas when the shareholders elect directors

The special treatment of listed companies results in Swedish listed companies incurring substantial costs, with a risk of weakening the competitiveness of Swedish listed companies, both as compared with listed companies from other parts of the world and compared with private equity firms. This may hamper future growth and job creation. It is inconsistent, on the one hand, to claim that it is important to achieve greater transparency in the market and govern trading from OTC to the stock exchange and, on the other hand, to make it less attractive to be listed than non-listed, by increasing the regulatory burden on listed companies alone.

PATENT
REEL: 037821 FRAME: 0365

Next step/procedure

1. The Stock Exchange intends to continue its cooperation with listed companies to underline the benefits of the Swedish variant of the "comply or explain principle" and to counteract discrimination against listed companies (due to burdensome legislation) as compared with unlisted companies.

2. During the autumn, the Stock Exchange will be taking the initiative to set up an expert group tasked with producing proposals as to how the regulatory burden on listed companies should reasonably be structured to ensure that there is a reasonable regulatory burden, transparency, a high level of confidence, growth, and the creation of jobs.

PATENT
REEL: 037821 FRAME: 0366

APPENDIX

To-do List:

	Action	Party primarily responsible for implementation	Date for implementation
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			

PATENT
REEL: 037821 FRAME: 0367

Conserved Protein Domain Family
KAZAL_FS

cd00104: KAZAL_FS



Kazal type serine protease inhibitors and follistatin-like domains. Kazal inhibitors inhibit serine proteases, such as, trypsin, chymotrypsin, avian ovomucoids, and elastases. The inhibitory domain has one reactive site peptide bond, which serves the cognate enzyme as substrate. The reactive site peptide bond is a combining loop which has an identical conformation in all Kazal inhibitors and in all enzyme/inhibitor complexes. These Kazal domains (small hydrophobic core of alpha/beta structure with 3 to 4 disulfide bonds) often occur in tandem arrays. Similar domains are also present in follistatin (FS) and follistatin-like family members, which play an important role in tissue specific regulation. The FS domain consists of an N-terminal beta hairpin (FOLN/EGF-like domain) and a Kazal-like domain and has five disulfide bonds. Although the Kazal-like FS substructure is similar to Kazal proteinase inhibitors, no FS domain has yet been shown to be a proteinase inhibitor. Follistatin-like family members include SPARC, also known as, BM-40 or osteonectin, the Gallus gallus Flik protein, as well as, agrin which has a long array of FS domains. The kazal-type inhibitor domain has also been detected in an extracellular loop region of solute carrier 21 (SLC21) family members (organic anion transporters) , which may regulate the specificity of anion uptake. The distant homolog, Ascidian trypsin inhibitor, is included in this CD.

Source

Source: Smart
Taxonomy: Eukaryota
PubMed: 6 links
Book: 2 links
Protein: Representatives
Specific Protein
Related Protein
Related Structure
Architectures
Superfamily: cl00097
BioSystems: 1157 links

Curation

PSSM-Id: 238052
View PSSM: cd00104
Aligned: 372 rows
TrustedHitScore: 27.6194
TrustedSettingGA: 17946659
Created: 1-Nov-2000
Updated: 17-Jan-2013

Display

Structure View
Program: Cn3D
Drawing: All Atoms
Aligned Rows: up to 10
Download Cn3D

Related

Interactive Display
Download CDTree

LinkOut - more resources

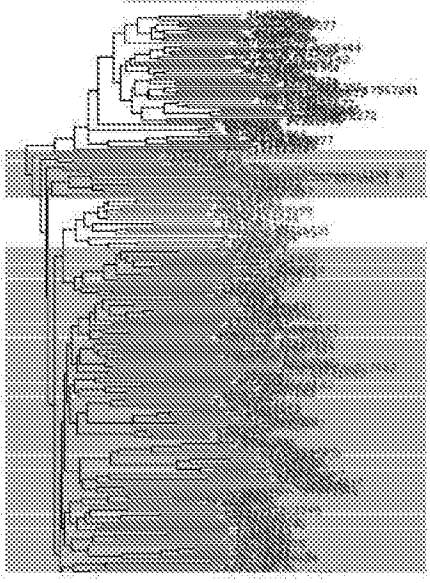
PubMed References

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- A Drosophila gene encoding multiple splice variants of Kazal-type serine protease inhibitor-like proteins with potential destinations of mitochondria, cytosol and the secretory pathway. *Eur J Biochem* 1998 Nov 258(1):97-109
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- SPARC, a matricellular protein: at the crossroads of cell-matrix communication. *Matrix Biol* 2001 Jan 19(8):816-27
- Primary structure and high expression of human agrin in basement membranes of adult lung and kidney. *Eur J Biochem* 1996 May 15 237(1):133-42

cd00104 is part of a hierarchy of related CD models.
Use the graphical representation to navigate this hierarchy.
cd00104 is a member of the superfamily cl00097.

cd00104 Sequence Cluster

Zoom In



Sub-family Hierarchy

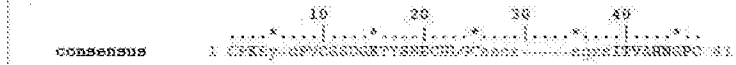
Interactive Display with CDTree

cd01327 KAZAL_PSTI
cd01328 FSL_SPARC
cd01330 KAZAL_SLC21

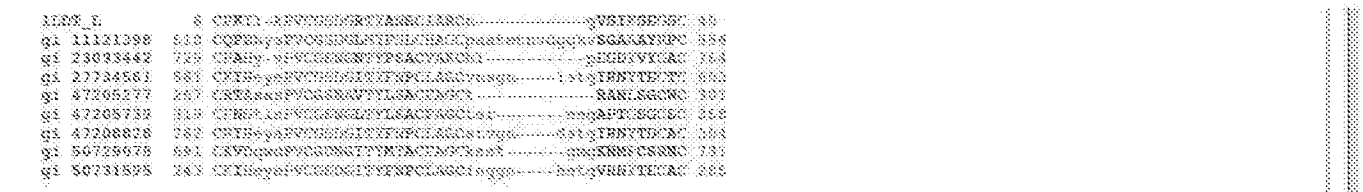
Sequence Alignment

Include Non-Redundant Sequences

Reformat | Format: mFasta | Row Display: up to 10 | Color Bits: 2.6 bit | Type Selection: the most diverse members



PATENT
REEL: 037821 FRAME: 0368



Marchler-Bauer A et al. (2015), *"CDD: NCBI's conserved domain database."*, **Nucleic Acids Res.** 43(Database Issue):D222-6.

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PATENT
REEL: 037821 FRAME: 0369

Doc Code: PD.REQ.RETR
Document Description: Request for USPTO to retrieve priority docs

PTO/SB/38 (10-14)
Approved for use through 05/31/2016. OMB 0651-0031
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Request to Retrieve Electronic Priority Application(s)

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COMPLETE IF KNOWN	
Application Number	675530
Filing Date	04/09/1977
First Named Inventor	ROBERT J. TEITEL
Art Unit	339558
Examiner Name	HARVEY E. BEYNERD
Attorney Docket Number	503

Pursuant to 37 CFR 1.55(h), the undersigned hereby requests that the USPTO retrieve an electronic copy of each of the following foreign applications for which priority has been claimed under 35 U.S.C. 119(a)-(d) from a foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement. This Request must be submitted:

- within the later of sixteen months from the filing date of the prior foreign application or four months from the actual filing date of an application under 35 U.S.C. 111(a),
- within four months from the later of the date of commencement (37 CFR 1.491(a)) or the date of the initial submission under 35 U.S.C. 371 of an application entering the national stage under 35 U.S.C. 371, or
- with a petition under 37 CFR 1.55(e).

☑ **OPTION A**

Please retrieve the priority application identified in Column C, a certified copy of which is contained in the EP or JP application identified in Columns A and B:

	A	B		C	
	Code for Participating Office (EP or JP only)	Application containing the non-participating priority application		Non-participating priority application to be retrieved	
		App. No.	Filing Date	Country Code	App. No.
1	JP	339558	04/09/1976	US	675530

☐ **OPTION B**

This Request may be used for the infrequent circumstance when a claim for priority to an application filed in a participating foreign intellectual property office was made prior to that foreign intellectual property office becoming a participating foreign intellectual property office.

Please retrieve the priority application identified in Columns A and B:

	A	B		
	Code for Participating Office (e.g., EP, JP, KR, CN) or WIPO DAS Depositing Office (e.g., AU, DK, ES, FI, GB, IB, SE)	Application to be retrieved		
		App. No.	Filing Date	Access Code (for WIPO DAS Depositing Office)
1				
2				

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I hereby declare that I have the authority to grant access to the above-identified foreign application(s).

/DWAYNE C. HANS/	02/14/2016
Signature	Date
DWAYNE C. HANS	(404)565-3434
Printed or Typed Name	Telephone Number
PRO SE INVENTOR	2928529
Title	Registration Number, if applicable

This collection of information is required by 37 CFR 1.55(d). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 8 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

World Intellectual Property Organization

Trademarks and Industrial Designs

E-Payment Service

Enter WIPO Reference » **View Payment Details (Step 2 of 3)**

Holder

DWAYNE HANS

1430 Mahan Ave
RICHLAND 99354
US

Other Details

WIPO Reference	**943136301**
Service Type	International Application

Total Amount Outstanding

Original Amount Due	882.00
Amount Paid	0.00
Amount Outstanding	**882.00 CHF**

Continue

PATENT
REEL: 037821 FRAME: 0372

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M.N.G.James§ÄM.N.G.°Ä0Ä†Ä°Ä0Ä†Ä–°Ä¢Ä§Ä´Ä1Ä§Ä0Ä†Ä1Ä†ÄÇ.Contribution of peptide bonds to inhibitor-protease binding: crystal structures of the turkey ovomucoid third domain backbone variants OMTKY3-Pro18I and OMTKY3-psi[COO]-Leu18I in complex with Streptomyces griseus proteinase B (SGPB) and the structure of the free inhibitor, OMTKY-3-psi[CH2NH2+]-Asp19I.°Ä0Ä†Ä†Ä0Ä0Ä†Ä°Ä0Ä†ÄBateman£Ä
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M.N.James§ÄM.N.°Ä†ÄÅ°Medical Research Council of Canada Group in Protein Structure and Function Department of Biochemistry, University of Alberta, Edmonton, Alberta, T6G 2H7, Canada.¢Ä†Ä0Ä†Ä1Ä§Ä
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structural difference exists between the complexes of SGPB:OMTKY3-psi[COO]-Leu18I and SGPB:OMTKY3-Leu18I, aside from an ester O replacing the P1 NH group. Therefore, the difference in DeltaG degrees, 1.5 kcal/mol as calculated from the measured equilibrium association constants, can be attributed to the contribution of the P1 NH hydrogen bond toward binding. A crystal structure of OMTKY3 having a reduced peptide bond between P1 Leu18I and P'1 Asp19I, (OMTKY3-psi[CH2NH2+]-Asp19I) has also been determined by X-ray crystallography. This variant has very weak association equilibrium constants with SGPB and with chymotrypsin. The structure of the free inhibitor suggests that the reduced peptide bond has not introduced any major structural changes in the inhibitor. Therefore, its poor ability to inhibit serine proteinases is likely due to the disruptions of the canonical interactions at the oxyanion hole.¨Ä™Q✱
¢Ä0Ä†Ä0Ä†Ä&Crystal Structure Of Omtky3-Ch2-Asp19i°ÄHydrolase Inhibitor ¢ÄÅ✱Mol_id: 1; Organism_scientific: Meleagris Gallopavo; Organism_common: Turkey; Organism_taxid: 9103; Expression_system: Escherichia Coli; Expression_system_taxid: 562; Other_details: The Peptide Bond Between Leu18i(2lu) And Asp Been Reduced.£ÄÅ·Crystal Structure Of Omtky3-Ch2-Asp19i Canonical Protein Inhibitor, Ovomucoid, Reduced Peptide Bond Hydrolase Inhibitor Mol_id: 1; Molecule: Ovomucoid; Chain: I; Fragment: Third Domain (Omtky3); Engineered: Yes; Mutation: YesßÄ¨°Ä0Ä0Ä†Ä°Ä0Ä†ÄI£Ä
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Highly effective and uniform SERS substrates fabricated by etching multi-layered gold nanoparticle arrays

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C6NR00502K, Paper
Li Zhang, Changrong Guan, Ying Wang, Jianhui Liao
Gold nanoparticle multilayers printed on silicon substrates layer by layer were etched by gold etchant to form highly effective and uniform substrates for surface-enhanced Raman scattering (SERS). The performance of...
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Highly efficient plasmonic tip design for plasmon nanofocusing in near-field optical microscopy

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08548A, Paper
Takayuki Umakoshi, Yuika Saito, Prabhat Verma
Near-field scanning optical microscopy (NSOM) combined with plasmon nanofocusing is a powerful nano-analytical tool due to its attractive feature of efficient background suppression as well as light energy compression into...
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3D Flexible Water Channel: Stretchability of Nanoscale Water Bridge

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08072J, Paper
Jige Chen, Chunlei Wang, Ning Wei, Rongzheng Wan, Yi Gao
Artificial water channel contributes to a better understanding of natural water channel and aims to offer highly selective, advanced conductance system. Most studies use nanotubes, however it is difficult to...
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Silver Nanoparticles Confined in Carbon Nanotubes: On the Understanding of

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Confinement Effect and Promotional Catalysis for the Selective Hydrogenation of Dimethyl Oxalate

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08651E, Paper
Jianwei Zheng, Xinping Duan, Haiqiang Lin, Zhengqiang Gu, Huihuang Fang, Jianhui Li, Youzhu Yuan
Confined Ag nanomaterial in the channels of herringbone multi-wall carbon nanotubes (Ag-in/hCNT) was effectively prepared. The space restriction induces morphological changes of Ag nanoparticles into rough nanowires with an estimated...
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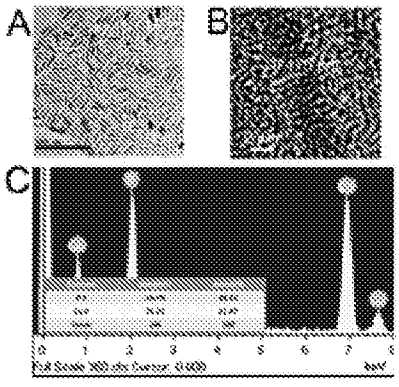
Large-area uniform and low-cost dual-mode plasmonic naked-eye colorimetry and SERS sensor with handheld Raman spectrometer

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08357E, Paper
Zhida Xu, Jing Jiang, Xinhao Wang, Kevin Han, Abid Ameen, Ibrahim Khan, Te-Wei Chang, Logan Liu
We demonstrated a highly-sensitive, wafer-scale, high-uniform plasmonic nano-mushroom substrate based on plastic for naked-eye plasmonic colorimetry and surface-enhanced Raman spectroscopy (SERS). We gave it the name FlexBrite. The dual-mode functionality...
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Elevated Gold Ellipse Nanoantenna Dimers as Sensitive and Tunable Surface Enhanced Raman Spectroscopy Substrates

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08920D, Paper
Aaron M Jubb, Yang Jiao, Gyula Eres, Scott Thomas Retterer, Baohua Gu
We demonstrate large area arrays of elevated gold ellipse dimers with precisely controlled gaps for use as sensitive and highly controllable surface enhanced Raman scattering (SERS) substrates. The significantly enhanced...
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A facile solution-phase synthesis of cobalt phosphide nanorods/hollow nanoparticles

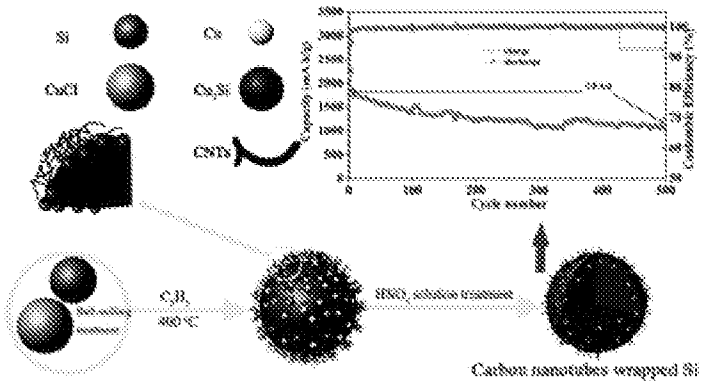


Nanoscale, 2016, Advance Article
DOI: 10.1039/C6NR00208K, Communication
Weiwei Yang, Yarong Huang, Jinlong Fan, Yongsheng Yu, Chunhui Yang, Haibo Li
A simple one-step solution-phase synthesis of cobalt phosphide nanorods (NRs) and hollow nanoparticles

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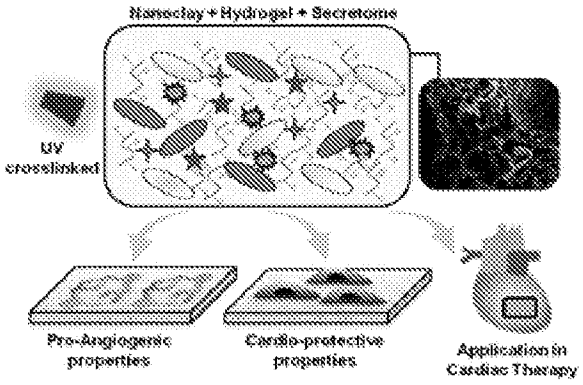
(NPs) has been reported in this paper.
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In situ growth of carbon nanotube wrapped Si composites as anodes for high performance lithium ion batteries



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08961A, Communication
Jianbin Zhou, Yang Lan, Kailong Zhang, Guoliang Xia, Jin Du, Yongchun Zhu, Yitai Qian
Carbon nanotube wrapped Si was synthesized *in situ* by using the CCVD method at 400 [degree]C and shows high electrochemical performance.
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Stem cell secretome-rich nanoclay hydrogel: a dual action therapy for cardiovascular regeneration

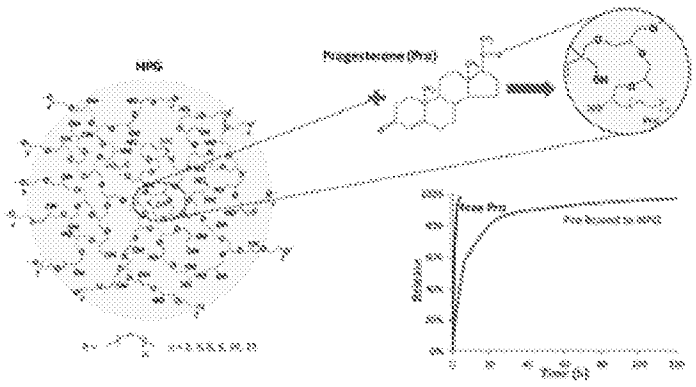


Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07806G, Communication
Renae Waters, Settimio Pacelli, Ryan Maloney, Indrani Medhi, Rafeeq P. H. Ahmed, Arghya Paul
We report development of a nanocomposite hydrogel platform using nanoclay materials and stem cell derived secretome for cardiac tissue repair and therapy.
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Progesterone binding nano-carriers based on hydrophobically modified

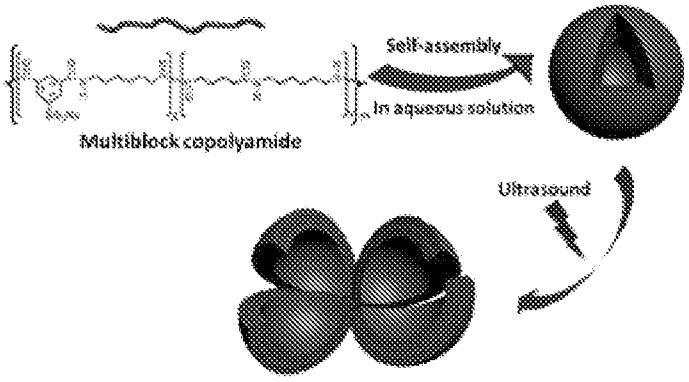
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hyperbranched polyglycerols



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08175K, Paper
M. Alizadeh Noghani, D. E. Brooks
A family of hydrophobically derivatized HPGs is assessed as a potential carrier for progesterone, an important steroid. Molecular determinants of binding and the release kinetics are investigated and the surprising role of non-freezing water on release kinetics described.
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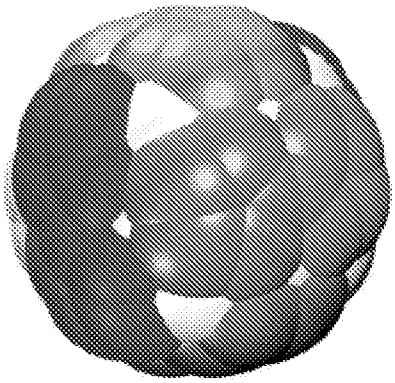
Ultrasound-responsive ultrathin multiblock copolyamide vesicles



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08596A, Communication
Lei Huang, Chunyang Yu, Tong Huang, Shuting Xu, Yongping Bai, Yongfeng Zhou
Novel ultrasound-responsive polymer vesicles with ultrathin walls and a special packing model were generated from an amphiphilic multiblock copolyamide.
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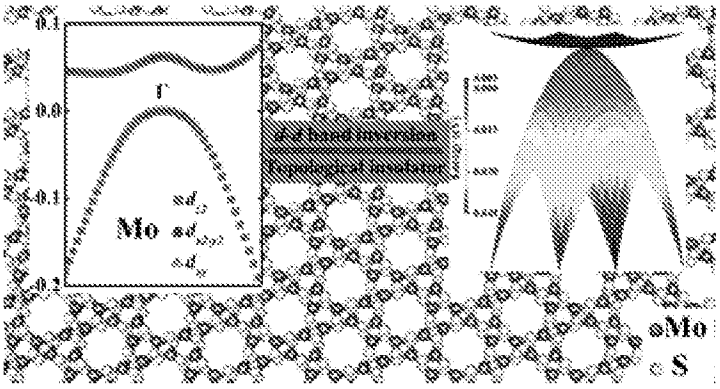
Sc20C60: a volleyballene

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REEL: 037821 FRAME: 0386



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07784B, Paper
Jing Wang, Hong-Man Ma, Ying Liu
A stable volleyball-like molecular cluster, *Volleyballene* $Sc_{20}C_{60}$, was identified. It possesses relatively high symmetry and a hollow space that can be used to accommodate other atoms or molecules for the purpose of studying fundamental chemistry.
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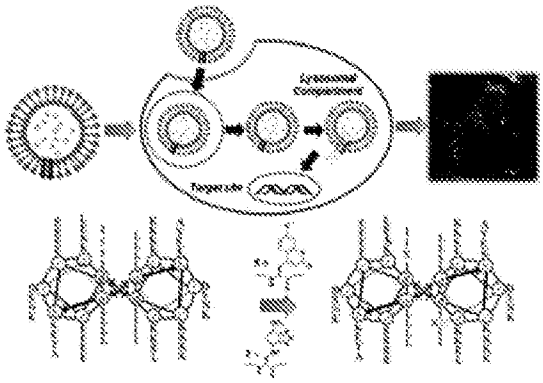
New quantum spin Hall insulator in two-dimensional MoS2 with periodically distributed pores



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08842A, Communication
Peng-Fei Liu, Liujiang Zhou, Thomas Frauenheim, Li-Ming Wu
A new two-dimensional topological insulator in two-dimensional MoS_2 with periodically distributed pores is predicted. Pure d-d band inversion is responsible for the quantum spin Hall effect. Theoretical analysis shows the largest nontrivial gap among MoS_2 isomers.
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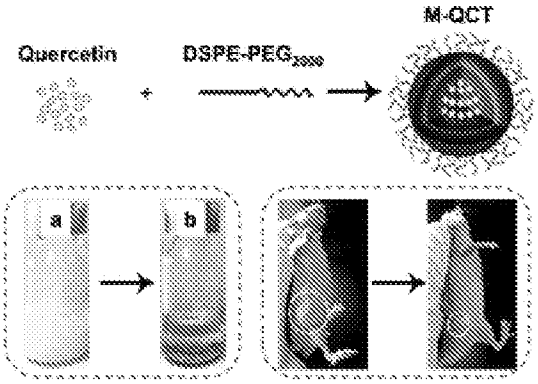
pH sensitive coiled coils: a strategy for enhanced liposomal drug delivery

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Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07734F, Paper
Rahi M. Reja, Mohsina Khan, Sumeet K. Singh, Rajkumar Misra, Anjali Shiras, Hosahudya N. Gopi
Design of pH sensitive coiled coils and their incorporation into the liposome vesicles as triggers for the controlled release of encapsulated drugs are reported.
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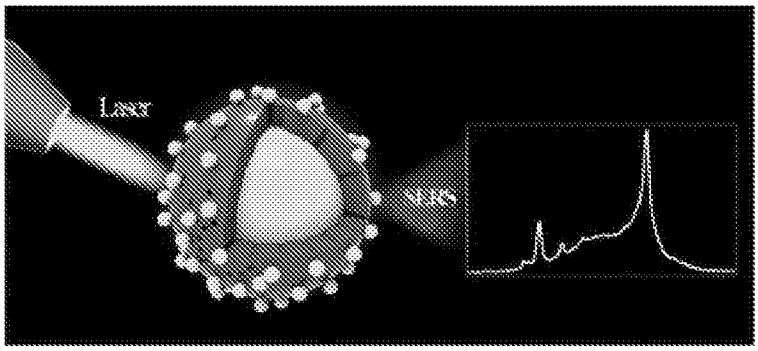
Quercetin-loaded nanomicelles to circumvent human castration-resistant prostate cancer in vitro and in vivo



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08966B, Paper
Jing Zhao, Juan Liu, Tuo Wei, Xiaowei Ma, Qiang Cheng, Shuaidong Huo, Chunqiu Zhang, Yanan Zhang, Xianglin Duan, Xing-Jie Liang
We develop a nanomicelle-based quercetin delivery system, which exhibits superior anticancer activity in the castration-resistant prostate cancer model.
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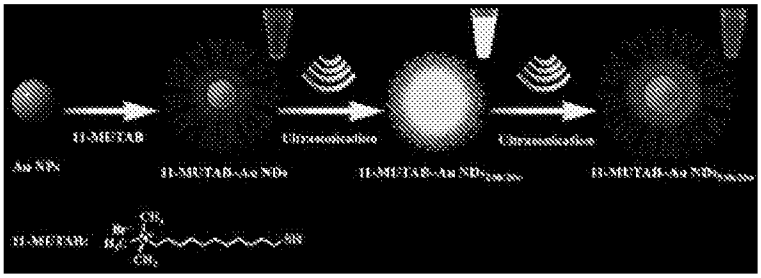
Hydrothermal synthesis of Ag@MSiO2@Ag three core-shell nanoparticles and their sensitive and stable SERS properties

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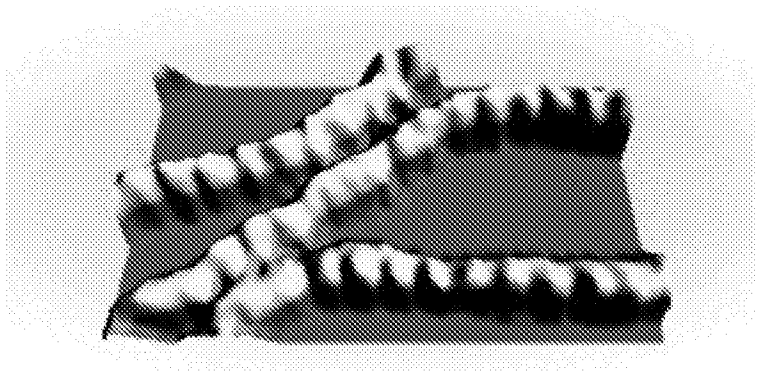
Nanoscale, 2016, Advance Article
DOI: 10.1039/C6NR00006A, Communication
Tao Jiang, Xiaolong Wang, Jun Zhou, Dong Chen, Ziqi Zhao
We report a unique Ag@MSiO$_2$@Ag three core-shell nanostructure as a SERS substrate with both sensitivity and stability.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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Ultrasound-mediated modulation of the emission of gold nanodots



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08387G, Paper
Yu-Ting Tseng, Rochelle Cherng, Zhiqin Yuan, Chien-Wei Wu, Huan-Tsung Chang, Chih-Ching Huang
Ultrasonication treatment of (11-mercaptoundecyl)-*N*,*N*,*N*-trimethylammonium bromide-capped gold nanodots (11-MUTAB-Au NDs) boosts a >1000-fold enhancement in its photoluminescence due to the smaller size and the higher 11-MUTAB ligand density on the surfaces.
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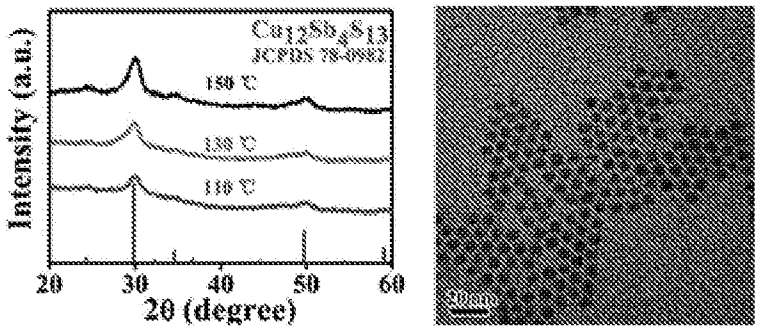
High resolution atomic force microscopy of double-stranded RNA



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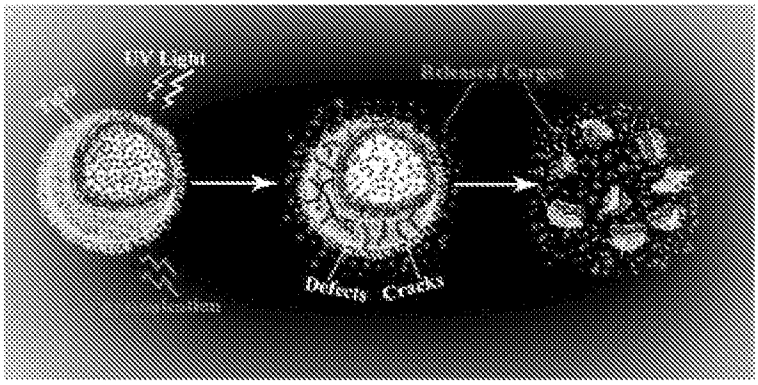
Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07445B, Paper
Pablo Ares, Maria Eugenia Fuentes-Perez, Elias Herrero-Galan, Jose M. Valpuesta, Adriana Gil, Julio Gomez-Herrero, Fernando Moreno-Herrero
Imaging double-stranded RNA at sub-helical pitch resolution with atomic force microscopy in liquid.
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A green synthesis route for the phase and size tunability of copper antimony sulfide nanocrystals with high yield



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR09097K, Paper
Keqiang Chen, Jing Zhou, Wen Chen, Qiao Chen, Peng Zhou, Yueli Liu
Typical XRD patterns of $Cu_{12}Sb_4S_{13}$ NCs with various sizes and a TEM image of 5.76 nm $Cu_{12}Sb_4S_{13}$ NCs.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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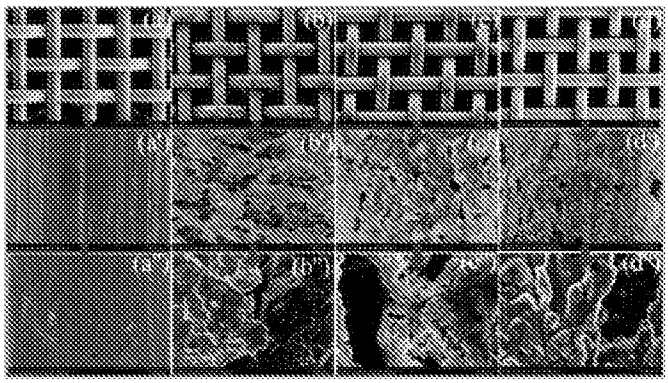
Bifunctional ultraviolet/ultrasound responsive composite TiO2/polyelectrolyte microcapsules



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR06666B, Paper
Hui Gao, Dongsheng Wen, Nadezda V. Tarakina, Jierong Liang, Andy J. Bushby, Gleb B. Sukhorukov
Functional composite TiO_2/polyelectrolyte microcapsules encapsulated with payloads are controllably opened by either ultraviolet or ultrasound treatment.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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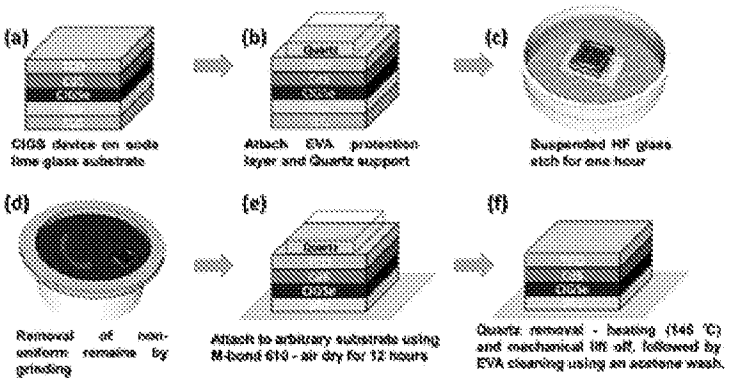
PATENT
REEL: 037821 FRAME: 0390

A multifunctional polymeric nanofilm with robust chemical performances for special wettability



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07601C, Paper
Yabin Wang, Feng Lin, Yaping Dong, Zhong Liu, Wu Li, Yudong Huang
A multifunctional polymeric nanofilm of a triazinedithiolsilane compound, which can protect metallic substrates and activate the corresponding surface simultaneously, is introduced onto a copper mesh surface *via* facile solution-immersion approaches.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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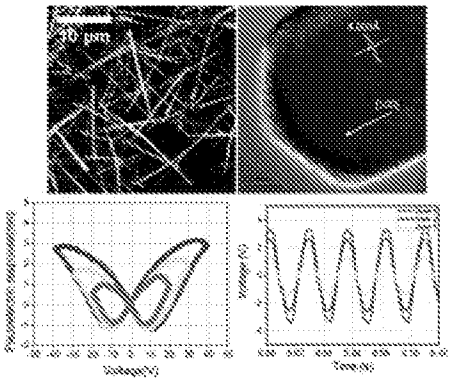
A facile chemical-mechanical polishing lift-off transfer process toward large scale Cu(In,Ga)Se2 thin-film solar cells on arbitrary substrates



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07008B, Paper
Kuan-Chun Tseng, Yu-Ting Yen, Stuart R. Thomas, Hung-Wei Tsai, Cheng-Hung Hsu, Wen-Chi Tsai, Chang-Hong Shen, Jia-Min Shieh, Zhiming M. Wang, Yu-Lun Chueh
The fabrication of Cu(In,Ga)Se_2 (CIGS) solar cells on flexible substrates is a non-trivial task due to thermal and ion diffusion related issues.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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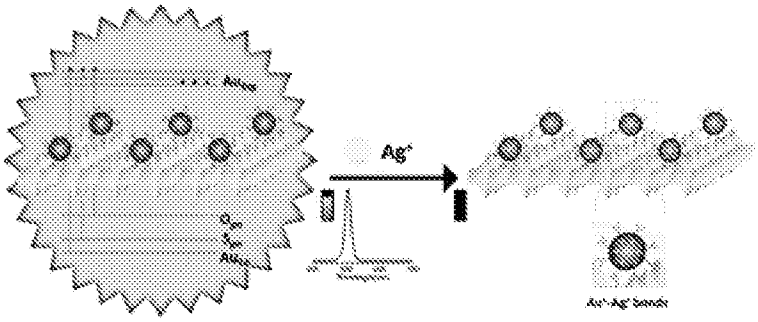
Lead-free 0.5Ba(Zr0.2Ti0.8)O3-0.5(Ba0.7Ca0.3)TiO3 nanowires for energy harvesting

PATENT
REEL: 037821 FRAME: 0391



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR09029F, Paper
Zhi Zhou, Christopher C. Bowland, Mohammad H. Malakooti, Haixiong Tang, Henry A. Sodano
$0.5Ba(Zr_{0.2}Ti_{0.8})O_3$-$0.5(Ba_{0.7}Ca_{0.3})TiO_3$ (BZT-BCT) nanowires with high piezoelectric coupling coefficient (90 +/- 5 pm V^{-1}) are utilized to fabricate a flexible, energy harvesting nanocomposite producing an open circuit voltage of 6.25 V and a power density of 2.25 [small mu]W cm^{-3}.
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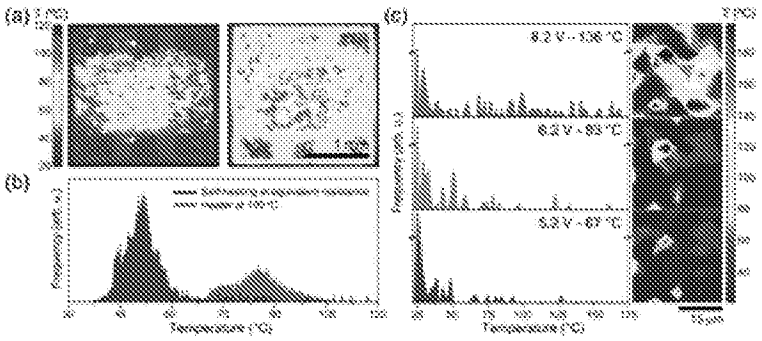
Green emission and Ag+ sensing of hydroxy double salt supported gold nanoclusters



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07029E, Paper
Jinyang Lu, Chunxiang Xu, Zhengshan Tian, Junfeng Lu, Yi Lin, Zengliang Shi
This work demonstrates a green-emitting complex of Zn-containing hydroxy double salt supported gold nanoclusters and its application for sensing Ag^+.
To cite this article before page numbers are assigned, use the DOI form of citation above.
The content of this RSS Feed (c) The Royal Society of Chemistry

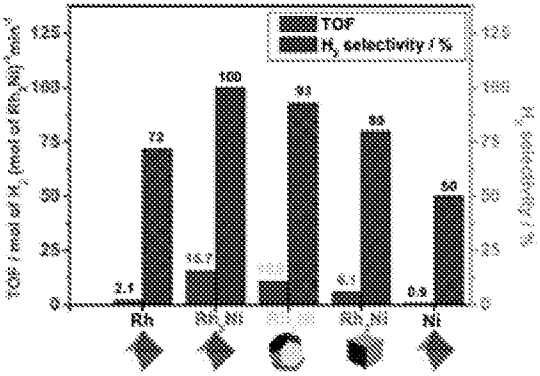
Localized self-heating in large arrays of 1D nanostructures

PATENT
REEL: 037821 FRAME: 0392



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07158E, Paper
O. Monereo, S. Illera, A. Varea, M. Schmidt, T. Sauerwald, A. Schutze, A. Cirera, J. D. Prades
Thermographic image of a CNFs film heated up by means of self-heating (left image) and external heater (right image). Raman mapping of the temperature distribution in a CNFs self-heated region at three different nominal temperatures with each corresponding temperature histogram.
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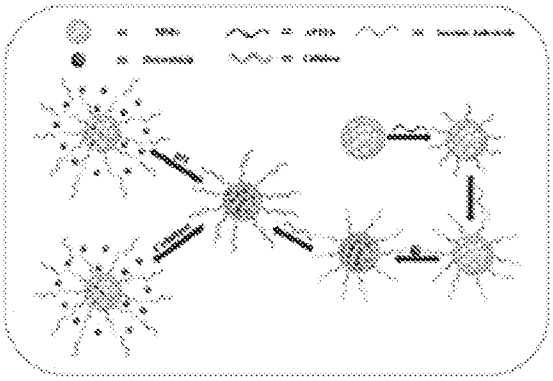
Synthesis of octahedral, truncated octahedral, and cubic Rh2Ni nanocrystals and their structure-activity relationship for the decomposition of hydrazine in aqueous solution to hydrogen



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR09227B, Paper
Chun Li, Tao Wang, Wei Chu, Ping Wu, Dong Ge Tong
Rh_2Ni nanocrystals with a higher percentage of {111} facets exhibited higher activity and H_2 selectivity during hydrazine dehydrogenation in aqueous solution.
To cite this article before page numbers are assigned, use the DOI form of citation above.
The content of this RSS Feed (c) The Royal Society of Chemistry

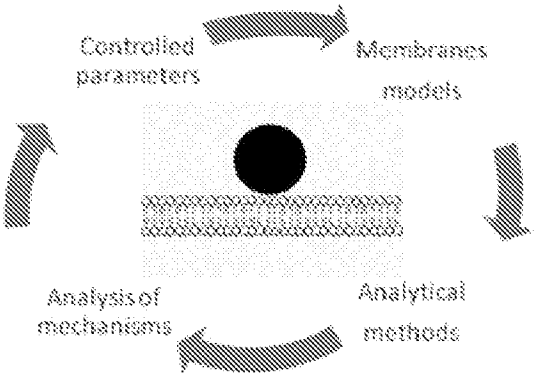
Cellulose conjugated FITC-labelled mesoporous silica nanoparticles: intracellular accumulation and stimuli responsive doxorubicin release

PATENT
REEL: 037821 FRAME: 0393



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08753H, Paper
Abdul Hakeem, Fouzia Zahid, Ruixue Duan, Muhammad Asif, Tianchi Zhang, Zhenyu Zhang, Yong Cheng, Xiaoding Lou, Fan Xia
Novel cellulose conjugated mesoporous silica nanoparticles (CLS-MSPs) for stimuli responsive intracellular doxorubicin (DOX) delivery were designed.
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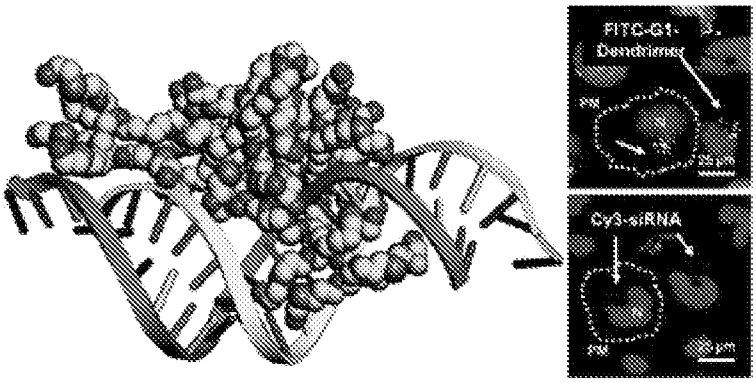
The relevance of membrane models to understand nanoparticles-cell membrane interactions



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07954C, Review Article
Estelle Rascol, Jean-Marie Devoisselle, Joel Chopineau
Membrane models are pertinent tools to explore and analyze nanoparticles-membrane interactions occurring at the cellular level.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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Low generation polyamine dendrimers bearing flexible tetraethylene glycol as nanocarriers for plasmids and siRNA

PATENT
REEL: 037821 FRAME: 0394



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR06757J, Paper
Rishi Sharma, Issan Zhang, Tze Chieh Shiao, Giovanni M. Pavan, Dusica Maysinger, Rene Roy
Polycationic tetraethyleneglycol dendrimers of low generation successfully deliver siRNA in human cells, with transfection efficiency comparable to that of Lipofectamine.
To cite this article before page numbers are assigned, use the DOI form of citation above.
The content of this RSS Feed (c) The Royal Society of Chemistry

DNA Origami Based Au-Ag-Core-Shell Nanoparticle Dimers with Single-Molecule SERS Sensitivity

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08674D, Paper
Julia Prinz, Christian Heck, Lisa Ellerik, virginia merk, Ilko Bald
DNA origami nanostructures are a versatile tool to arrange metal nanostructures and other chemical entities with nanometer precision. In this way gold nanoparticle dimers with defined distance can be constructed,...
The content of this RSS Feed (c) The Royal Society of Chemistry

Surface energy and wettability of van der Waals structures

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR06705G, Paper
Meenakshi Annamalai, Kalon Gopinadhan, Sang A Han, Surajit Saha, Hye-Jeong Park, Eun Bi Cho, Brijesh Kumar, Abhijeet Patra, Sang-Woo Kim, Thirumalai Venkatesan
Wetting behaviour of surfaces is believed to be affected by van der Waals (vdW) forces; however, there is no clear demonstration of this. With the isolation of two-dimensional vdW layered...
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Quantitative characterization of conformational-specific protein-DNA binding using a dual-spectral interferometric imaging biosensor

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR06785E, Paper
Xirui Zhang, George Daaboul, Philipp Sphuler, Peter Droege, Selim Unlu
DNA-binding proteins play crucial roles in the maintenance and functions of the genome and yet, their specific binding mechanisms are not fully understood. Recently, it was discovered that DNA-binding proteins...
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Sequential protein unfolding through a carbon nanotube pore

PATENT
REEL: 037821 FRAME: 0395

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C6NR00410E, Paper
Zhonghe Xu, Shuang Zhang, Jeffrey K Weber, Binquan Luan, Ruhong Zhou, Jingyuan Li
An assortment of biological processes, like protein degradation and the transport of proteins across membranes, depend on protein unfolding events mediated by nanopore interfaces. In this work, we exploit fully...
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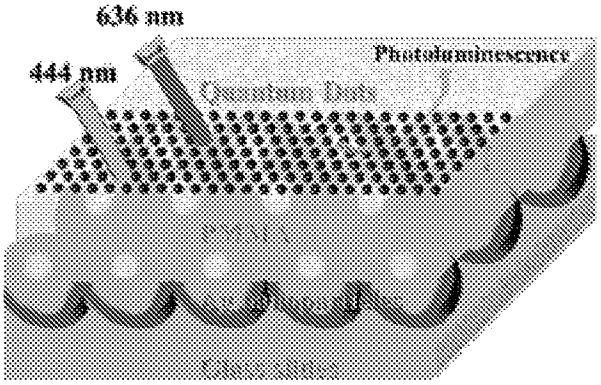
Charge Effects and Nanoparticle Pattern Formation in Electrohydrodynamic NanoDrip Printing of Colloids

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08783J, Paper
Patrizia Richner, Stephan J. P. Kress, David Norris, Dimos Poulikakos
Advancing open atmosphere printing technologies to produce features in the nanoscale range has important and broad applications ranging from electronics, to photonics, plasmonics and biology. Recently an electrohydrodynamic printing regime...
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Correction: CoPt/CeO2 catalysts for the growth of narrow diameter semiconducting single-walled carbon nanotubes

Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR90226F, Correction
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Lei Tang, Taotao Li, Chaowei Li, Lin Ling, Kai Zhang, Yagang Yao
To cite this article before page numbers are assigned, use the DOI form of citation above.
The content of this RSS Feed (c) The Royal Society of Chemistry

Silver nanoparticle film induced photoluminescence enhancement of near-infrared emitting PbS and PbS/CdS core/shell quantum dots: observation of different enhancement mechanisms

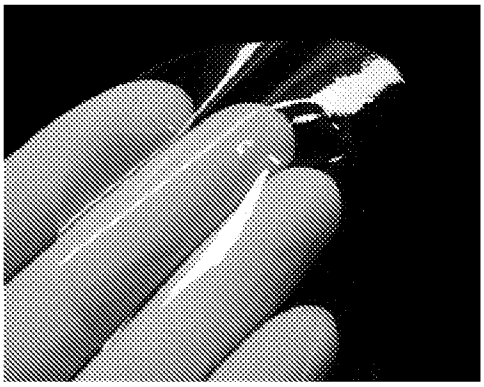


Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR05906B, Communication
H. Y. Liang, H. G. Zhao, Z. P. Li, C. Harnagea, D. L. Ma
A plasmon/fluorophore system consisting of Ag nanoparticles and near-infrared quantum dots (QDs) is investigated for photoluminescence (PL) enhancement.

PATENT
REEL: 037821 FRAME: 0396

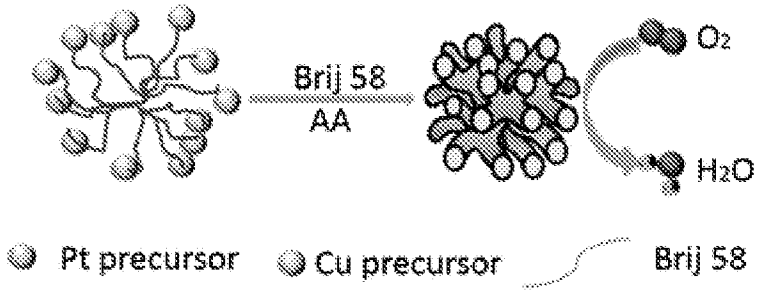
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Combinatorial release of dexamethasone and amiodarone from a nano-structured parylene-C film to reduce perioperative inflammation and atrial fibrillation



Nanoscale, 2016, **8**,4267-4275
DOI: 10.1039/C5NR07456H, Paper
Erik Robinson, Sunjay Kaushal, Justice Alaboson, Sudhish Sharma, Amogh Belagodu, Claire Watkins, Brandon Walker, Gregory Webster, Patrick McCarthy, Dean Ho
Suppressing perioperative inflammation and post-operative atrial fibrillation requires effective drug delivery platforms (DDP).
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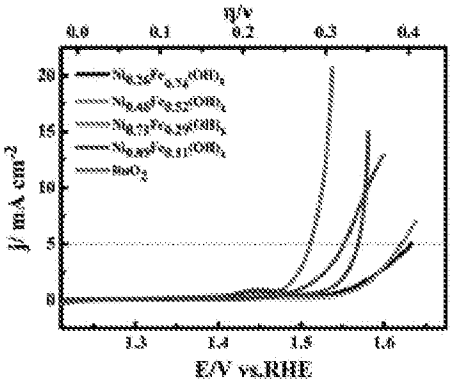
Highly branched PtCu bimetallic alloy nanodendrites with superior electrocatalytic activities for oxygen reduction reactions



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07682J, Paper
Shaofang Fu, Chengzhou Zhu, Qiurong Shi, Haibing Xia, Dan Du, Yuehe Lin
The highly branched PtCu bimetallic alloy nanodendrites were synthesized by a facile chemical reduction method using Brij 58 as the soft template. The as-prepared alloys presented superior electrocatalytic activities for oxygen reduction reactions.
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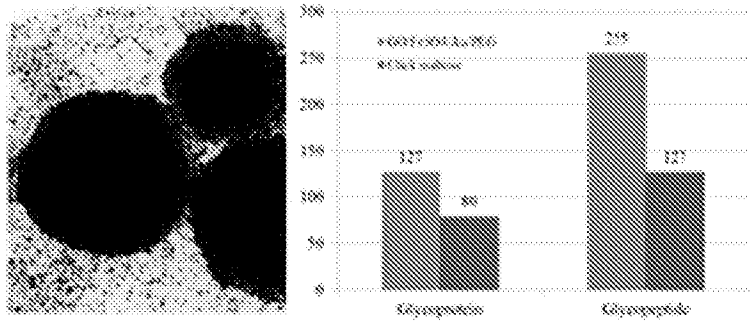
Amorphous mixed-metal hydroxide nanostructures for advanced water oxidation catalysts

PATENT
REEL: 037821 FRAME: 0397



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08989A, Paper
Y. Q. Gao, X. Y. Liu, G. W. Yang
We have synthesized amorphous mixed-metal (Ni-Fe) hydroxide nanostructures with a homogeneous distribution of Ni/Fe as well as a tunable Ni/Fe ratio by a simple, facile, green and low-cost electrochemical technique, and we have also demonstrated that the synthesized amorphous nanomaterials possess ultrahigh activity and super long-term cycle stability in the OER process.
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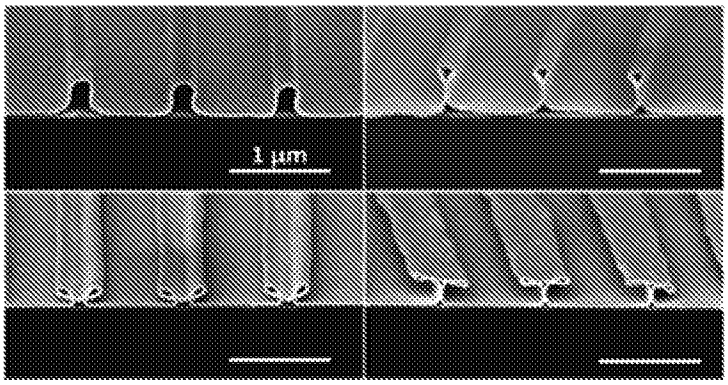
Hydrophilic GO/Fe3O4/Au/PEG nanocomposites for highly selective enrichment of glycopeptides



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08126B, Communication
Bo Jiang, Qi Wu, Nan Deng, Yuanbo Chen, Lihua Zhang, Zhen Liang, Yukui Zhang
GO/Fe_3O_4/Au/PEG nanocomposites were synthesized, and exhibited high selectivity to capture glycopeptides.
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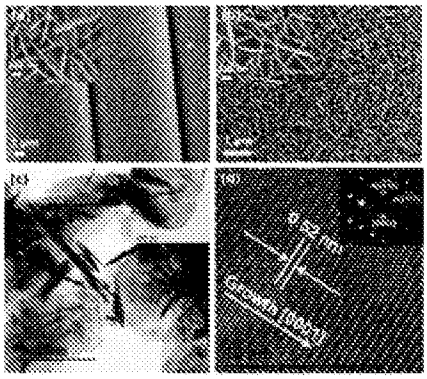
Fabrication and design of metal nano-accordion structures using atomic layer deposition and interference lithography

PATENT
REEL: 037821 FRAME: 0398



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08566G, Paper
J.-H. Min, A. Bagal, J. Z. Mundy, C. J. Oldham, B.-I. Wu, G. N. Parsons, C.-H. Chang
Fabricated free-standing platinum nano-accordion structures with a wide variety of cross-sectional profiles using a combination of ALD and IL.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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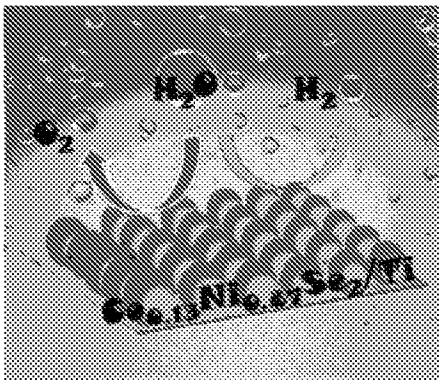
Flexible, transparent and exceptionally high power output nanogenerators based on ultrathin ZnO nanoflakes



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08324A, Paper
Huynh Van Ngoc, Dae Joon Kang
Novel nanogenerator structures composed of ZnO nanoflakes of less than 10 nm thickness were fabricated using a novel method involving a facile synthetic route and a rational design.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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Electrodeposited Co-doped NiSe2 nanoparticles film: a good electrocatalyst for efficient water splitting

PATENT
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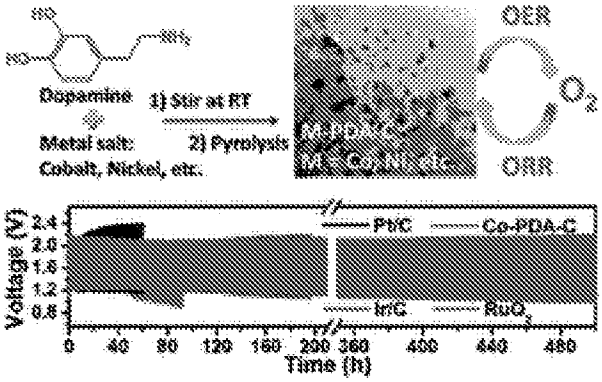


Nanoscale, 2016, **8**,3911-3915
DOI: 10.1039/C5NR07170D, Communication
Tingting Liu, Abdullah M. Asiri, Xuping Sun
Co-doped $NiSe_2$ nanoparticles film electrodeposited on Ti plate ($Co_{0.13}Ni_{0.87}Se_2$/Ti) acts as a robust water-splitting electrocatalyst in 1.0 M KOH, driving 10 mA cm^{-2} at HER overpotential of 64 mV and 100 mA cm^{-2} at OER overpotential of 320 mV.
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Correction: Polyol synthesis, functionalisation, and biocompatibility studies of superparamagnetic iron oxide nanoparticles as potential MRI contrast agents

Nanoscale, 2016, **8**,4395-4395
DOI: 10.1039/C5NR90206A, Correction
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Roxanne Hachani, Mark Lowdell, Martin Birchall, Aziliz Hervault, Damien Mertz, Sylvie Begin-Colin, Nguyen Thị Kim Thanh
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Mussel-inspired one-pot synthesis of transition metal and nitrogen co-doped carbon (M/N-C) as efficient oxygen catalysts for Zn-air batteries

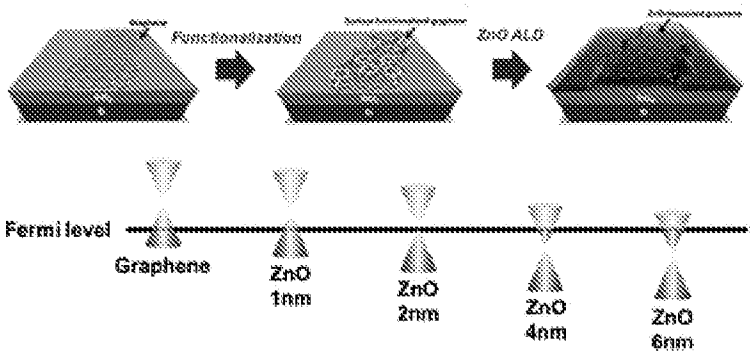


Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR06538K, Paper
Bing Li, Ye Chen, Xiaoming Ge, Jianwei Chai, Xiao Zhang, T. S. Andy Hor, Guojun Du, Zhaolin Liu, Hua Zhang, Yun Zong
Transition metal and nitrogen co-doped nanostructured carbons, synthesized *via* a simple and scalable room

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REEL: 037821 FRAME: 0400

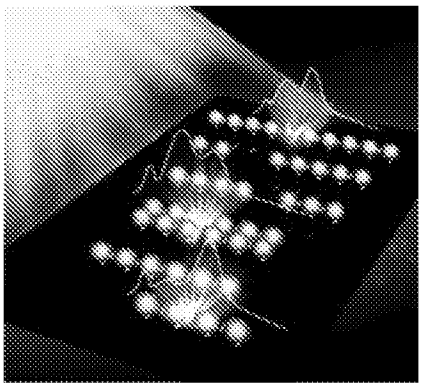
temperature approach inspired by mussels, have enabled robust cycling of Zn-air batteries.
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A non-destructive n-doping method for graphene with precise control of electronic properties via atomic layer deposition



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08016A, Paper
Kyu Seok Han, Pranav Y. Kalode, Yong-Eun Koo Lee, Hongbum Kim, Lynn Lee, Myung Mo Sung
A precise n-doping technique for graphene *via* atomic layer deposition (ALD) of ZnO thin films is presented.
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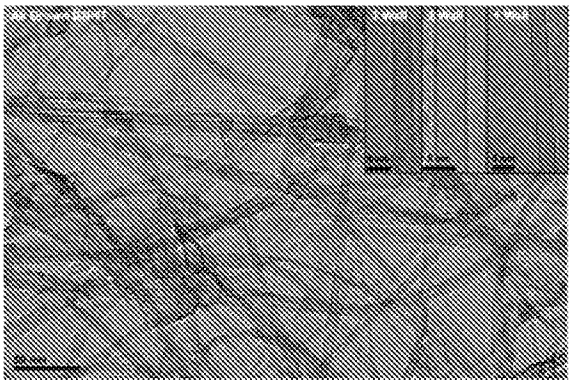
Strong plasmon coupling in self-assembled superparamagnetic nanoshell chains



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR09101B, Paper
Min Xiong, Xiulong Jin, Jian Ye
Construction of plasmonic superparamagnetic nanoshell chains by using a magnetic field is described. Strong plasmon coupling effects in the chains result in large electric field enhancements. Taking advantage of low-cost and large-area fabrication methods, these nanoshell chains are promising for biosensing, metamaterials, electromagnetic energy transport, and optical waveguide.
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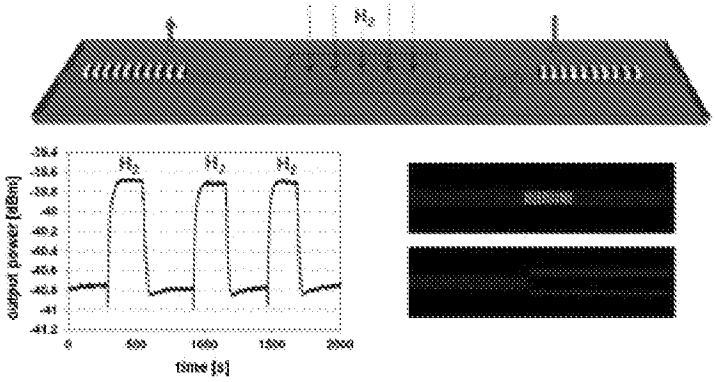
Thermodynamic approach to boron nitride nanotube solubility and dispersion

PATENT
REEL: 037821 FRAME: 0401



Nanoscale, 2016, **8**,4348-4359
DOI: 10.1039/C5NR08259E, Paper
A. L. Tiano, L. Gibbons, M. Tsui, S. I. Applin, R. Silva, C. Park, C. C. Fay
Inadequate dispersion of nanomaterials is a critical issue that significantly limits the potential properties of nanocomposites and when overcome, will enable further enhancement of material properties.
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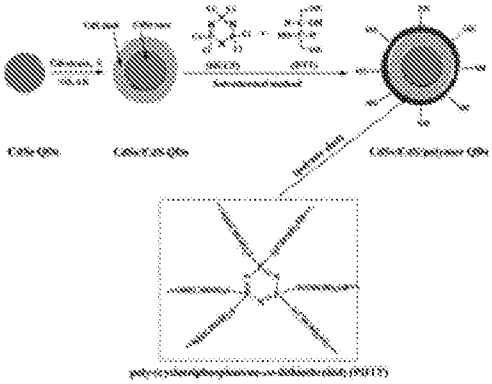
Hydrogen sensing with Pd-coated long-range surface plasmon membrane waveguides



Nanoscale, 2016, **8**,4284-4290
DOI: 10.1039/C5NR08001K, Paper
Norman R. Fong, Pierre Berini, R. N. Tait
A low power optical hydrogen sensor using a Pd film on a flexible LRSPP membrane waveguide with grating couplers.
The content of this RSS Feed (c) The Royal Society of Chemistry

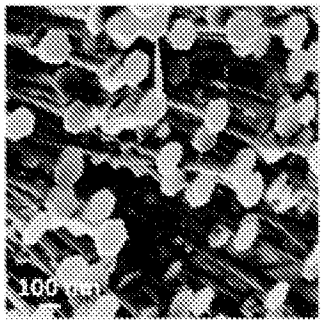
Suppressed blinking behavior of CdSe/CdS QDs by polymer coating

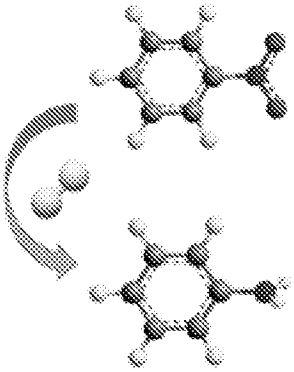
PATENT
REEL: 037821 FRAME: 0402



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08504G, Paper
Aidi Zhang, Yannan Bian, Jinjie Wang, Kuiyong Chen, Chaoqing Dong, Jicun Ren
Semiconductor quantum dots (QDs) are very important fluorescent nanocrystals with excellent optical properties.
To cite this article before page numbers are assigned, use the DOI form of citation above.
The content of this RSS Feed (c) The Royal Society of Chemistry

Designing axial growth of Co-Ni bimetallic nanowires with hexagon-like caps and their catalytic hydrogenation for nitrobenzene

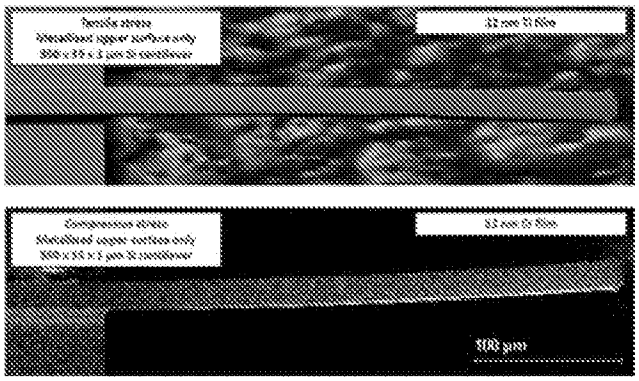




Nanoscale, 2016, **8**,3949-3953
DOI: 10.1039/C5NR09131D, Communication
Jiawen Wang, Jingwei Liu, Nating Yang, Shuangshuang Huang, Yuhan Sun, Yan Zhu
Co-Ni bimetal nanowires with hexagonal caps are more effective than corresponding nanoparticles for the nitrobenzene hydrogenation to produce aniline.
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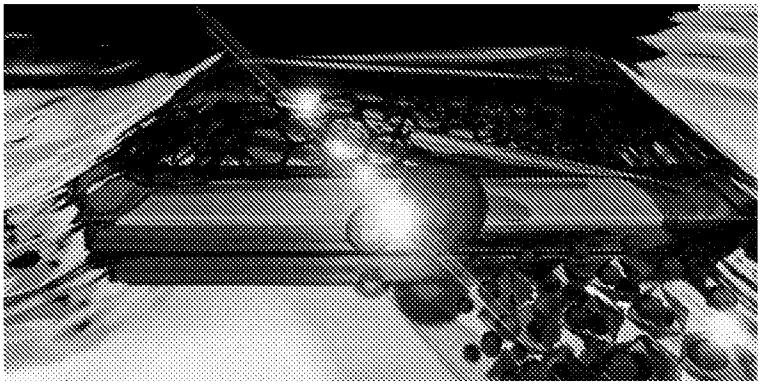
On the origin and magnitude of surface stresses due to metal nanofilms

PATENT
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Nanoscale, 2016, **8**,4245-4251
DOI: 10.1039/C5NR08789A, Paper
James Bowen, David Cheneler
Metallisation is a vital process for micro- and nanofabrication. We investigate the metallisation of silicon cantilevers with nano-films of chromium and titanium. Surface stresses acting in opposite directions were measured for these two metals.
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Ultrasensitive 1D field-effect phototransistors: CH3NH3PbI3 nanowire sensitized individual carbon nanotubes

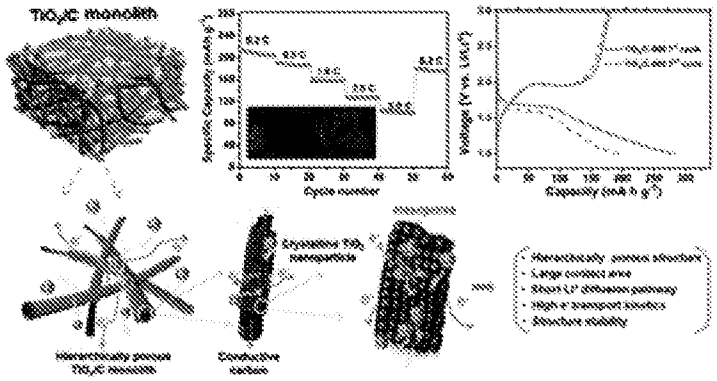


Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR06727H, Communication
M. Spina, B. Nafradi, H. M. Tohati, K. Kamaras, E. Bonvin, R. Gaal, L. Forro, E. Horvath
Field-effect phototransistors were fabricated based on individual carbon nanotubes (CNTs) sensitized by $CH_3NH_3PbI_3$ nanowires ($MAPbI_3NWs$).

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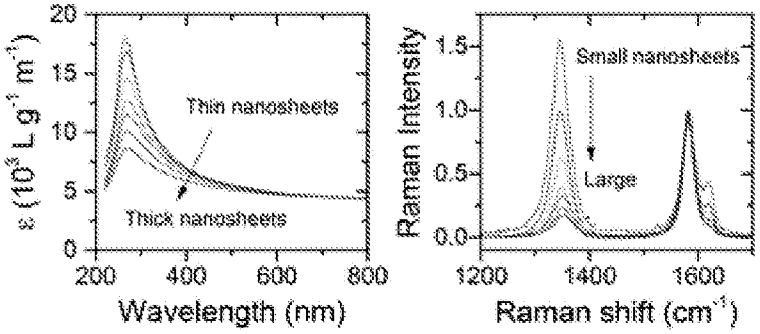
Hierarchical TiO2/C nanocomposite monoliths with a robust scaffolding architecture, mesopore-macropore network and TiO2-C heterostructure for high-performance lithium ion batteries

PATENT
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Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR09149G, Paper
Hai-Bo Huang, Yue Yang, Li-Hua Chen, Yun Wang, Shao-Zhuan Huang, Jia-Wei Tao, Xiao-Ting Ma, Tawfique Hasan, Yu Li, Yan Xu, Bao-Lian Su
A general approach for the design of TiO_2/C nanocomposites with structural stability, and tunable and interconnected hierarchical porosity that leads to a new high electrochemical performance electrode.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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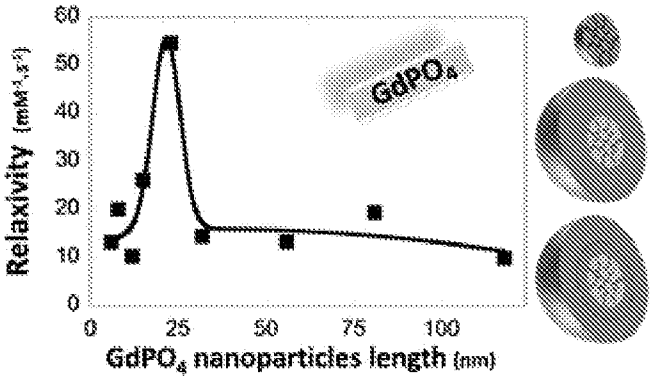
Spectroscopic metrics allow in situ measurement of mean size and thickness of liquid-exfoliated few-layer graphene nanosheets



Nanoscale, 2016, **8**,4311-4323
DOI: 10.1039/C5NR08047A, Paper
Claudia Backes, Keith R. Paton, Damien Hanlon, Shengjun Yuan, Mikhail I. Katsnelson, James Houston, Ronan J. Smith, David McCloskey, John F. Donegan, Jonathan N. Coleman
Quantitative spectroscopic metrics based on absorbance and Raman spectroscopy are presented for size-selected liquid-exfoliated graphene.
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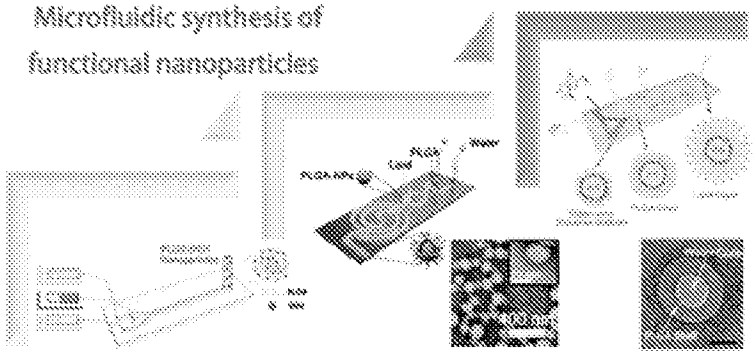
Hyperbranched polymer mediated size-controlled synthesis of gadolinium phosphate nanoparticles: colloidal properties and particle size-dependence on MRI relaxivity

PATENT
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Nanoscale, 2016, **8**,4252-4259
DOI: 10.1039/C5NR05064B, Paper
Camille Frangville, Maylis Gallois, Yichen Li, Hong Hanh Nguyen, Nancy Lauth-de Viguerie, Daniel R. Talham, Christophe Mingotaud, Jean-Daniel Marty
Core-shell(s) hyperbranched polymers were used to synthesize size-controlled gadolinium phosphate nanowires. An optimum particle size with high relaxivity values was evidenced.
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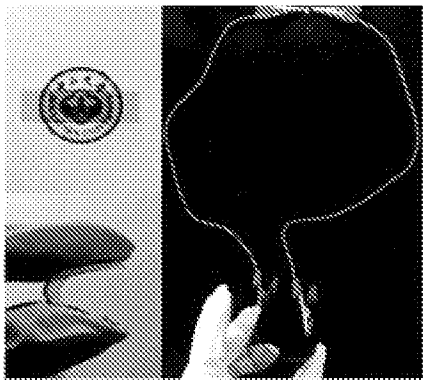
Microfluidics-mediated assembly of functional nanoparticles for cancer-related pharmaceutical applications



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07964K, Review Article
Qiang Feng, Jiashu Sun, Xingyu Jiang
This review focuses on microfluidic synthesis of functional nanoparticles with tunable structures and properties for cancer treatment and diagnosis.
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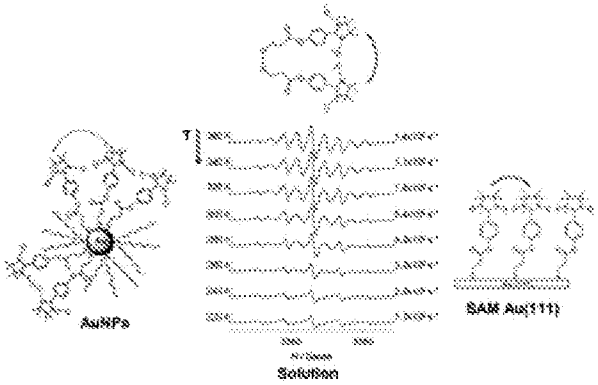
A flexible, transparent and super-long-life supercapacitor based on ultrafine Co3O4 nanocrystal electrodes

PATENT
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Nanoscale, 2016, **8**,4227-4235
DOI: 10.1039/C5NR09145D, Paper
X. Y. Liu, Y. Q. Gao, G. W. Yang
A flexible, transparent and super-long-life supercapacitor has been fabricated based on ultrafine Co_3O_4 nanocrystal electrodes.
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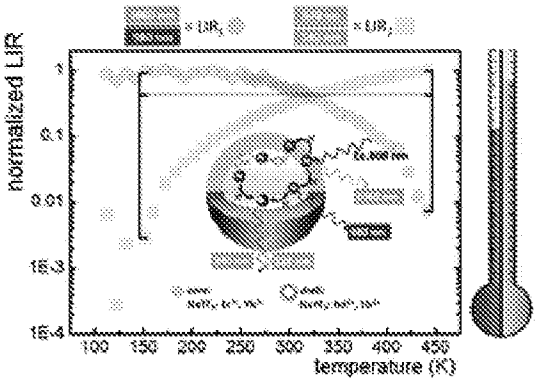
Dynamics of intramolecular spin exchange interaction of a nitronyl nitroxide diradical in solution and on surfaces



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08824K, Paper
V. Lloveras, E. Badetti, J. Veciana, J. Vidal-Gancedo
It is possible to preserve the same dynamic behaviour observed for a diradical in solution in AuNP surface-anchored radicals.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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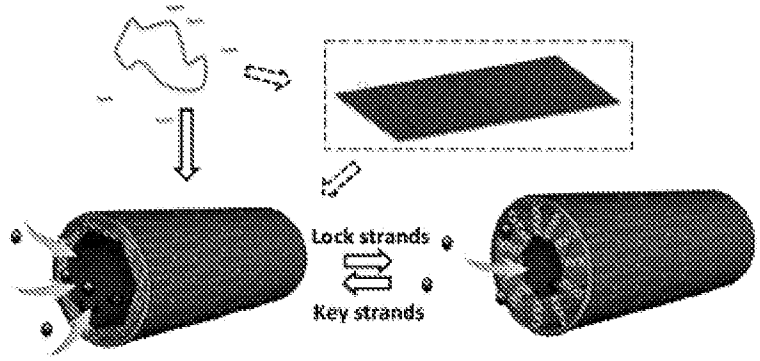
A broadening temperature sensitivity range with a core-shell YbEr@YbNd double ratiometric optical nanothermometer

PATENT
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Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08223D, Paper
L. Marciniak, K. Prorok, L. Frances-Soriano, J. Perez-Prieto, A. Bednarkiewicz
The chemical architecture of lanthanide doped core-shell up-converting nanoparticles can be engineered to purposely design the properties of luminescent nanomaterials, which are typically inaccessible to their homogeneous counterparts.
To cite this article before page numbers are assigned, use the DOI form of citation above.
The content of this RSS Feed (c) The Royal Society of Chemistry

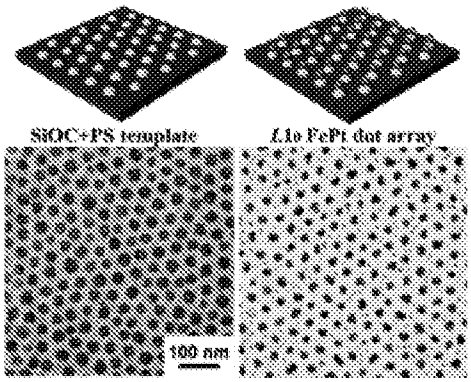
A switchable DNA origami nanochannel for regulating molecular transport at the nanometer scale



Nanoscale, 2016, **8**,3944-3948
DOI: 10.1039/C5NR08206D, Communication
Dianming Wang, Yiyang Zhang, Miao Wang, Yuanchen Dong, Chao Zhou, Mark Antonin Isbell, Zhongqiang Yang, Huajie Liu, Dongsheng Liu
A nanochannel with a shutter at one end was built by DNA nanotechnology.
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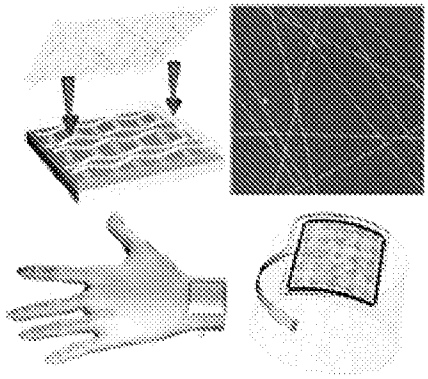
Thermal dewetting with a chemically heterogeneous nano-template for self-assembled L10 FePt nanoparticle arrays

PATENT
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Nanoscale, 2016, **8**,3926-3935
DOI: 10.1039/C5NR08339G, Communication
Liang-Wei Wang, Chung-Fu Cheng, Jung-Wei Liao, Chiu-Yen Wang, Ding-Shuo Wang, Kuo-Feng Huang, Tzu-Ying Lin, Rong-Ming Ho, Lih-Juann Chen, Chih-Huang Lai
The self-assembled $L1_0$ FePt nanoparticles are fabricated by thermal dewetting with a chemically heterogeneous nano-template.
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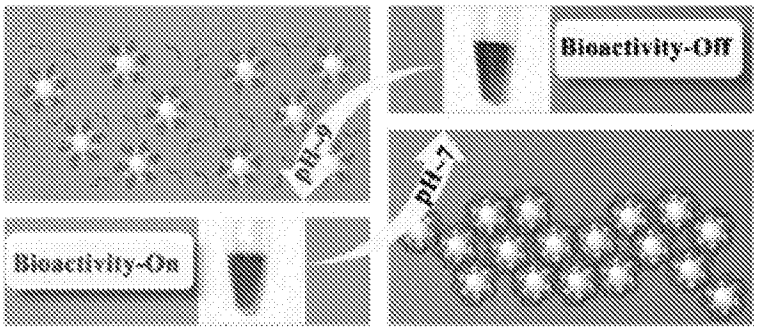
A high-performance, flexible and robust metal nanotrough-embedded transparent conducting film for wearable touch screen panels



Nanoscale, 2016, **8**,3916-3922
DOI: 10.1039/C5NR07657A, Communication
Hyeon-Gyun Im, Byeong Wan An, Jungho Jin, Junho Jang, Young-Geun Park, Jang-Ung Park, Byeong-Soo Bae
A junction resistance-free continuous metal nanotrough-embedded transparent conducting electrode (TCE) composite film (metal nanotrough-GFRHybrimer film) is reported.
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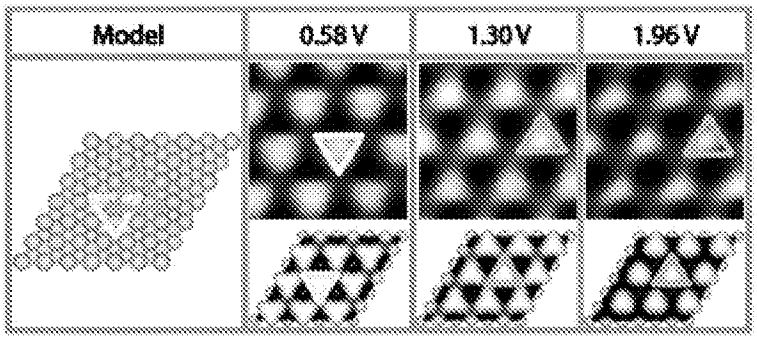
Multifunctional nanoparticle-protein conjugates with controllable bioactivity and pH responsiveness

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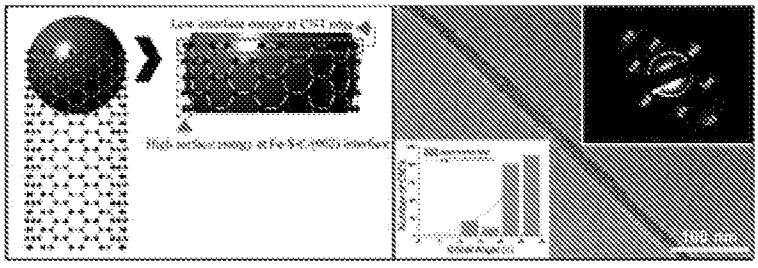
Nanoscale, 2016, **8**,4387-4394
DOI: 10.1039/C5NR07436C, Paper
Feng Liu, Lulu Xue, Yuqi Yuan, Jingjing Pan, Chenjie Zhang, Hongwei Wang, John L. Brash, Lin Yuan, Hong Chen
With the interaction of polymers, the nanoparticle-protein conjugates show controllable bioactivity and pH responsiveness.
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Tuning the surface electronic structure of a Pt3Ti(111) electro catalyst



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08420B, Paper
M. Pa[German sz ligature}ens, V. Caciuc, N. Atodiresei, M. Moors, S. Blugel, R. Waser, S. Karthauser
Combining voltage dependent STM imaging with *ab initio* DFT calculations to identify the exact termination of an electro catalyst.
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Inherent predominance of high chiral angle metallic carbon nanotubes in continuous fibers grown from a molten catalyst

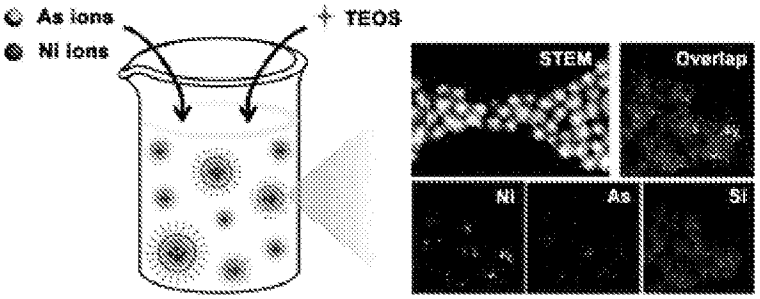


Nanoscale, 2016, **8**,4236-4244
DOI: 10.1039/C5NR07455J, Paper

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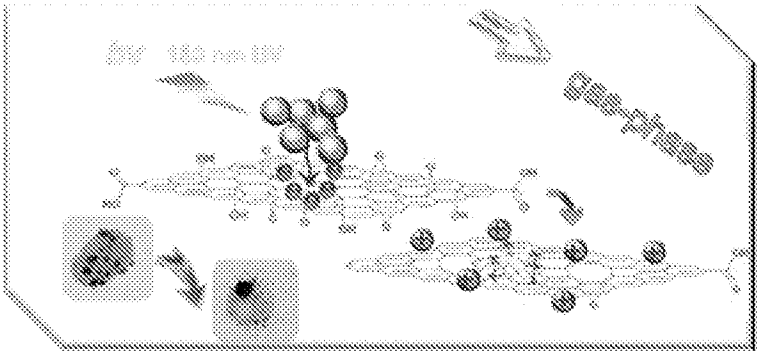
B. Aleman, M. Mar Bernal, B. Mas, Emilio M. Perez, V. Reguero, G. Xu, Y. Cui, Juan J. Vilatela
The armchair-biased chiral angle distribution in continuous fibres of CNTs is controlled by the molten state of the Fe-S-C alloy catalyst.
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A facile route to core-shell nanoparticulate formation of arsenic trioxide for effective solid tumor treatment



Nanoscale, 2016, **8**,4373-4380
DOI: 10.1039/C5NR07860A, Paper
Zongjun Zhang, Hanyu Liu, Hualu Zhou, Xianglong Zhu, Zhenghuan Zhao, Xiaoqin Chi, Hong Shan, Jinhao Gao
The facile synthesis of pH-sensitive arsenic-based nanodrugs by a "one-pot" reverse microemulsion method was reported.
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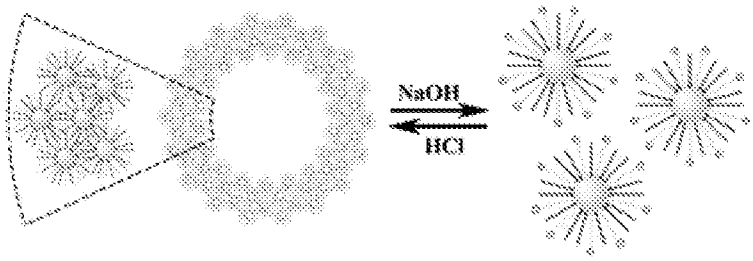
Gas-phase rapid reduction of graphene oxide through photoionization of gold nanoparticles



Nanoscale, 2016, **8**,3906-3910
DOI: 10.1039/C5NR08509H, Communication
Jeong Hoon Byeon
This work introduces for the first time a rapid reduction of graphene oxide *via* the photoionization of gold nanoparticles in a continuous gas-phase process.
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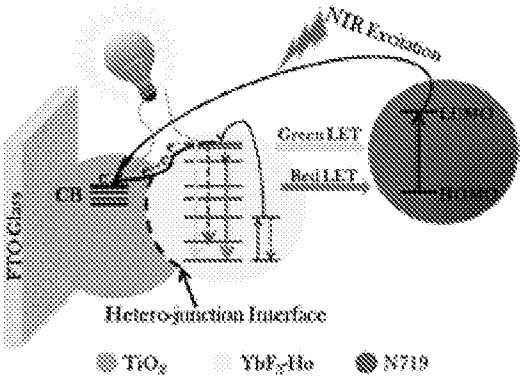
pH-Responsive reversible self-assembly of gold nanoparticles into nanovesicles

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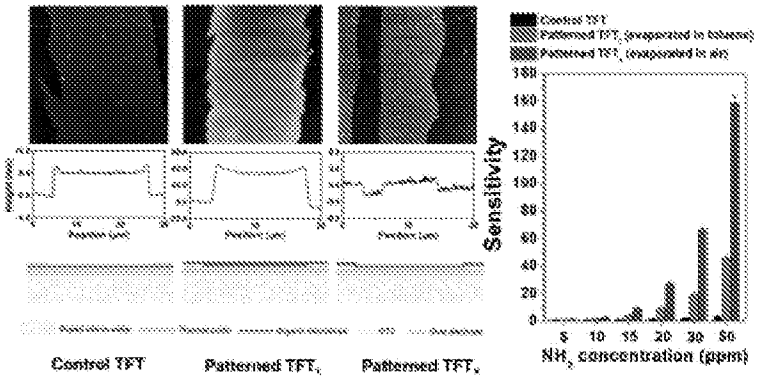
Nanoscale, 2016, **8**,3923-3925
DOI: 10.1039/C6NR00044D, Communication
Chunfang Fan, Tong Bian, Lu Shang, Run Shi, Li-Zhu Wu, Chen-Ho Tung, Tierui Zhang
pH-Responsive Au nanovesicles with reversible self-assembly and disassembly performance were developed by adjusting protonation and deprotonation of surface ligands.
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Enhanced photovoltaic performance of dye-sensitized solar cells using a new photoelectrode material: upconversion YbF3-Ho/TiO2 nanoheterostructures



Nanoscale, 2016, **8**,4173-4180
DOI: 10.1039/C5NR08319B, Paper
Jia Yu, Yulin Yang, Ruiqing Fan, Ping Wang, Yuwei Dong
UC/TiO_2 nanoheterostructures induce electron-injection from YbF_3-Ho to TiO_2 by utilizing near-infrared light, and further improve the existing merits of TiO_2.
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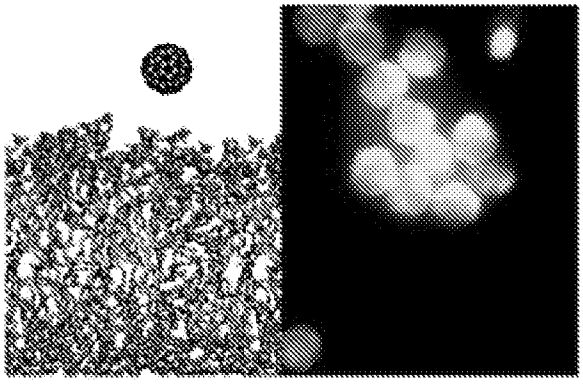
Fast patterning of oriented organic microstripes for field-effect ammonia gas sensors



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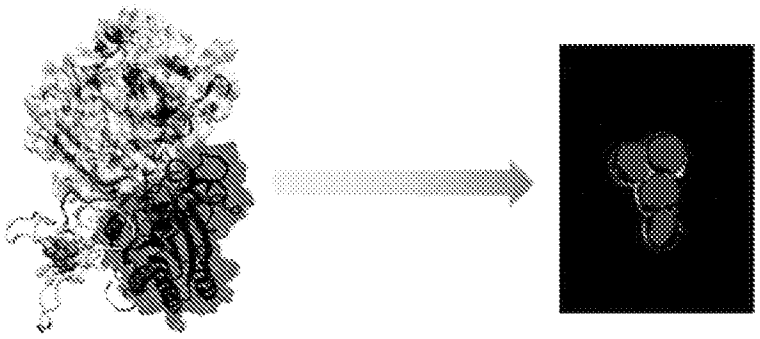
Nanoscale, 2016, **8**,3954-3961
DOI: 10.1039/C5NR09001F, Communication
Binghao Wang, Jinqiang Ding, Tao Zhu, Wei Huang, Zequn Cui, Jianmei Chen, Lizhen Huang, Lifeng Chi
A series of organic field-effect transistors (OFETs) with patterned ultra-thin films for NH_3 detection are achieved *via* fast dip-coating.
The content of this RSS Feed (c) The Royal Society of Chemistry

C60 fullerene localization and membrane interactions in RAW 264.7 immortalized mouse macrophages



Nanoscale, 2016, **8**,4134-4144
DOI: 10.1039/C5NR07003A, Paper
K. A. Russ, P. Elvati, T. L. Parsonage, A. Dews, J. A. Jarvis, M. Ray, B. Schneider, P. J. S. Smith, P. T. F. Williamson, A. Violi, M. A. Philbert
There continues to be a significant increase in the number and complexity of hydrophobic nanomaterials that are engineered for a variety of commercial purposes making human exposure a significant health concern.
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Computational design of peptide-Au cluster probe for sensitive detection of [small alpha]IIb[small beta]3 integrin

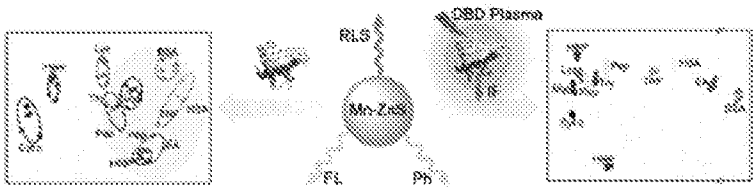


Nanoscale, 2016, **8**,4203-4208
DOI: 10.1039/C5NR09175F, Paper
Lina Zhao, Jiao Zhai, Xuejie Zhang, Xueyun Gao, Xiaohong Fang, Jingyuan Li
We have designed a novel peptide-Au cluster probe to specifically bind to [small alpha]$_{IIb}$[small beta]$_3$ integrin.
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Plasma-assisted quadruple-channel optosensing of proteins and cells with Mn-

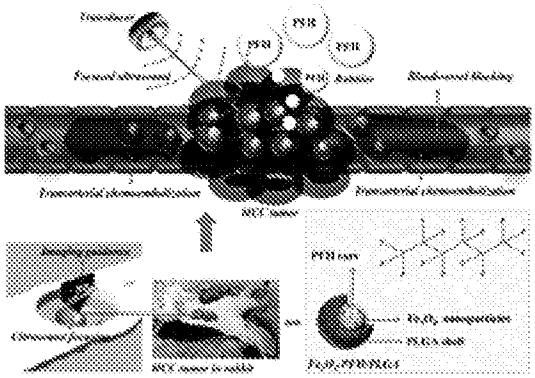
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doped ZnS quantum dots



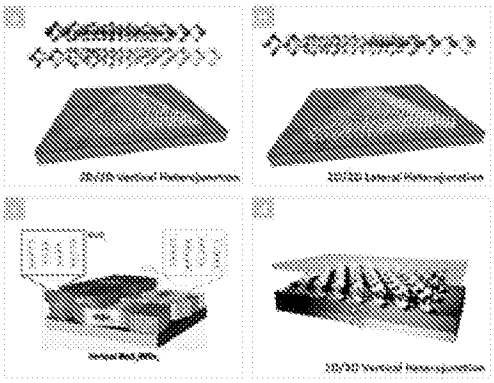
Nanoscale, 2016, **8**,4291-4298
DOI: 10.1039/C5NR09130F, Paper
Chenghui Li, Peng Wu, Xiandeng Hou
The addition of the intrinsic fluorescence of proteins to the existing triple-channel optical properties of Mn-ZnS QDs yields new quadruple-channel optosensing devices with substantially increased discrimination capacity for proteins. A low-temperature plasma for protein treatment further enforces the discrimination.
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Nanoparticle-enhanced synergistic HIFU ablation and transarterial chemoembolization for efficient cancer therapy



Nanoscale, 2016, **8**,4324-4339
DOI: 10.1039/C5NR08292G, Paper
Yufeng You, Zhigang Wang, Haitao Ran, Yuanyi Zheng, Dong Wang, Jinshun Xu, Zhibiao Wang, Yu Chen, Pan Li
We have developed a nanoparticle-based HIFU synergistic cancer surgery enhanced by transarterial chemoembolization for high-efficient HCC treatment based on Fe_3O_4-PFH/PLGA nanocapsules.
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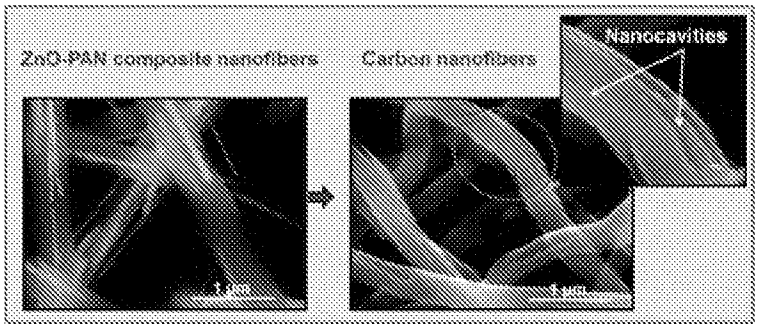
Fundamentals of lateral and vertical heterojunctions of atomically thin materials



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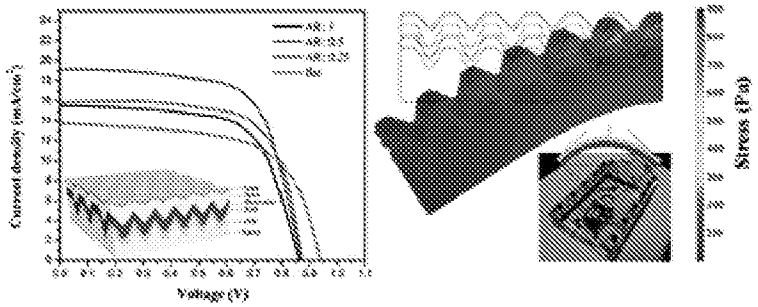
Nanoscale, 2016, **8**,3870-3887
DOI: 10.1039/C5NR08982D, Minireview
Anupum Pant, Zafer Mutlu, Darshana Wickramaratne, Hui Cai, Roger K. Lake, Cengiz Ozkan, Sefaattin Tongay
At the turn of this century, Herbert Kroemer, the 2000 Nobel Prize winner in Physics, famously commented that "the interface is the device".
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Zinc oxide nanorod assisted rapid single-step process for the conversion of electrospun poly(acrylonitrile) nanofibers to carbon nanofibers with a high graphitic content



Nanoscale, 2016, **8**,4360-4372
DOI: 10.1039/C5NR06809F, Paper
Ratyakshi Nain, Dhirendra Singh, Manjeet Jassal, Ashwini K. Agrawal
The effect of incorporation of rigid zinc oxide (ZnO) nanostructures on carbonization behavior of electrospun special acrylic fiber grade poly(acrylonitrile) (PAN-SAF) nanofibers was investigated.
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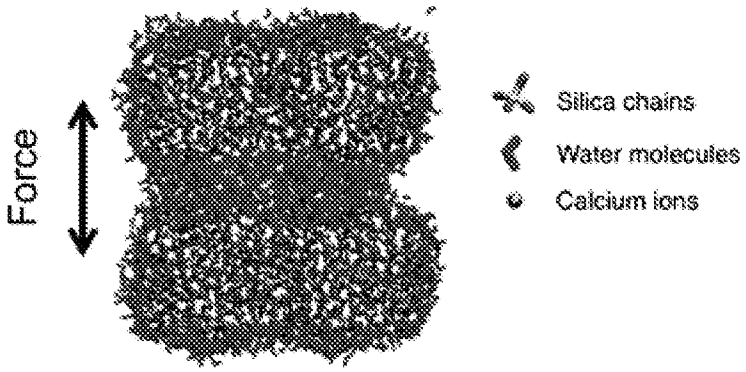
Efficient, flexible and mechanically robust perovskite solar cells on inverted nanocone plastic substrates



Nanoscale, 2016, **8**,4276-4283
DOI: 10.1039/C5NR08836D, Paper
Mohammad Mahdi Tavakoli, Qingfeng Lin, Siu-Fung Leung, Ga Ching Lui, Hao Lu, Liang Li, Bin Xiang, Zhiyong Fan
Utilization of nanostructures on photovoltaic devices can significantly improve the device energy conversion efficiency by enhancing the device light harvesting capability as well as carrier collection efficiency.
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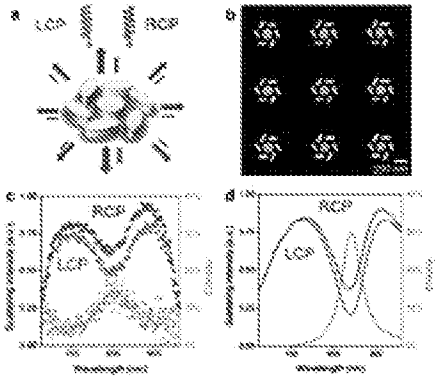
Interaction grand potential between calcium-silicate-hydrate nanoparticles at the molecular level

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Nanoscale, 2016, **8**,4160-4172
DOI: 10.1039/C5NR08142D, Paper
Patrick A. Bonnaud, Christophe Labbez, Ryuji Miura, Ai Suzuki, Naoto Miyamoto, Nozomu Hatakeyama, Akira Miyamoto, Krystyn J. Van Vliet
Mean forces and interaction grand potentials between calcium-silicate-hydrate particles.
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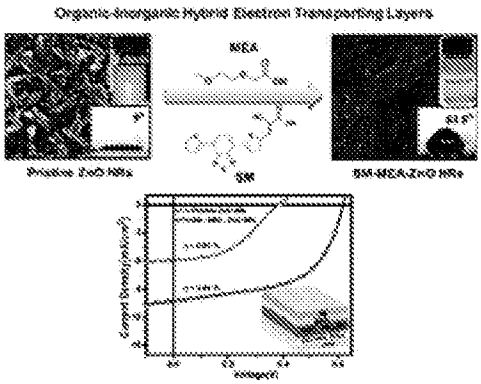
Planar plasmonic chiral nanostructures



Nanoscale, 2016, **8**,3900-3905
DOI: 10.1039/C5NR09302C, Communication
Shuai Zu, Yanjun Bao, Zheyu Fang
A strong chiral optical response induced at a plasmonic Fano resonance in a planar Au heptamer nanostructure was experimentally and theoretically demonstrated.
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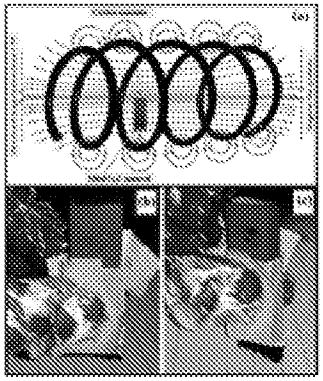
Co-functionalized organic/inorganic hybrid ZnO nanorods as electron transporting layers for inverted organic solar cells

PATENT
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Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08849F, Paper
Swapnil B. Ambade, Rohan B. Ambade, Seung Hun Eom, Myung-Jin Baek, Sushil S. Bagde, Rajaram S. Mane, Soo-Hyoung Lee
The first hybrid co-functionalization of solution processed planar ZnO nanorod ETLs in iOSCs with organic small molecule based on a D-A-D configuration with meticulous control of aggregation.
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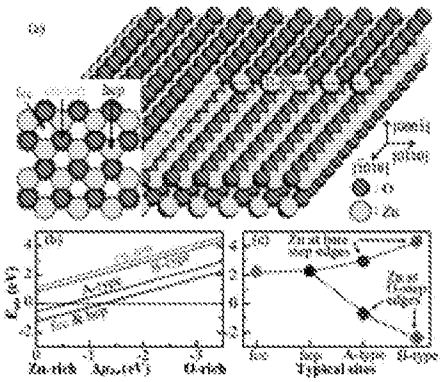
Fe3C-filled carbon nanotubes: permanent cylindrical nanomagnets possessing exotic magnetic properties



Nanoscale, 2016, **8**,4299-4310
DOI: 10.1039/C5NR09188H, Paper
Reetu Kumari, Lucky Krishnia, Vinay Kumar, Sandeep Singh, H. K. Singh, R. K. Kotnala, R. R. Juluri, U. M. Bhatta, P. V. Satyam, Brajesh S. Yadav, Zainab Naqvi, Pawan K. Tyagi
We study how confinement affects the magnetism of Fe_3C filled CNTs and stress induced structural phase transition. A model describing the growth mechanism as well as *in situ* pole formation in nanorod is discussed.
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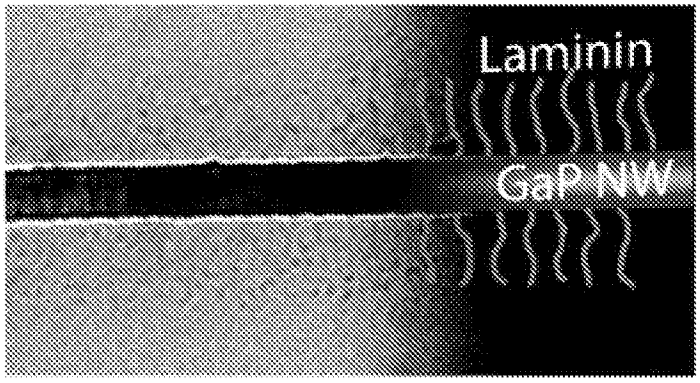
Effects of nitrogen dopants on the atomic step kinetics and electronic structures of O-polar ZnO

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Nanoscale, 2016, **8**,4381-4386
DOI: 10.1039/C5NR09060A, Paper
Hao Wang, Huahan Zhan, Yinghui Zhou, Yaping Wu, Xiaohang Chen, Huiqiong Wang, Junyong Kang
Oxygen-polar ZnO films are grown in step flow mode by molecular beam epitaxy.
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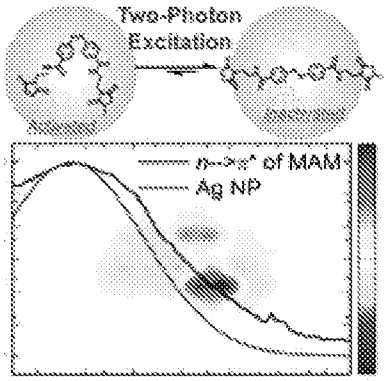
Electron microscopy imaging of proteins on gallium phosphide semiconductor nanowires



Nanoscale, 2016, **8**,3936-3943
DOI: 10.1039/C5NR08888G, Communication
Martin Hjort, Mikael Bauer, Stefan Gunnarsson, Erik Marsell, Alexei A. Zakharov, Gunnel Karlsson, Elodie Sanfins, Christelle N. Prinz, Reine Wallenberg, Tommy Cedervall, Anders Mikkelsen
We have imaged GaP nanowires (NWs) incubated with human laminin, serum albumin (HSA), and blood plasma using both cryo-transmission electron microscopy and synchrotron based X-ray photoemission electron microscopy.
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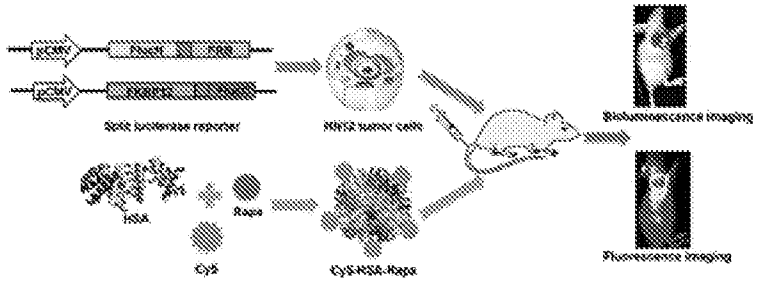
Plasmon-enhanced two-photon-induced isomerization for highly-localized light-based actuation of inorganic/organic interfaces

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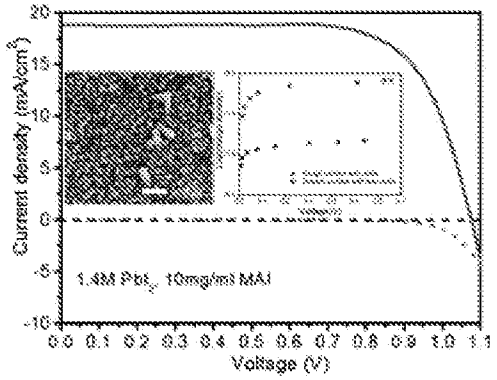
Nanoscale, 2016, **8**,4194-4202
DOI: 10.1039/C5NR07973J, Paper
Chang-Keun Lim, Xin Li, Yue Li, Kurt L. M. Drew, J. Pablo Palafox-Hernandez, Zhenghua Tang, Alexander Baev, Andrey N. Kuzmin, Marc R. Knecht, Tiffany R. Walsh, Mark T. Swihart, Hans Agren, Paras N. Prasad
Plasmon-enhanced two-photon isomerization of non-donor/acceptor modified azobenzene on Ag NPs.
The content of this RSS Feed (c) The Royal Society of Chemistry

Combined image guided monitoring the pharmacokinetics of rapamycin loaded human serum albumin nanoparticles with a split luciferase reporter



Nanoscale, 2016, **8**,3991-4000
DOI: 10.1039/C5NR07308A, Paper
Fu Wang, Kai Yang, Zhe Wang, Ying Ma, J. Silvio Gutkind, Naoki Hida, Gang Niu, Jie Tian
This integrated imaging platform could provide more reliable respective PK profiles of a loaded drug and its carrier.
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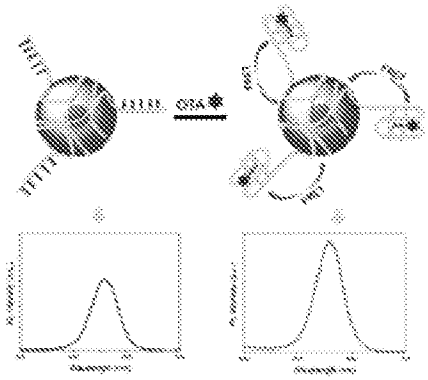
Influence of void-free perovskite capping layer on the charge recombination process in high performance CH3NH3PbI3 perovskite solar cells



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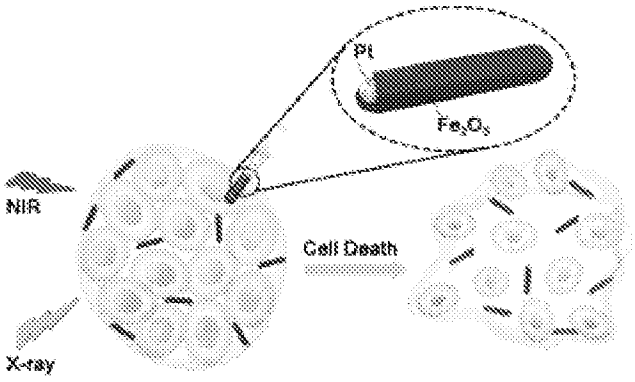
Nanoscale, 2016, **8**,4181-4193
DOI: 10.1039/C5NR06362K, Paper
Kunwu Fu, Christopher T. Nelson, Mary Cooper Scott, Andrew Minor, Nripan Mathews, Lydia Helena Wong
Uniform surface coverage of perovskite capping layer formed with less void formation reduces charge recombination and enhances device performance.
The content of this RSS Feed (c) The Royal Society of Chemistry

A self-assembly aptasensor based on thick-shell quantum dots for sensing of ochratoxin A



Nanoscale, 2016, **8**,4127-4133
DOI: 10.1039/C5NR08284F, Paper
Xianfeng Chu, Xiaowen Dou, Ruizheng Liang, Menghua Li, Weijun Kong, Xihui Yang, Jiaoyang Luo, Meihua Yang, Ming Zhao
A tunable-valency self-assembling aptasensor based on a thick-shell quantum dot was fabricated for ochratoxin A (OTA).
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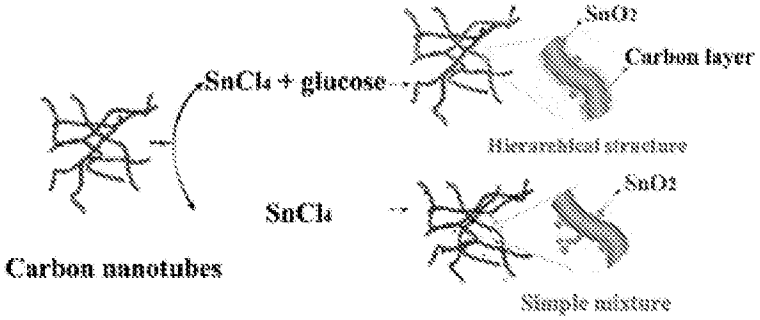
Facile preparation of hybrid core-shell nanorods for photothermal and radiation combined therapy



Nanoscale, 2016, **8**,3895-3899
DOI: 10.1039/C5NR09102K, Communication
Yaoyao Deng, Erdong Li, Xiaju Cheng, Jing Zhu, Shuanglong Lu, Cuicui Ge, Hongwei Gu, Yue Pan
Water-soluble platinum@iron oxide core-shell nanorods were synthesized and explored for NIR photothermal and X-ray radiation combined therapy.
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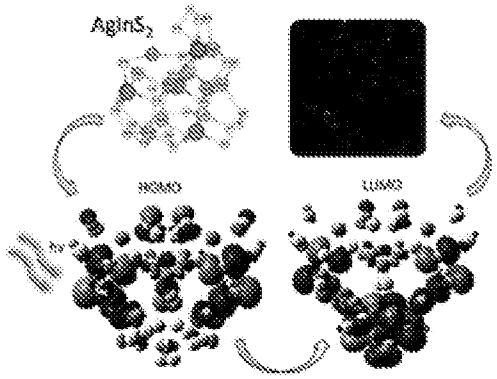
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Carbon coated SnO2 nanoparticles anchored on CNT as a superior anode material for lithium-ion batteries



Nanoscale, 2016, **8**,4121-4126
DOI: 10.1039/C5NR07996A, Paper
Chunrong Ma, Weimin Zhang, Yu-Shi He, Qiang Gong, Haiying Che, Zi-Feng Ma
High performance hierarchically structured carbon covering SnO_2 nanoparticles on CNTs were synthesized *via* a facile glucose mediated hydrothermal method and subsequent calcination as an anode for lithium-ion batteries.
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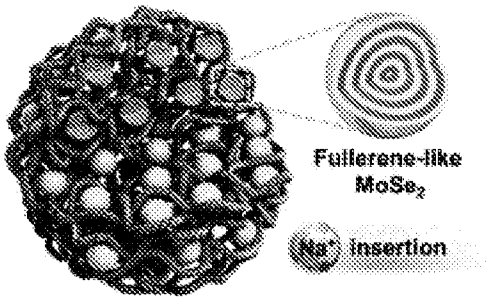
Two blinking mechanisms in highly confined AgInS2 and AgInS2/ZnS quantum dots evaluated by single particle spectroscopy



Nanoscale, 2016, **8**,4151-4159
DOI: 10.1039/C5NR07992F, Paper
B. Cichy, R. Rich, A. Olejniczak, Z. Gryczynski, W. Strek
Ternary $AgInS_2$ quantum dots (QDs) have been found as promising cadmium-free, red-shifted, and tunable luminescent bio-probes with efficient Stokes and anti-Stokes excitations and luminescence lifetimes (*ca.* 100 ns) convenient for time resolved techniques.
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Fullerene-like MoSe2 nanoparticles-embedded CNT balls with excellent structural stability for highly reversible sodium-ion storage

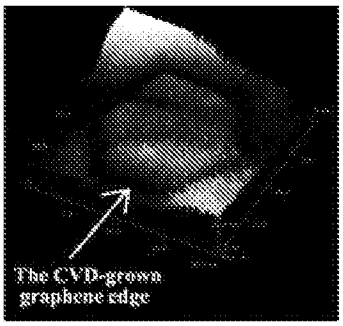
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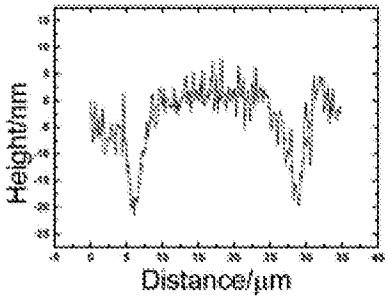


Fullerene-like $MoSe_2$ nanoparticles embedded CNT ball

Nanoscale, 2016, **8**,4209-4216
DOI: 10.1039/C5NR07733H, Paper
Seung Ho Choi, Yun Chan Kang
Three-dimensional (3D) porous-structured carbon nanotube (CNT) balls embedded with metal selenide nanocrystals were prepared by a simple two-step process. The fullerene-like $MoSe_2$/CNT composite balls, selected as the first target material, showed excellent sodium-ion storage properties.
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Edge morphology evolution of graphene domains during chemical vapor deposition cooling revealed through hydrogen etching

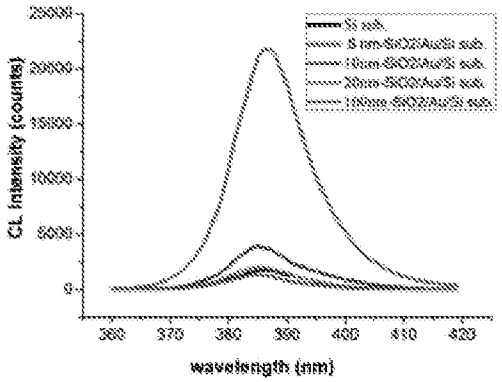




Nanoscale, 2016, **8**,4145-4150
DOI: 10.1039/C5NR06624G, Paper
Haoran Zhang, Yanhui Zhang, Yaqian Zhang, Zhiying Chen, Yanping Sui, Xiaoming Ge, Guanghui Yu, Zhi Jin, Xinyu Liu
The CVD cooling process induced graphene edge evolution, such as nanoparticle accumulation and graphene edge sinking. The results revealed the peculiar graphene-Cu movement during CVD cooling.
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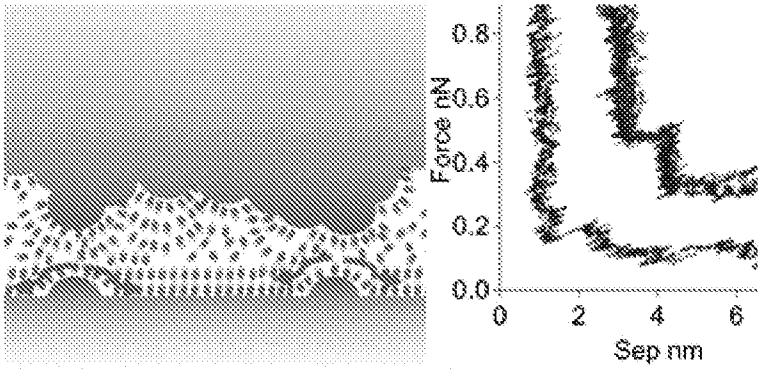
Strongly enhanced ultraviolet emission of an Au@SiO2/ZnO plasmonic hybrid nanostructure

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Nanoscale, 2016, **8**,4030-4036
DOI: 10.1039/C5NR06153A, Paper
Li Wang, Xiaodong Wang, Shengcheng Mao, Hua Wu, Xia Guo, Yuan Ji, Xiaodong Han
We present the surface plasmon polariton (SPP)-enhanced ultraviolet (UV) emission of an Au@SiO_2/ZnO hybrid nanostructure.
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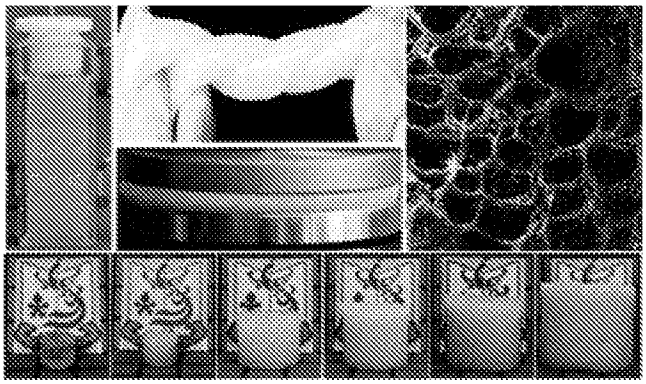
Layering of ionic liquids on rough surfaces



Nanoscale, 2016, **8**,4094-4106
DOI: 10.1039/C5NR07805A, Paper
Alexis Sheehan, L. Andres Jurado, Shivaprakash N. Ramakrishna, Andrea Arcifa, Antonella Rossi, Nicholas D. Spencer, Rosa M. Espinosa-Marzal
Structural forces reveal the ordered structure of one ionic liquid at rough interfaces of well-defined nanoscale roughness, also under nanoconfinement.
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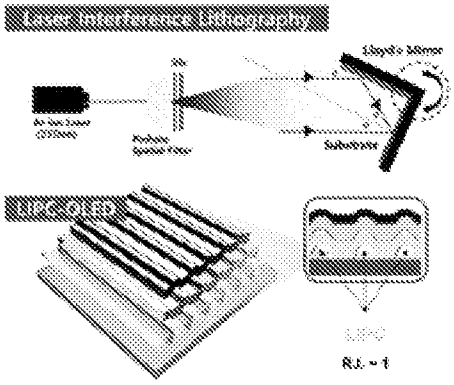
Aqueous compatible boron nitride nanosheets for high-performance hydrogels

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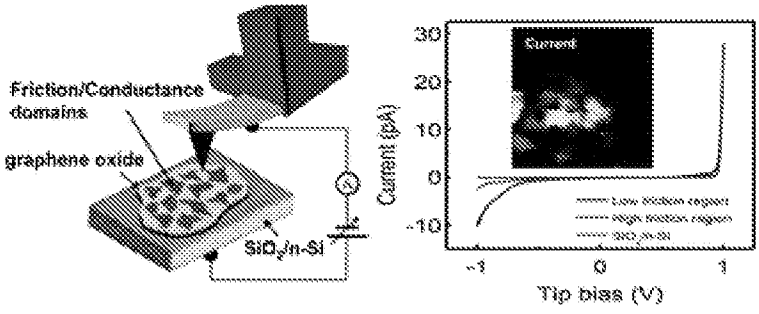
Nanoscale, 2016, **8**,4260-4266
DOI: 10.1039/C5NR07578E, Paper
Xiaozhen Hu, Jiahui Liu, Qiuju He, Yuan Meng, Liu Cao, Ya-Ping Sun, Jijie Chen, Fushen Lu
Aqueous dispersible boron nitride nanosheets were produced and used to fabricate nanocomposite hydrogels with high water retentivity and flexibility.
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An extremely low-index photonic crystal layer for enhanced light extraction from organic light-emitting diodes



Nanoscale, 2016, **8**,4113-4120
DOI: 10.1039/C5NR07312J, Paper
Yong Sub Shim, Ju Hyun Hwang, Cheol Hwee Park, Sun-Gyu Jung, Young Wook Park, Byeong-Kwon Ju
This paper reports organic light-emitting diodes (OLEDs) with improved light extraction fabricated by embedding an extremely low-index photonic crystal (LIPC) layer.
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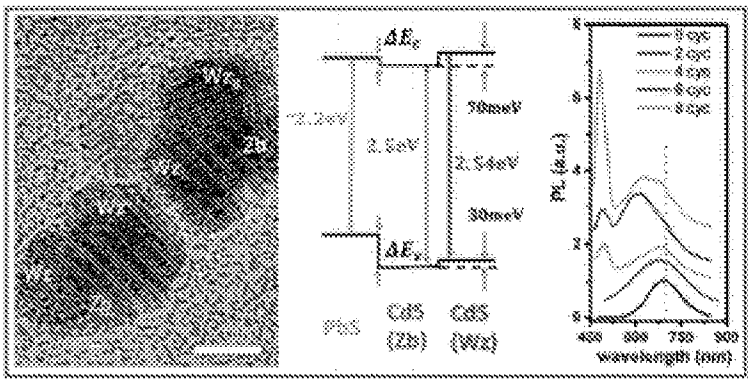
Friction and conductance imaging of sp2- and sp3-hybridized subdomains on single-layer graphene oxide



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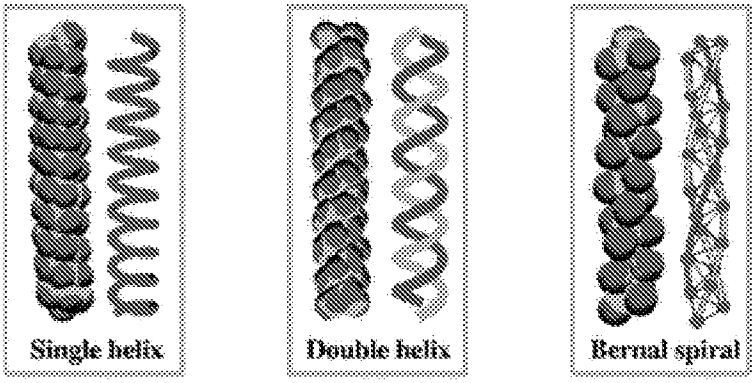
Nanoscale, 2016, **8**,4063-4069
DOI: 10.1039/C5NR06469D, Paper
Hyunsoo Lee, Narae Son, Hu Young Jeong, Tae Gun Kim, Gyeong Sook Bang, Jong Yun Kim, Gi Woong Shim, Kalyan C. Goddeti, Jong Hun Kim, Namdong Kim, Hyun-Joon Shin, Wondong Kim, Sehun Kim, Sung-Yool Choi, Jeong Young Park
We investigated the subdomain structures of graphene oxide with friction and conductance mappings.
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Dual emission in asymmetric "giant" PbS/CdS/CdS core/shell/shell quantum dots



Nanoscale, 2016, **8**,4217-4226
DOI: 10.1039/C5NR08881J, Paper
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Haiguang Zhao, Gianluca Sirigu, Andrea Parisini, Andrea Camellini, Giuseppe Nicotra, Federico Rosei, Vittorio Morandi, Margherita Zavelani-Rossi, Alberto Vomiero
Dual emission in asymmetric "giant" PbS/CdS/CdS core/shell/shell quantum dots enables color monitoring/modulation and control in the visible/NIR region for advanced applications.
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Supracolloidal helices from soft Janus particles by tuning the particle softness



Nanoscale, 2016, **8**,4070-4076
DOI: 10.1039/C5NR07011B, Paper
Qing-Zhi Zou, Zhan-Wei Li, Zhong-Yuan Lu, Zhao-Yan Sun
Supracolloidal helices including single helices, double helices, and Bernal spirals are observed through the self-

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assembly of soft Janus particles by properly tuning particle softness.
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Highly effective and uniform SERS substrates fabricated by etching multi-layered gold nanoparticle arrays

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C6NR00502K, Paper
Li Zhang, Changrong Guan, Ying Wang, Jianhui Liao
Gold nanoparticle multilayers printed on silicon substrates layer by layer were etched by gold etchant to form highly effective and uniform substrates for surface-enhanced Raman scattering (SERS). The performance of...
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Highly efficient plasmonic tip design for plasmon nanofocusing in near-field optical microscopy

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08548A, Paper
Takayuki Umakoshi, Yuika Saito, Prabhat Verma
Near-field scanning optical microscopy (NSOM) combined with plasmon nanofocusing is a powerful nano-analytical tool due to its attractive feature of efficient background suppression as well as light energy compression into...
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3D Flexible Water Channel: Stretchability of Nanoscale Water Bridge

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08072J, Paper
Jige Chen, Chunlei Wang, Ning Wei, Rongzheng Wan, Yi Gao
Artificial water channel contributes to a better understanding of natural water channel and aims to offer highly selective, advanced conductance system. Most studies use nanotubes, however it is difficult to...
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Silver Nanoparticles Confined in Carbon Nanotubes: On the Understanding of

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Confinement Effect and Promotional Catalysis for the Selective Hydrogenation of Dimethyl Oxalate

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08651E, Paper
Jianwei Zheng, Xinping Duan, Haiqiang Lin, Zhengqiang Gu, Huihuang Fang, Jianhui Li, Youzhu Yuan
Confined Ag nanomaterial in the channels of herringbone multi-wall carbon nanotubes (Ag-in/hCNT) was effectively prepared. The space restriction induces morphological changes of Ag nanoparticles into rough nanowires with an estimated...
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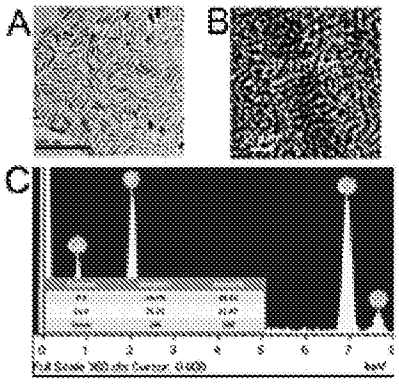
Large-area uniform and low-cost dual-mode plasmonic naked-eye colorimetry and SERS sensor with handheld Raman spectrometer

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08357E, Paper
Zhida Xu, Jing Jiang, Xinhao Wang, Kevin Han, Abid Ameen, Ibrahim Khan, Te-Wei Chang, Logan Liu
We demonstrated a highly-sensitive, wafer-scale, high-uniform plasmonic nano-mushroom substrate based on plastic for naked-eye plasmonic colorimetry and surface-enhanced Raman spectroscopy (SERS). We gave it the name FlexBrite. The dual-mode functionality...
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Elevated Gold Ellipse Nanoantenna Dimers as Sensitive and Tunable Surface Enhanced Raman Spectroscopy Substrates

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08920D, Paper
Aaron M Jubb, Yang Jiao, Gyula Eres, Scott Thomas Retterer, Baohua Gu
We demonstrate large area arrays of elevated gold ellipse dimers with precisely controlled gaps for use as sensitive and highly controllable surface enhanced Raman scattering (SERS) substrates. The significantly enhanced...
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A facile solution-phase synthesis of cobalt phosphide nanorods/hollow nanoparticles

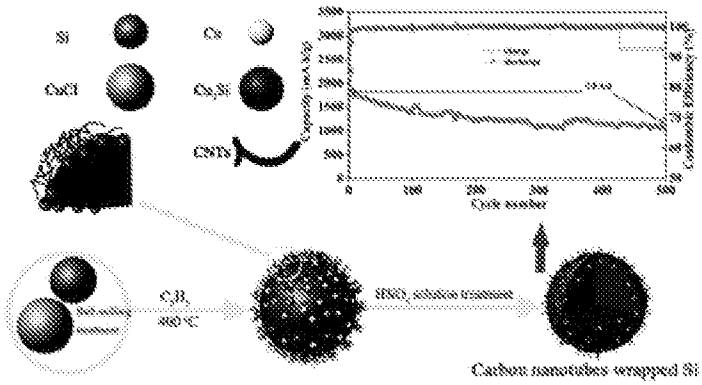


Nanoscale, 2016, Advance Article
DOI: 10.1039/C6NR00208K, Communication
Weiwei Yang, Yarong Huang, Jinlong Fan, Yongsheng Yu, Chunhui Yang, Haibo Li
A simple one-step solution-phase synthesis of cobalt phosphide nanorods (NRs) and hollow nanoparticles

PATENT
REEL: 037821 FRAME: 0429

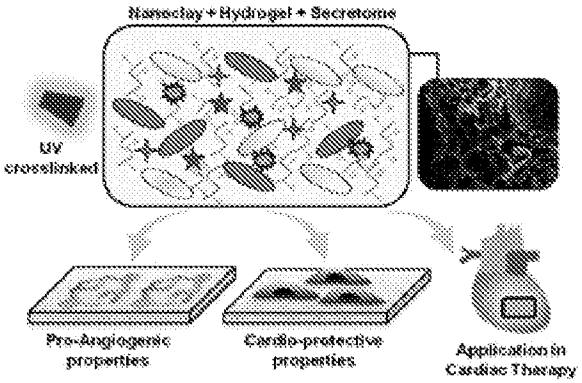
(NPs) has been reported in this paper.
To cite this article before page numbers are assigned, use the DOI form of citation above.
The content of this RSS Feed (c) The Royal Society of Chemistry

In situ growth of carbon nanotube wrapped Si composites as anodes for high performance lithium ion batteries



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08961A, Communication
Jianbin Zhou, Yang Lan, Kailong Zhang, Guoliang Xia, Jin Du, Yongchun Zhu, Yitai Qian
Carbon nanotube wrapped Si was synthesized *in situ* by using the CCVD method at 400 [degree]C and shows high electrochemical performance.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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Stem cell secretome-rich nanoclay hydrogel: a dual action therapy for cardiovascular regeneration

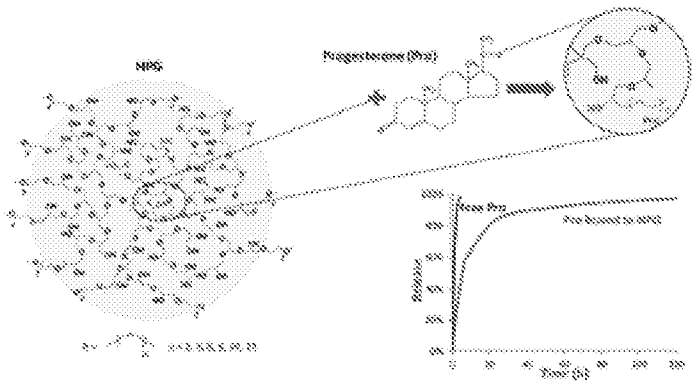


Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07806G, Communication
Renae Waters, Settimio Pacelli, Ryan Maloney, Indrani Medhi, Rafeeq P. H. Ahmed, Arghya Paul
We report development of a nanocomposite hydrogel platform using nanoclay materials and stem cell derived secretome for cardiac tissue repair and therapy.
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Progesterone binding nano-carriers based on hydrophobically modified

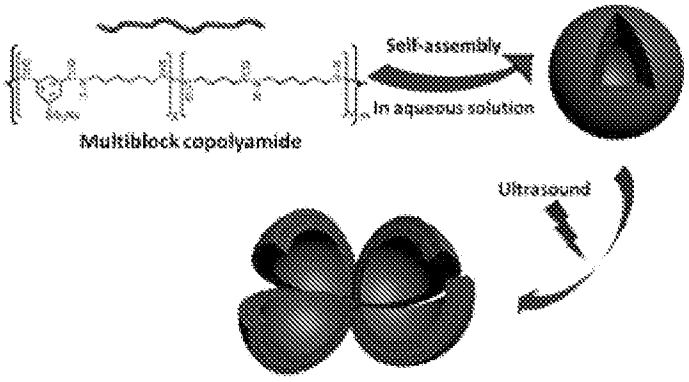
PATENT
REEL: 037821 FRAME: 0430

hyperbranched polyglycerols



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08175K, Paper
M. Alizadeh Noghani, D. E. Brooks
A family of hydrophobically derivatized HPGs is assessed as a potential carrier for progesterone, an important steroid. Molecular determinants of binding and the release kinetics are investigated and the surprising role of non-freezing water on release kinetics described.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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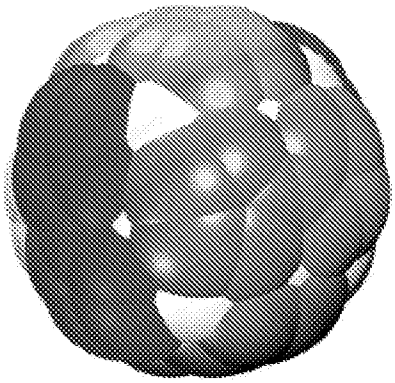
Ultrasound-responsive ultrathin multiblock copolyamide vesicles



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08596A, Communication
Lei Huang, Chunyang Yu, Tong Huang, Shuting Xu, Yongping Bai, Yongfeng Zhou
Novel ultrasound-responsive polymer vesicles with ultrathin walls and a special packing model were generated from an amphiphilic multiblock copolyamide.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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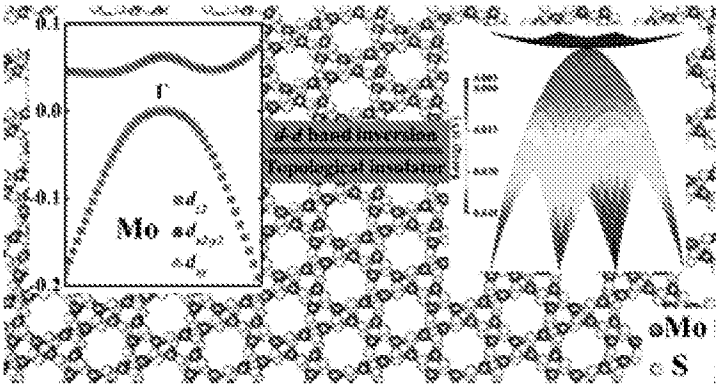
Sc20C60: a volleyballene

PATENT
REEL: 037821 FRAME: 0431



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07784B, Paper
Jing Wang, Hong-Man Ma, Ying Liu
A stable volleyball-like molecular cluster, *Volleyballene* $Sc_{20}C_{60}$, was identified. It possesses relatively high symmetry and a hollow space that can be used to accommodate other atoms or molecules for the purpose of studying fundamental chemistry.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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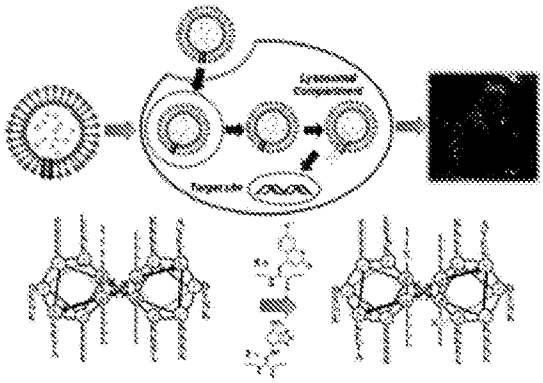
New quantum spin Hall insulator in two-dimensional MoS2 with periodically distributed pores



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08842A, Communication
Peng-Fei Liu, Liujiang Zhou, Thomas Frauenheim, Li-Ming Wu
A new two-dimensional topological insulator in two-dimensional MoS_2 with periodically distributed pores is predicted. Pure d-d band inversion is responsible for the quantum spin Hall effect. Theoretical analysis shows the largest nontrivial gap among MoS_2 isomers.
To cite this article before page numbers are assigned, use the DOI form of citation above.
The content of this RSS Feed (c) The Royal Society of Chemistry

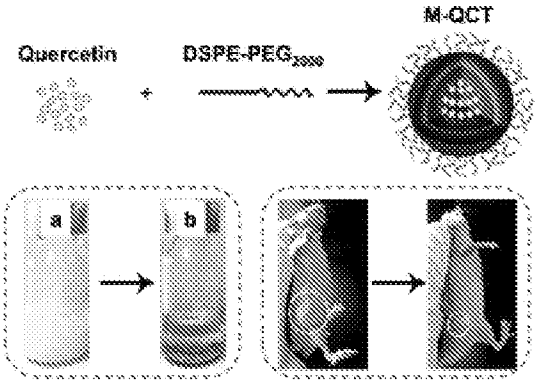
pH sensitive coiled coils: a strategy for enhanced liposomal drug delivery

PATENT
REEL: 037821 FRAME: 0432



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07734F, Paper
Rahi M. Reja, Mohsina Khan, Sumeet K. Singh, Rajkumar Misra, Anjali Shiras, Hosahudya N. Gopi
Design of pH sensitive coiled coils and their incorporation into the liposome vesicles as triggers for the controlled release of encapsulated drugs are reported.
To cite this article before page numbers are assigned, use the DOI form of citation above.
The content of this RSS Feed (c) The Royal Society of Chemistry

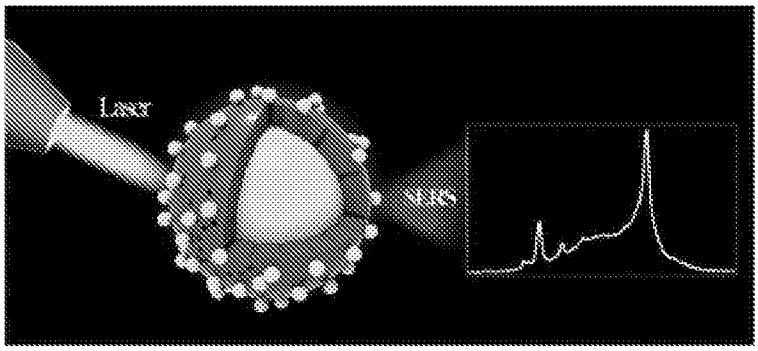
Quercetin-loaded nanomicelles to circumvent human castration-resistant prostate cancer in vitro and in vivo



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08966B, Paper
Jing Zhao, Juan Liu, Tuo Wei, Xiaowei Ma, Qiang Cheng, Shuaidong Huo, Chunqiu Zhang, Yanan Zhang, Xianglin Duan, Xing-Jie Liang
We develop a nanomicelle-based quercetin delivery system, which exhibits superior anticancer activity in the castration-resistant prostate cancer model.
To cite this article before page numbers are assigned, use the DOI form of citation above.
The content of this RSS Feed (c) The Royal Society of Chemistry

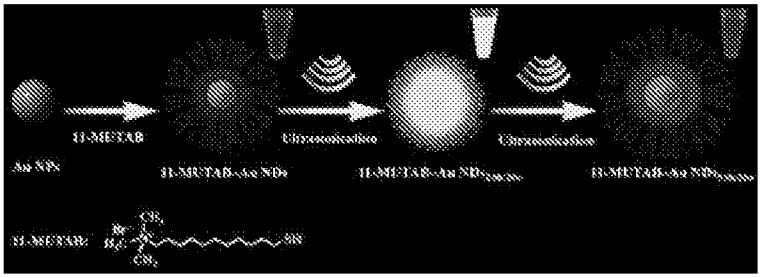
Hydrothermal synthesis of Ag@MSiO2@Ag three core-shell nanoparticles and their sensitive and stable SERS properties

PATENT
REEL: 037821 FRAME: 0433



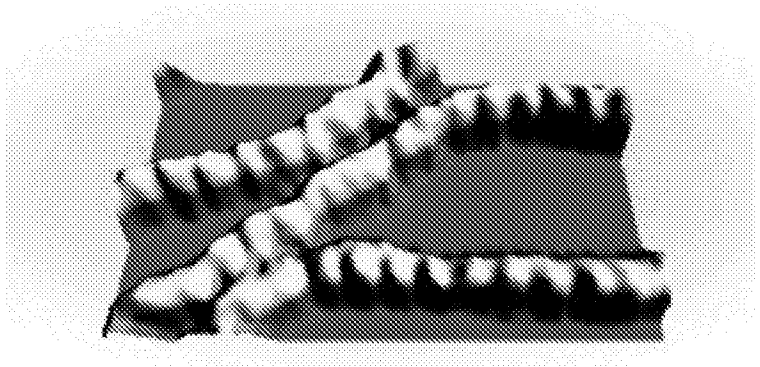
Nanoscale, 2016, Advance Article
DOI: 10.1039/C6NR00006A, Communication
Tao Jiang, Xiaolong Wang, Jun Zhou, Dong Chen, Ziqi Zhao
We report a unique Ag@MSiO$_2$@Ag three core-shell nanostructure as a SERS substrate with both sensitivity and stability.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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Ultrasound-mediated modulation of the emission of gold nanodots



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08387G, Paper
Yu-Ting Tseng, Rochelle Cherng, Zhiqin Yuan, Chien-Wei Wu, Huan-Tsung Chang, Chih-Ching Huang
Ultrasonication treatment of (11-mercaptoundecyl)-*N*,*N*,*N*-trimethylammonium bromide-capped gold nanodots (11-MUTAB-Au NDs) boosts a >1000-fold enhancement in its photoluminescence due to the smaller size and the higher 11-MUTAB ligand density on the surfaces.
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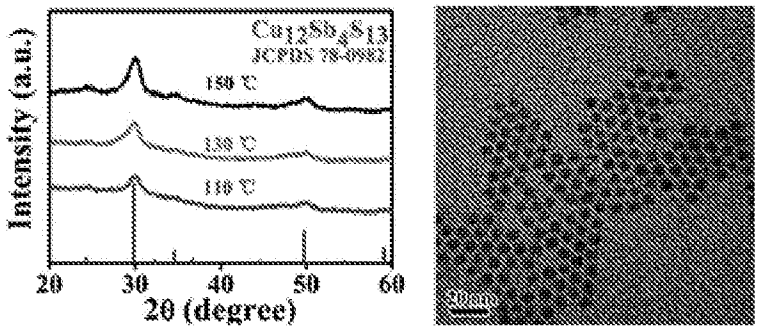
High resolution atomic force microscopy of double-stranded RNA



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REEL: 037821 FRAME: 0434

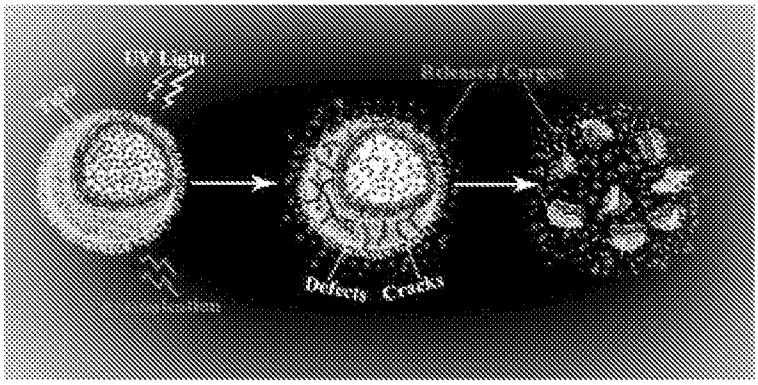
Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07445B, Paper
Pablo Ares, Maria Eugenia Fuentes-Perez, Elias Herrero-Galan, Jose M. Valpuesta, Adriana Gil, Julio Gomez-Herrero, Fernando Moreno-Herrero
Imaging double-stranded RNA at sub-helical pitch resolution with atomic force microscopy in liquid.
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A green synthesis route for the phase and size tunability of copper antimony sulfide nanocrystals with high yield



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR09097K, Paper
Keqiang Chen, Jing Zhou, Wen Chen, Qiao Chen, Peng Zhou, Yueli Liu
Typical XRD patterns of $Cu_{12}Sb_4S_{13}$ NCs with various sizes and a TEM image of 5.76 nm $Cu_{12}Sb_4S_{13}$ NCs.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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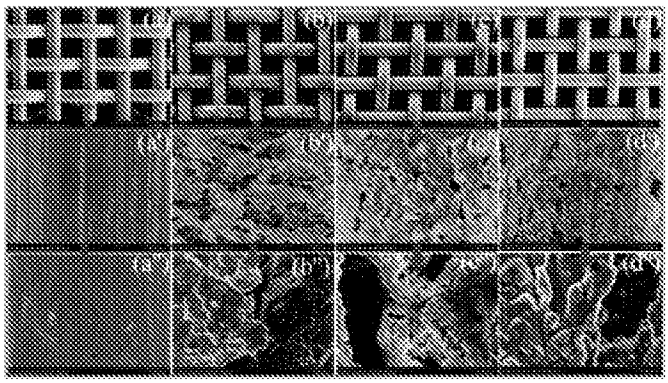
Bifunctional ultraviolet/ultrasound responsive composite TiO2/polyelectrolyte microcapsules



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR06666B, Paper
Hui Gao, Dongsheng Wen, Nadezda V. Tarakina, Jierong Liang, Andy J. Bushby, Gleb B. Sukhorukov
Functional composite TiO_2/polyelectrolyte microcapsules encapsulated with payloads are controllably opened by either ultraviolet or ultrasound treatment.
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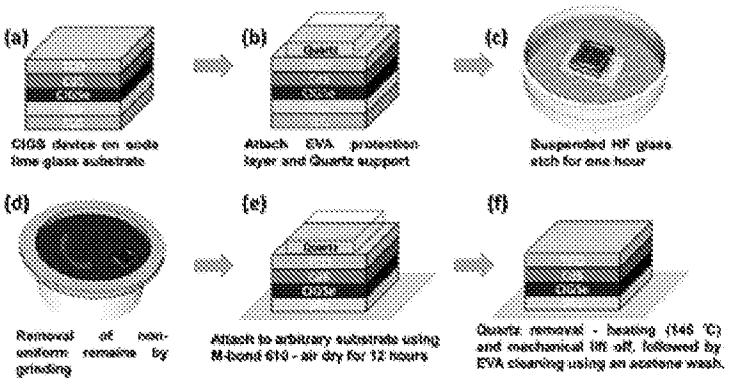
PATENT
REEL: 037821 FRAME: 0435

A multifunctional polymeric nanofilm with robust chemical performances for special wettability



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07601C, Paper
Yabin Wang, Feng Lin, Yaping Dong, Zhong Liu, Wu Li, Yudong Huang
A multifunctional polymeric nanofilm of a triazinedithiolsilane compound, which can protect metallic substrates and activate the corresponding surface simultaneously, is introduced onto a copper mesh surface *via* facile solution-immersion approaches.
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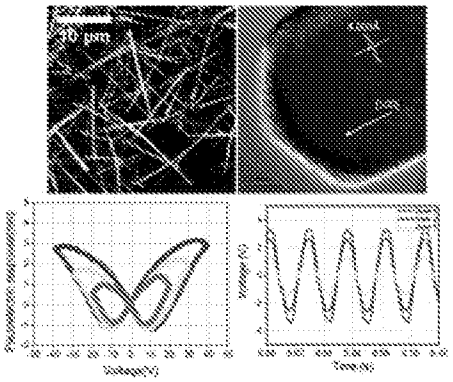
A facile chemical-mechanical polishing lift-off transfer process toward large scale Cu(In,Ga)Se2 thin-film solar cells on arbitrary substrates



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07008B, Paper
Kuan-Chun Tseng, Yu-Ting Yen, Stuart R. Thomas, Hung-Wei Tsai, Cheng-Hung Hsu, Wen-Chi Tsai, Chang-Hong Shen, Jia-Min Shieh, Zhiming M. Wang, Yu-Lun Chueh
The fabrication of Cu(In,Ga)Se_2 (CIGS) solar cells on flexible substrates is a non-trivial task due to thermal and ion diffusion related issues.
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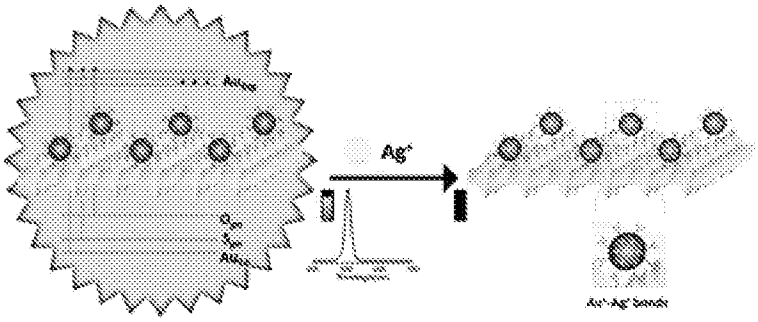
Lead-free 0.5Ba(Zr0.2Ti0.8)O3-0.5(Ba0.7Ca0.3)TiO3 nanowires for energy harvesting

PATENT
REEL: 037821 FRAME: 0436



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR09029F, Paper
Zhi Zhou, Christopher C. Bowland, Mohammad H. Malakooti, Haixiong Tang, Henry A. Sodano
$0.5Ba(Zr_{0.2}Ti_{0.8})O_3$-$0.5(Ba_{0.7}Ca_{0.3})TiO_3$ (BZT-BCT) nanowires with high piezoelectric coupling coefficient (90 +/- 5 pm V^{-1}) are utilized to fabricate a flexible, energy harvesting nanocomposite producing an open circuit voltage of 6.25 V and a power density of 2.25 [small mu]W cm^{-3}.
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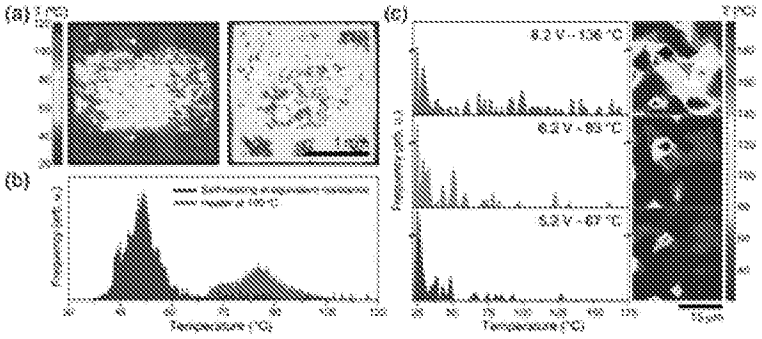
Green emission and Ag+ sensing of hydroxy double salt supported gold nanoclusters



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07029E, Paper
Jinyang Lu, Chunxiang Xu, Zhengshan Tian, Junfeng Lu, Yi Lin, Zengliang Shi
This work demonstrates a green-emitting complex of Zn-containing hydroxy double salt supported gold nanoclusters and its application for sensing Ag^+.
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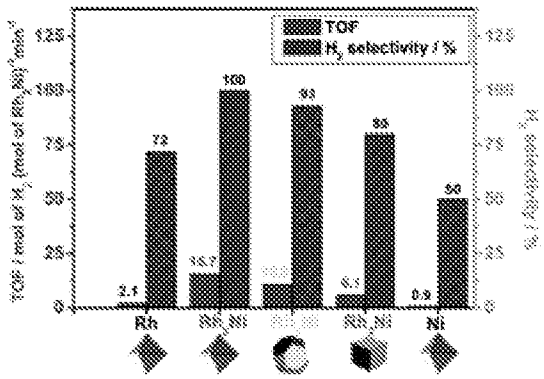
Localized self-heating in large arrays of 1D nanostructures

PATENT
REEL: 037821 FRAME: 0437



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07158E, Paper
O. Monereo, S. Illera, A. Varea, M. Schmidt, T. Sauerwald, A. Schutze, A. Cirera, J. D. Prades
Thermographic image of a CNFs film heated up by means of self-heating (left image) and external heater (right image). Raman mapping of the temperature distribution in a CNFs self-heated region at three different nominal temperatures with each corresponding temperature histogram.
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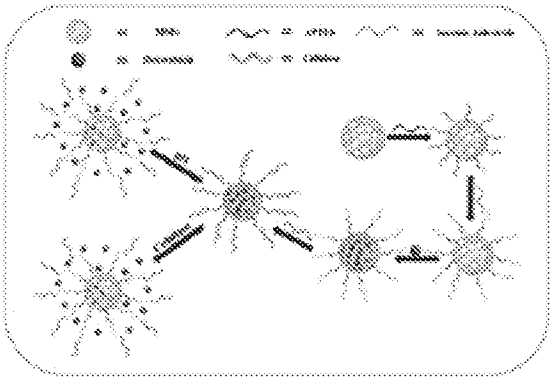
Synthesis of octahedral, truncated octahedral, and cubic Rh2Ni nanocrystals and their structure-activity relationship for the decomposition of hydrazine in aqueous solution to hydrogen



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR09227B, Paper
Chun Li, Tao Wang, Wei Chu, Ping Wu, Dong Ge Tong
Rh_2Ni nanocrystals with a higher percentage of {111} facets exhibited higher activity and H_2 selectivity during hydrazine dehydrogenation in aqueous solution.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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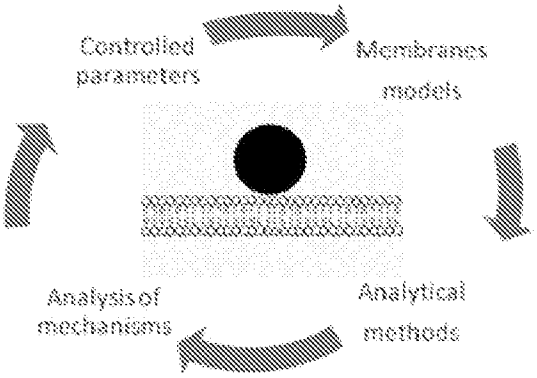
Cellulose conjugated FITC-labelled mesoporous silica nanoparticles: intracellular accumulation and stimuli responsive doxorubicin release

PATENT
REEL: 037821 FRAME: 0438



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08753H, Paper
Abdul Hakeem, Fouzia Zahid, Ruixue Duan, Muhammad Asif, Tianchi Zhang, Zhenyu Zhang, Yong Cheng, Xiaoding Lou, Fan Xia
Novel cellulose conjugated mesoporous silica nanoparticles (CLS-MSPs) for stimuli responsive intracellular doxorubicin (DOX) delivery were designed.
To cite this article before page numbers are assigned, use the DOI form of citation above.
The content of this RSS Feed (c) The Royal Society of Chemistry

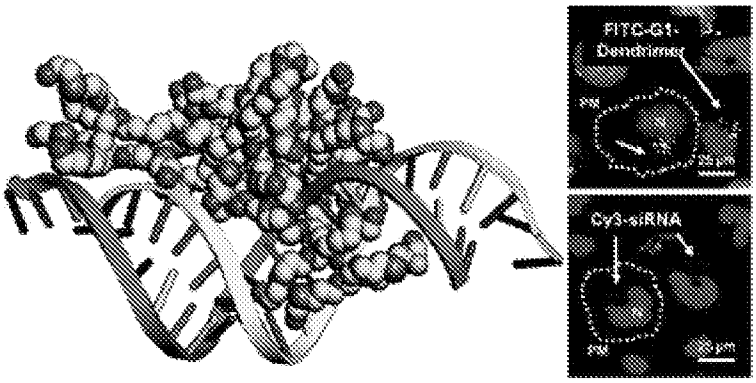
The relevance of membrane models to understand nanoparticles-cell membrane interactions



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07954C, Review Article
Estelle Rascol, Jean-Marie Devoisselle, Joel Chopineau
Membrane models are pertinent tools to explore and analyze nanoparticles-membrane interactions occurring at the cellular level.
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Low generation polyamine dendrimers bearing flexible tetraethylene glycol as nanocarriers for plasmids and siRNA

PATENT
REEL: 037821 FRAME: 0439



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR06757J, Paper
Rishi Sharma, Issan Zhang, Tze Chieh Shiao, Giovanni M. Pavan, Dusica Maysinger, Rene Roy
Polycationic tetraethyleneglycol dendrimers of low generation successfully deliver siRNA in human cells, with transfection efficiency comparable to that of Lipofectamine.
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DNA Origami Based Au-Ag-Core-Shell Nanoparticle Dimers with Single-Molecule SERS Sensitivity

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08674D, Paper
Julia Prinz, Christian Heck, Lisa Ellerik, virginia merk, Ilko Bald
DNA origami nanostructures are a versatile tool to arrange metal nanostructures and other chemical entities with nanometer precision. In this way gold nanoparticle dimers with defined distance can be constructed,...
The content of this RSS Feed (c) The Royal Society of Chemistry

Surface energy and wettability of van der Waals structures

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR06705G, Paper
Meenakshi Annamalai, Kalon Gopinadhan, Sang A Han, Surajit Saha, Hye-Jeong Park, Eun Bi Cho, Brijesh Kumar, Abhijeet Patra, Sang-Woo Kim, Thirumalai Venkatesan
Wetting behaviour of surfaces is believed to be affected by van der Waals (vdW) forces; however, there is no clear demonstration of this. With the isolation of two-dimensional vdW layered...
The content of this RSS Feed (c) The Royal Society of Chemistry

Quantitative characterization of conformational-specific protein-DNA binding using a dual-spectral interferometric imaging biosensor

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR06785E, Paper
Xirui Zhang, George Daaboul, Philipp Sphuler, Peter Droege, Selim Unlu
DNA-binding proteins play crucial roles in the maintenance and functions of the genome and yet, their specific binding mechanisms are not fully understood. Recently, it was discovered that DNA-binding proteins...
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Sequential protein unfolding through a carbon nanotube pore

PATENT
REEL: 037821 FRAME: 0440

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C6NR00410E, Paper
Zhonghe Xu, Shuang Zhang, Jeffrey K Weber, Binquan Luan, Ruhong Zhou, Jingyuan Li
An assortment of biological processes, like protein degradation and the transport of proteins across membranes, depend on protein unfolding events mediated by nanopore interfaces. In this work, we exploit fully...
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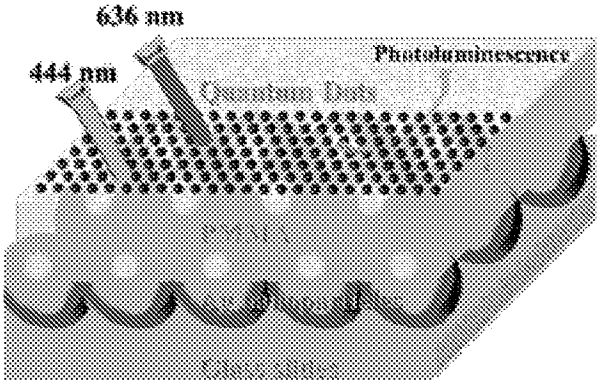
Charge Effects and Nanoparticle Pattern Formation in Electrohydrodynamic NanoDrip Printing of Colloids

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08783J, Paper
Patrizia Richner, Stephan J. P. Kress, David Norris, Dimos Poulikakos
Advancing open atmosphere printing technologies to produce features in the nanoscale range has important and broad applications ranging from electronics, to photonics, plasmonics and biology. Recently an electrohydrodynamic printing regime...
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Correction: CoPt/CeO2 catalysts for the growth of narrow diameter semiconducting single-walled carbon nanotubes

Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR90226F, Correction
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This article is licensed under a **Creative Commons Attribution 3.0 Unported Licence.**
Lei Tang, Taotao Li, Chaowei Li, Lin Ling, Kai Zhang, Yagang Yao
To cite this article before page numbers are assigned, use the DOI form of citation above.
The content of this RSS Feed (c) The Royal Society of Chemistry

Silver nanoparticle film induced photoluminescence enhancement of near-infrared emitting PbS and PbS/CdS core/shell quantum dots: observation of different enhancement mechanisms

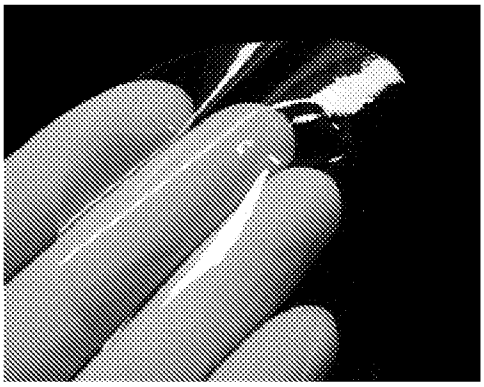


Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR05906B, Communication
H. Y. Liang, H. G. Zhao, Z. P. Li, C. Harnagea, D. L. Ma
A plasmon/fluorophore system consisting of Ag nanoparticles and near-infrared quantum dots (QDs) is investigated for photoluminescence (PL) enhancement.

PATENT
REEL: 037821 FRAME: 0441

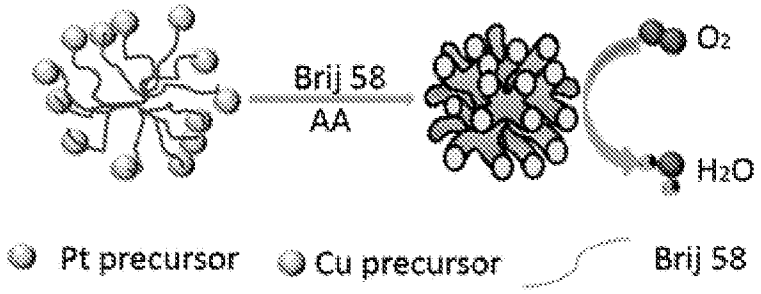
To cite this article before page numbers are assigned, use the DOI form of citation above.
The content of this RSS Feed (c) The Royal Society of Chemistry

Combinatorial release of dexamethasone and amiodarone from a nano-structured parylene-C film to reduce perioperative inflammation and atrial fibrillation



Nanoscale, 2016, **8**,4267-4275
DOI: 10.1039/C5NR07456H, Paper
Erik Robinson, Sunjay Kaushal, Justice Alaboson, Sudhish Sharma, Amogh Belagodu, Claire Watkins, Brandon Walker, Gregory Webster, Patrick McCarthy, Dean Ho
Suppressing perioperative inflammation and post-operative atrial fibrillation requires effective drug delivery platforms (DDP).
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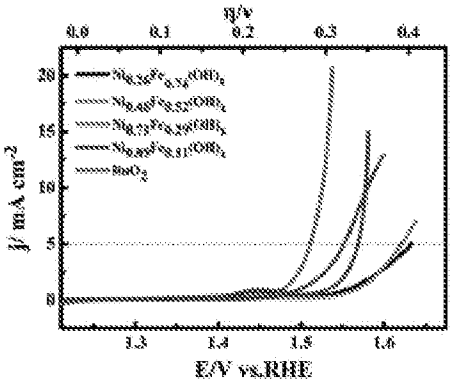
Highly branched PtCu bimetallic alloy nanodendrites with superior electrocatalytic activities for oxygen reduction reactions



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07682J, Paper
Shaofang Fu, Chengzhou Zhu, Qiurong Shi, Haibing Xia, Dan Du, Yuehe Lin
The highly branched PtCu bimetallic alloy nanodendrites were synthesized by a facile chemical reduction method using Brij 58 as the soft template. The as-prepared alloys presented superior electrocatalytic activities for oxygen reduction reactions.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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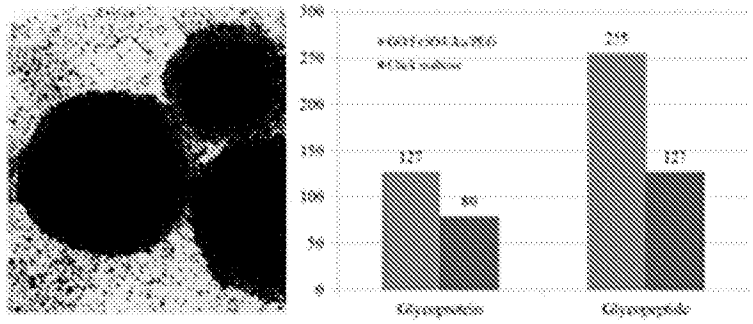
Amorphous mixed-metal hydroxide nanostructures for advanced water oxidation catalysts

PATENT
REEL: 037821 FRAME: 0442



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08989A, Paper
Y. Q. Gao, X. Y. Liu, G. W. Yang
We have synthesized amorphous mixed-metal (Ni-Fe) hydroxide nanostructures with a homogeneous distribution of Ni/Fe as well as a tunable Ni/Fe ratio by a simple, facile, green and low-cost electrochemical technique, and we have also demonstrated that the synthesized amorphous nanomaterials possess ultrahigh activity and super long-term cycle stability in the OER process.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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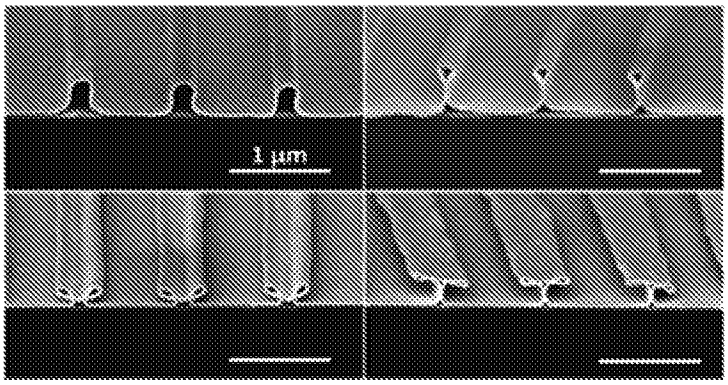
Hydrophilic GO/Fe3O4/Au/PEG nanocomposites for highly selective enrichment of glycopeptides



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08126B, Communication
Bo Jiang, Qi Wu, Nan Deng, Yuanbo Chen, Lihua Zhang, Zhen Liang, Yukui Zhang
GO/Fe_3O_4/Au/PEG nanocomposites were synthesized, and exhibited high selectivity to capture glycopeptides.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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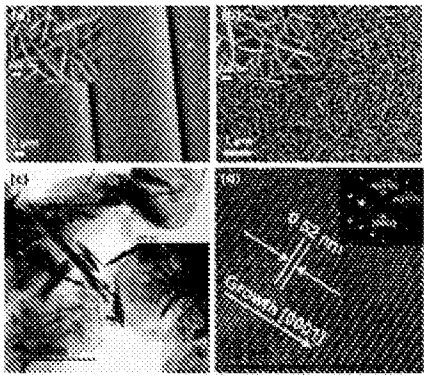
Fabrication and design of metal nano-accordion structures using atomic layer deposition and interference lithography

PATENT
REEL: 037821 FRAME: 0443



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08566G, Paper
J.-H. Min, A. Bagal, J. Z. Mundy, C. J. Oldham, B.-I. Wu, G. N. Parsons, C.-H. Chang
Fabricated free-standing platinum nano-accordion structures with a wide variety of cross-sectional profiles using a combination of ALD and IL.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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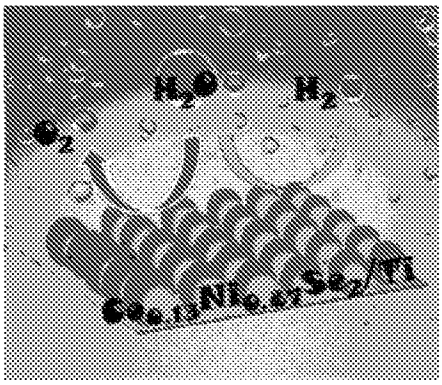
Flexible, transparent and exceptionally high power output nanogenerators based on ultrathin ZnO nanoflakes



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08324A, Paper
Huynh Van Ngoc, Dae Joon Kang
Novel nanogenerator structures composed of ZnO nanoflakes of less than 10 nm thickness were fabricated using a novel method involving a facile synthetic route and a rational design.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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Electrodeposited Co-doped NiSe2 nanoparticles film: a good electrocatalyst for efficient water splitting

PATENT
REEL: 037821 FRAME: 0444

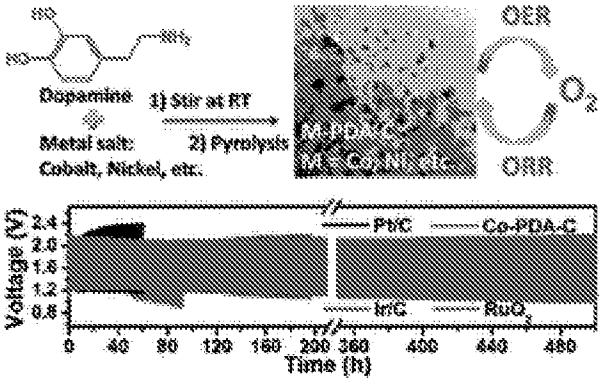


Nanoscale, 2016, **8**,3911-3915
DOI: 10.1039/C5NR07170D, Communication
Tingting Liu, Abdullah M. Asiri, Xuping Sun
Co-doped $NiSe_2$ nanoparticles film electrodeposited on Ti plate ($Co_{0.13}Ni_{0.87}Se_2$/Ti) acts as a robust water-splitting electrocatalyst in 1.0 M KOH, driving 10 mA cm^{-2} at HER overpotential of 64 mV and 100 mA cm^{-2} at OER overpotential of 320 mV.
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Correction: Polyol synthesis, functionalisation, and biocompatibility studies of superparamagnetic iron oxide nanoparticles as potential MRI contrast agents

Nanoscale, 2016, **8**,4395-4395
DOI: 10.1039/C5NR90206A, Correction
Open Access
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Roxanne Hachani, Mark Lowdell, Martin Birchall, Aziliz Hervault, Damien Mertz, Sylvie Begin-Colin, Nguyen Thị Kim Thanh
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Mussel-inspired one-pot synthesis of transition metal and nitrogen co-doped carbon (M/N-C) as efficient oxygen catalysts for Zn-air batteries

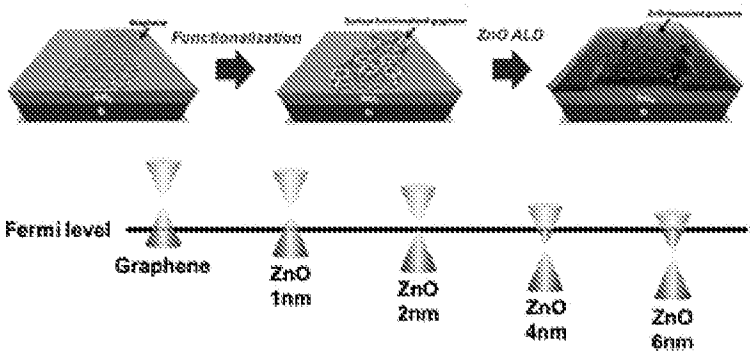


Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR06538K, Paper
Bing Li, Ye Chen, Xiaoming Ge, Jianwei Chai, Xiao Zhang, T. S. Andy Hor, Guojun Du, Zhaolin Liu, Hua Zhang, Yun Zong
Transition metal and nitrogen co-doped nanostructured carbons, synthesized *via* a simple and scalable room

PATENT
REEL: 037821 FRAME: 0445

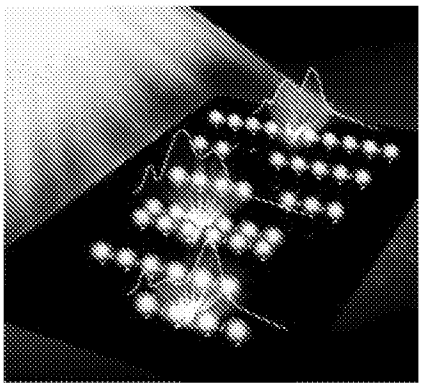
temperature approach inspired by mussels, have enabled robust cycling of Zn-air batteries.
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A non-destructive n-doping method for graphene with precise control of electronic properties via atomic layer deposition



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08016A, Paper
Kyu Seok Han, Pranav Y. Kalode, Yong-Eun Koo Lee, Hongbum Kim, Lynn Lee, Myung Mo Sung
A precise n-doping technique for graphene *via* atomic layer deposition (ALD) of ZnO thin films is presented.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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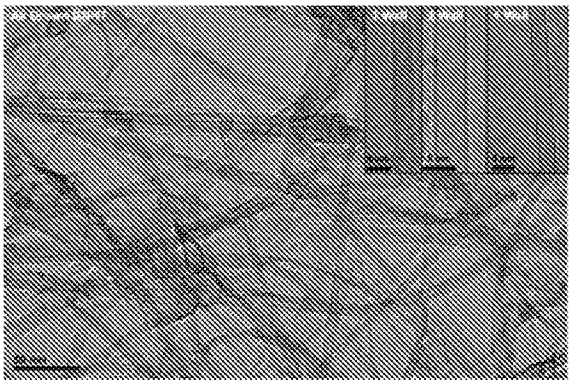
Strong plasmon coupling in self-assembled superparamagnetic nanoshell chains



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR09101B, Paper
Min Xiong, Xiulong Jin, Jian Ye
Construction of plasmonic superparamagnetic nanoshell chains by using a magnetic field is described. Strong plasmon coupling effects in the chains result in large electric field enhancements. Taking advantage of low-cost and large-area fabrication methods, these nanoshell chains are promising for biosensing, metamaterials, electromagnetic energy transport, and optical waveguide.
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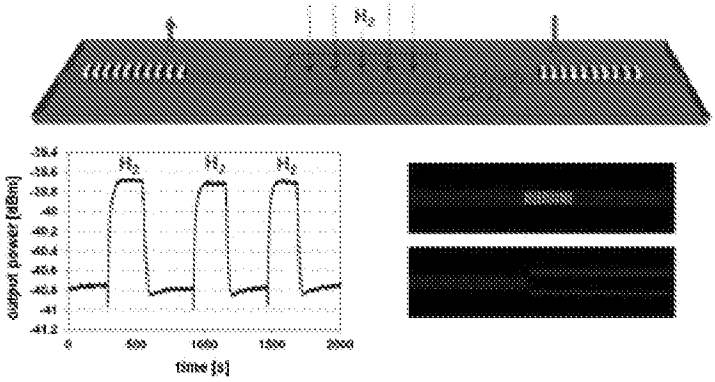
Thermodynamic approach to boron nitride nanotube solubility and dispersion

PATENT
REEL: 037821 FRAME: 0446



Nanoscale, 2016, **8**,4348-4359
DOI: 10.1039/C5NR08259E, Paper
A. L. Tiano, L. Gibbons, M. Tsui, S. I. Applin, R. Silva, C. Park, C. C. Fay
Inadequate dispersion of nanomaterials is a critical issue that significantly limits the potential properties of nanocomposites and when overcome, will enable further enhancement of material properties.
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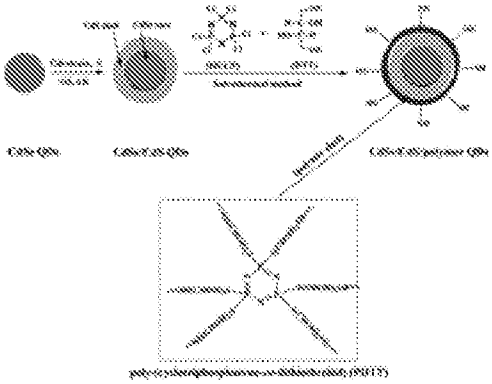
Hydrogen sensing with Pd-coated long-range surface plasmon membrane waveguides



Nanoscale, 2016, **8**,4284-4290
DOI: 10.1039/C5NR08001K, Paper
Norman R. Fong, Pierre Berini, R. N. Tait
A low power optical hydrogen sensor using a Pd film on a flexible LRSPP membrane waveguide with grating couplers.
The content of this RSS Feed (c) The Royal Society of Chemistry

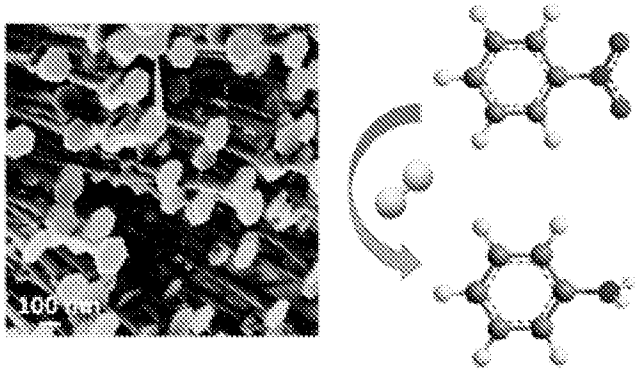
Suppressed blinking behavior of CdSe/CdS QDs by polymer coating

PATENT
REEL: 037821 FRAME: 0447



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08504G, Paper
Aidi Zhang, Yannan Bian, Jinjie Wang, Kuiyong Chen, Chaoqing Dong, Jicun Ren
Semiconductor quantum dots (QDs) are very important fluorescent nanocrystals with excellent optical properties.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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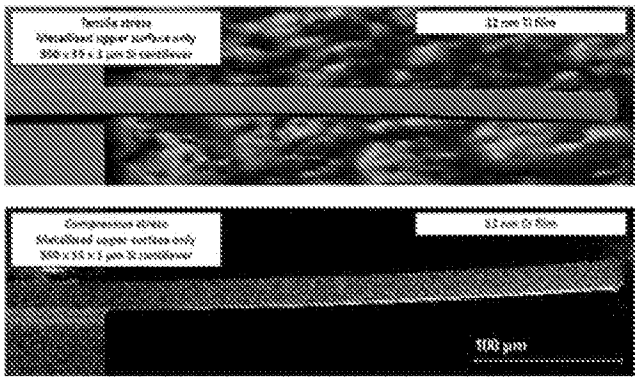
Designing axial growth of Co-Ni bimetallic nanowires with hexagon-like caps and their catalytic hydrogenation for nitrobenzene



Nanoscale, 2016, **8**,3949-3953
DOI: 10.1039/C5NR09131D, Communication
Jiawen Wang, Jingwei Liu, Nating Yang, Shuangshuang Huang, Yuhan Sun, Yan Zhu
Co-Ni bimetal nanowires with hexagonal caps are more effective than corresponding nanoparticles for the nitrobenzene hydrogenation to produce aniline.
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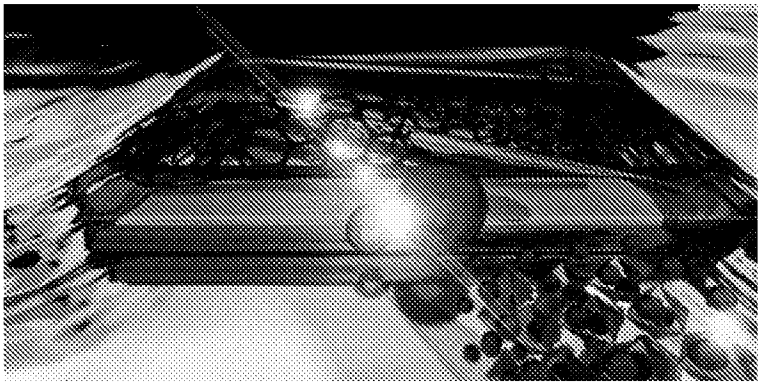
On the origin and magnitude of surface stresses due to metal nanofilms

PATENT
REEL: 037821 FRAME: 0448



Nanoscale, 2016, **8**,4245-4251
DOI: 10.1039/C5NR08789A, Paper
James Bowen, David Cheneler
Metallisation is a vital process for micro- and nanofabrication. We investigate the metallisation of silicon cantilevers with nano-films of chromium and titanium. Surface stresses acting in opposite directions were measured for these two metals.
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Ultrasensitive 1D field-effect phototransistors: CH3NH3PbI3 nanowire sensitized individual carbon nanotubes

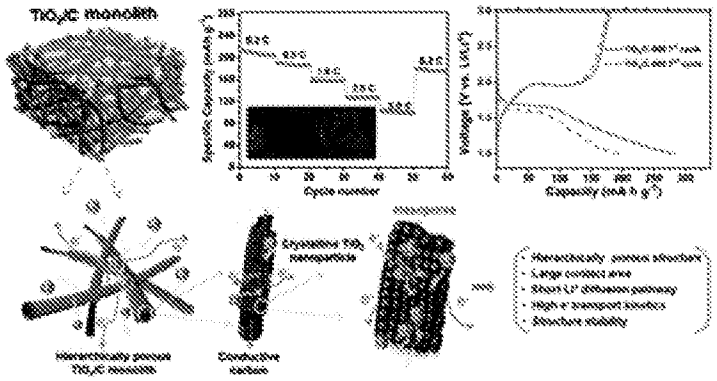


Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR06727H, Communication
M. Spina, B. Nafradi, H. M. Tohati, K. Kamaras, E. Bonvin, R. Gaal, L. Forro, E. Horvath
Field-effect phototransistors were fabricated based on individual carbon nanotubes (CNTs) sensitized by $CH_3NH_3PbI_3$ nanowires ($MAPbI_3NWs$).

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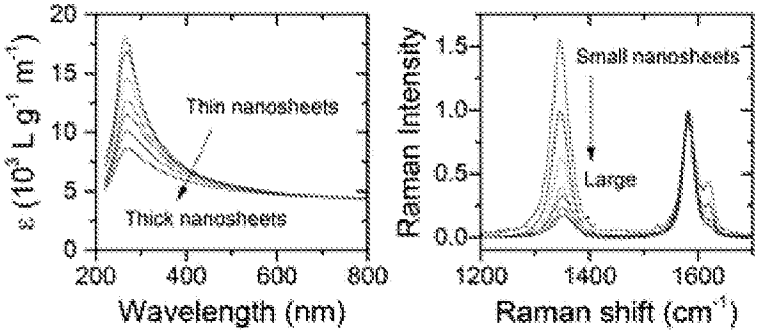
Hierarchical TiO2/C nanocomposite monoliths with a robust scaffolding architecture, mesopore-macropore network and TiO2-C heterostructure for high-performance lithium ion batteries

PATENT
REEL: 037821 FRAME: 0449



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR09149G, Paper
Hai-Bo Huang, Yue Yang, Li-Hua Chen, Yun Wang, Shao-Zhuan Huang, Jia-Wei Tao, Xiao-Ting Ma, Tawfique Hasan, Yu Li, Yan Xu, Bao-Lian Su
A general approach for the design of TiO_2/C nanocomposites with structural stability, and tunable and interconnected hierarchical porosity that leads to a new high electrochemical performance electrode.
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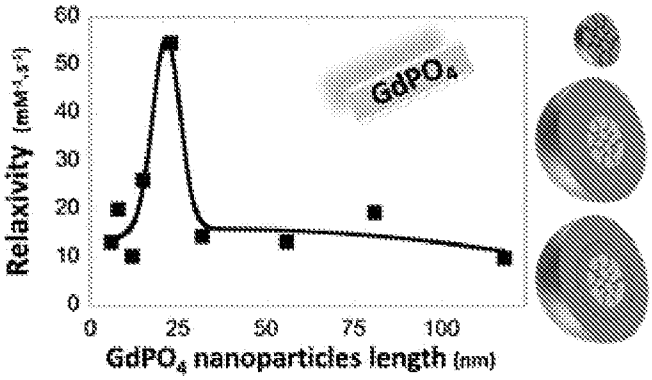
Spectroscopic metrics allow in situ measurement of mean size and thickness of liquid-exfoliated few-layer graphene nanosheets



Nanoscale, 2016, **8**,4311-4323
DOI: 10.1039/C5NR08047A, Paper
Claudia Backes, Keith R. Paton, Damien Hanlon, Shengjun Yuan, Mikhail I. Katsnelson, James Houston, Ronan J. Smith, David McCloskey, John F. Donegan, Jonathan N. Coleman
Quantitative spectroscopic metrics based on absorbance and Raman spectroscopy are presented for size-selected liquid-exfoliated graphene.
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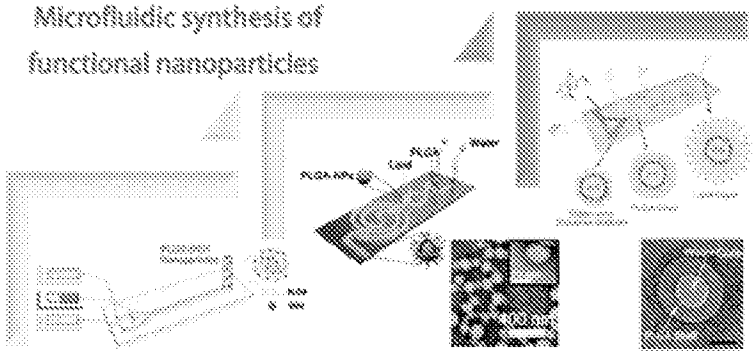
Hyperbranched polymer mediated size-controlled synthesis of gadolinium phosphate nanoparticles: colloidal properties and particle size-dependence on MRI relaxivity

PATENT
REEL: 037821 FRAME: 0450



Nanoscale, 2016, **8**,4252-4259
DOI: 10.1039/C5NR05064B, Paper
Camille Frangville, Maylis Gallois, Yichen Li, Hong Hanh Nguyen, Nancy Lauth-de Viguerie, Daniel R. Talham, Christophe Mingotaud, Jean-Daniel Marty
Core-shell(s) hyperbranched polymers were used to synthesize size-controlled gadolinium phosphate nanowires. An optimum particle size with high relaxivity values was evidenced.
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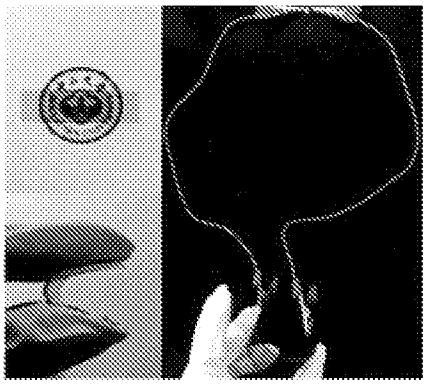
Microfluidics-mediated assembly of functional nanoparticles for cancer-related pharmaceutical applications



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07964K, Review Article
Qiang Feng, Jiashu Sun, Xingyu Jiang
This review focuses on microfluidic synthesis of functional nanoparticles with tunable structures and properties for cancer treatment and diagnosis.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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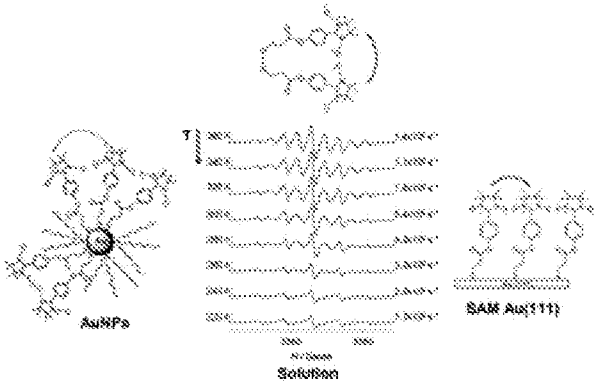
A flexible, transparent and super-long-life supercapacitor based on ultrafine Co3O4 nanocrystal electrodes

PATENT
REEL: 037821 FRAME: 0451



Nanoscale, 2016, **8**,4227-4235
DOI: 10.1039/C5NR09145D, Paper
X. Y. Liu, Y. Q. Gao, G. W. Yang
A flexible, transparent and super-long-life supercapacitor has been fabricated based on ultrafine Co_3O_4 nanocrystal electrodes.
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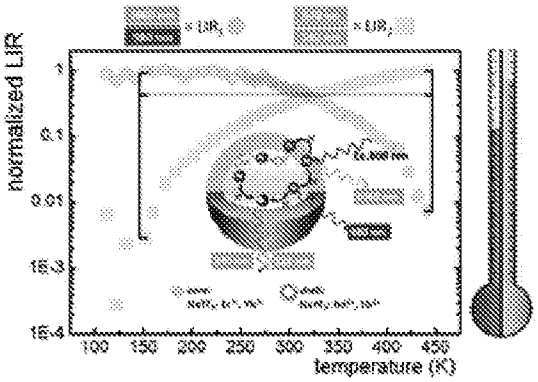
Dynamics of intramolecular spin exchange interaction of a nitronyl nitroxide diradical in solution and on surfaces



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08824K, Paper
V. Lloveras, E. Badetti, J. Veciana, J. Vidal-Gancedo
It is possible to preserve the same dynamic behaviour observed for a diradical in solution in AuNP surface-anchored radicals.
To cite this article before page numbers are assigned, use the DOI form of citation above.
The content of this RSS Feed (c) The Royal Society of Chemistry

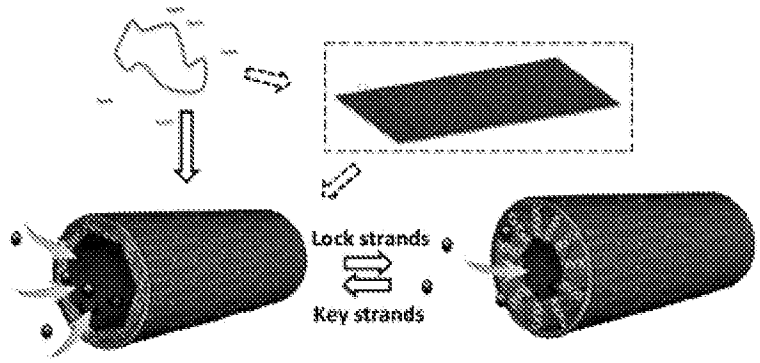
A broadening temperature sensitivity range with a core-shell YbEr@YbNd double ratiometric optical nanothermometer

PATENT
REEL: 037821 FRAME: 0452



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08223D, Paper
L. Marciniak, K. Prorok, L. Frances-Soriano, J. Perez-Prieto, A. Bednarkiewicz
The chemical architecture of lanthanide doped core-shell up-converting nanoparticles can be engineered to purposely design the properties of luminescent nanomaterials, which are typically inaccessible to their homogeneous counterparts.
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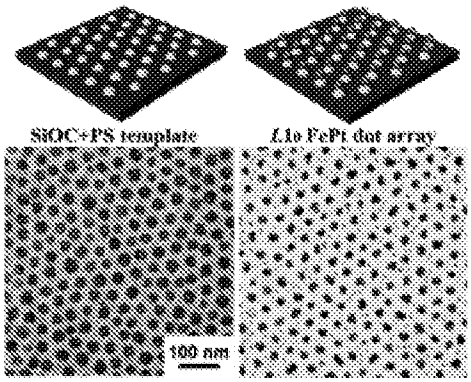
A switchable DNA origami nanochannel for regulating molecular transport at the nanometer scale



Nanoscale, 2016, **8**,3944-3948
DOI: 10.1039/C5NR08206D, Communication
Dianming Wang, Yiyang Zhang, Miao Wang, Yuanchen Dong, Chao Zhou, Mark Antonin Isbell, Zhongqiang Yang, Huajie Liu, Dongsheng Liu
A nanochannel with a shutter at one end was built by DNA nanotechnology.
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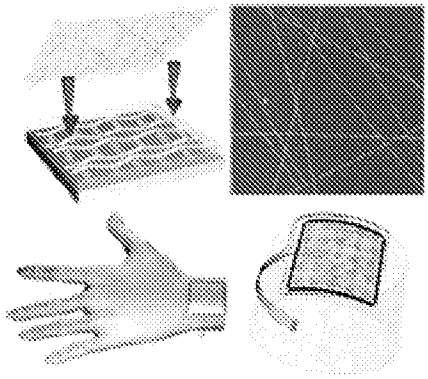
Thermal dewetting with a chemically heterogeneous nano-template for self-assembled L10 FePt nanoparticle arrays

PATENT
REEL: 037821 FRAME: 0453



Nanoscale, 2016, **8**,3926-3935
DOI: 10.1039/C5NR08339G, Communication
Liang-Wei Wang, Chung-Fu Cheng, Jung-Wei Liao, Chiu-Yen Wang, Ding-Shuo Wang, Kuo-Feng Huang, Tzu-Ying Lin, Rong-Ming Ho, Lih-Juann Chen, Chih-Huang Lai
The self-assembled $L1_0$ FePt nanoparticles are fabricated by thermal dewetting with a chemically heterogeneous nano-template.
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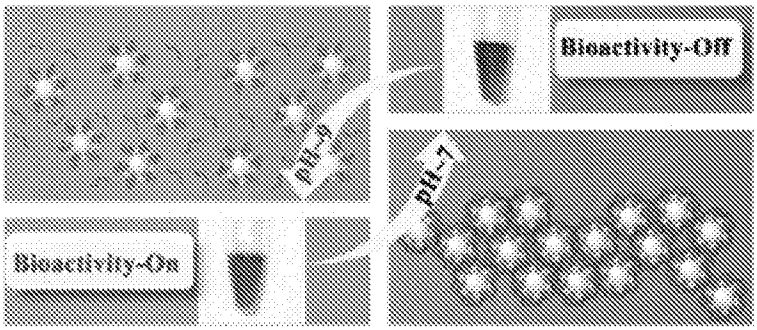
A high-performance, flexible and robust metal nanotrough-embedded transparent conducting film for wearable touch screen panels



Nanoscale, 2016, **8**,3916-3922
DOI: 10.1039/C5NR07657A, Communication
Hyeon-Gyun Im, Byeong Wan An, Jungho Jin, Junho Jang, Young-Geun Park, Jang-Ung Park, Byeong-Soo Bae
A junction resistance-free continuous metal nanotrough-embedded transparent conducting electrode (TCE) composite film (metal nanotrough-GFRHybrimer film) is reported.
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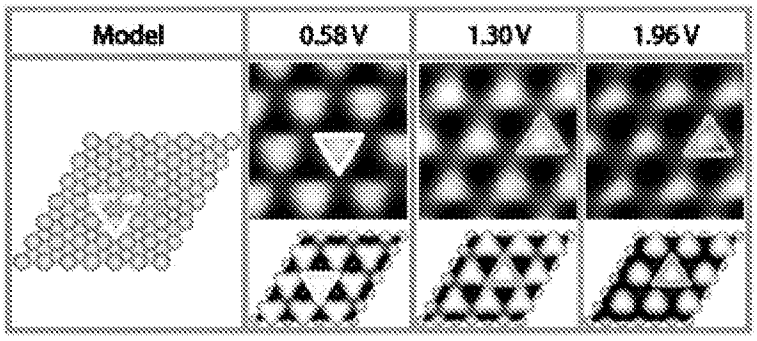
Multifunctional nanoparticle-protein conjugates with controllable bioactivity and pH responsiveness

PATENT
REEL: 037821 FRAME: 0454



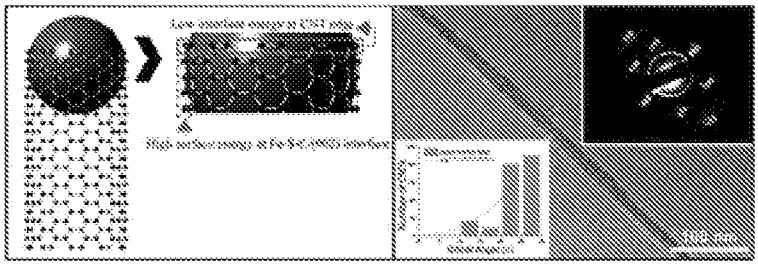
Nanoscale, 2016, **8**,4387-4394
DOI: 10.1039/C5NR07436C, Paper
Feng Liu, Lulu Xue, Yuqi Yuan, Jingjing Pan, Chenjie Zhang, Hongwei Wang, John L. Brash, Lin Yuan, Hong Chen
With the interaction of polymers, the nanoparticle-protein conjugates show controllable bioactivity and pH responsiveness.
The content of this RSS Feed (c) The Royal Society of Chemistry

Tuning the surface electronic structure of a Pt3Ti(111) electro catalyst



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08420B, Paper
M. Pa[German sz ligature}ens, V. Caciuc, N. Atodiresei, M. Moors, S. Blugel, R. Waser, S. Karthauser
Combining voltage dependent STM imaging with *ab initio* DFT calculations to identify the exact termination of an electro catalyst.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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Inherent predominance of high chiral angle metallic carbon nanotubes in continuous fibers grown from a molten catalyst

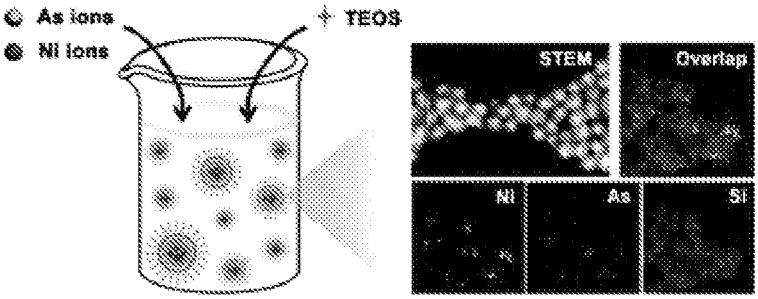


Nanoscale, 2016, **8**,4236-4244
DOI: 10.1039/C5NR07455J, Paper

PATENT
REEL: 037821 FRAME: 0455

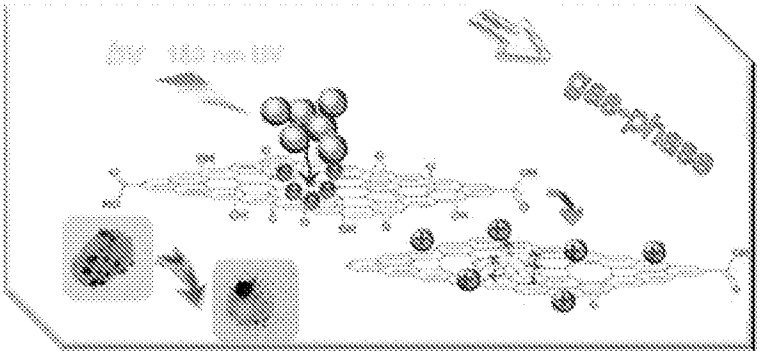
B. Aleman, M. Mar Bernal, B. Mas, Emilio M. Perez, V. Reguero, G. Xu, Y. Cui, Juan J. Vilatela
The armchair-biased chiral angle distribution in continuous fibres of CNTs is controlled by the molten state of the Fe-S-C alloy catalyst.
The content of this RSS Feed (c) The Royal Society of Chemistry

A facile route to core-shell nanoparticulate formation of arsenic trioxide for effective solid tumor treatment



Nanoscale, 2016, **8**,4373-4380
DOI: 10.1039/C5NR07860A, Paper
Zongjun Zhang, Hanyu Liu, Hualu Zhou, Xianglong Zhu, Zhenghuan Zhao, Xiaoqin Chi, Hong Shan, Jinhao Gao
The facile synthesis of pH-sensitive arsenic-based nanodrugs by a "one-pot" reverse microemulsion method was reported.
The content of this RSS Feed (c) The Royal Society of Chemistry

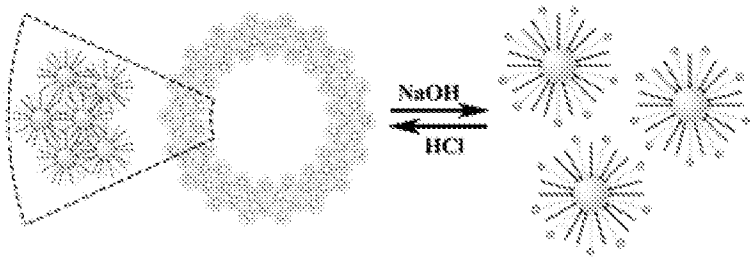
Gas-phase rapid reduction of graphene oxide through photoionization of gold nanoparticles



Nanoscale, 2016, **8**,3906-3910
DOI: 10.1039/C5NR08509H, Communication
Jeong Hoon Byeon
This work introduces for the first time a rapid reduction of graphene oxide *via* the photoionization of gold nanoparticles in a continuous gas-phase process.
The content of this RSS Feed (c) The Royal Society of Chemistry

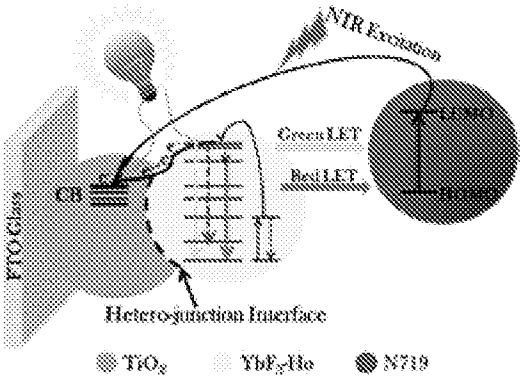
pH-Responsive reversible self-assembly of gold nanoparticles into nanovesicles

PATENT
REEL: 037821 FRAME: 0456



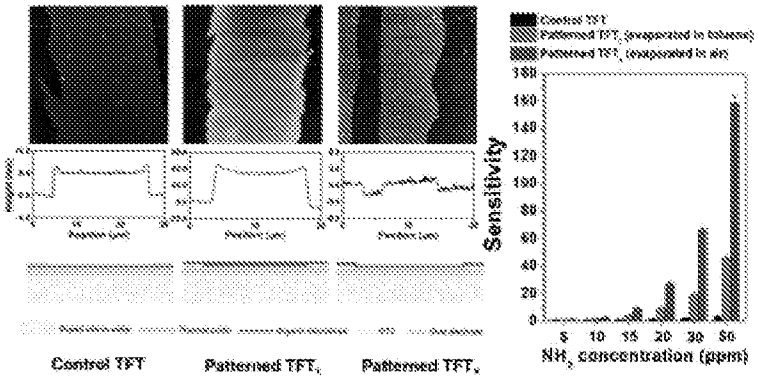
Nanoscale, 2016, **8**,3923-3925
DOI: 10.1039/C6NR00044D, Communication
Chunfang Fan, Tong Bian, Lu Shang, Run Shi, Li-Zhu Wu, Chen-Ho Tung, Tierui Zhang
pH-Responsive Au nanovesicles with reversible self-assembly and disassembly performance were developed by adjusting protonation and deprotonation of surface ligands.
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Enhanced photovoltaic performance of dye-sensitized solar cells using a new photoelectrode material: upconversion YbF3-Ho/TiO2 nanoheterostructures



Nanoscale, 2016, **8**,4173-4180
DOI: 10.1039/C5NR08319B, Paper
Jia Yu, Yulin Yang, Ruiqing Fan, Ping Wang, Yuwei Dong
UC/TiO_2 nanoheterostructures induce electron-injection from YbF_3-Ho to TiO_2 by utilizing near-infrared light, and further improve the existing merits of TiO_2.
The content of this RSS Feed (c) The Royal Society of Chemistry

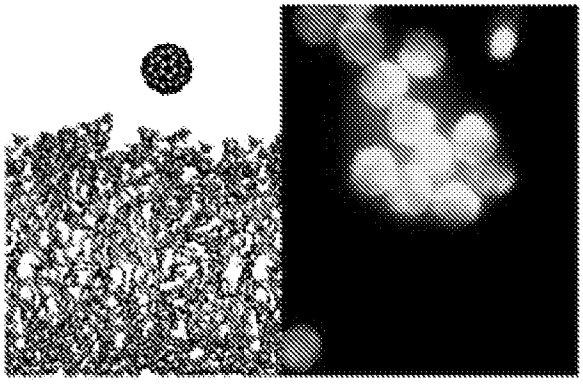
Fast patterning of oriented organic microstripes for field-effect ammonia gas sensors



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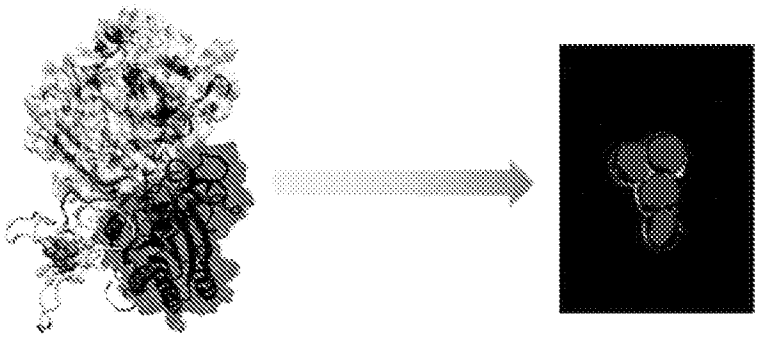
Nanoscale, 2016, **8**,3954-3961
DOI: 10.1039/C5NR09001F, Communication
Binghao Wang, Jinqiang Ding, Tao Zhu, Wei Huang, Zequn Cui, Jianmei Chen, Lizhen Huang, Lifeng Chi
A series of organic field-effect transistors (OFETs) with patterned ultra-thin films for NH_3 detection are achieved *via* fast dip-coating.
The content of this RSS Feed (c) The Royal Society of Chemistry

C60 fullerene localization and membrane interactions in RAW 264.7 immortalized mouse macrophages



Nanoscale, 2016, **8**,4134-4144
DOI: 10.1039/C5NR07003A, Paper
K. A. Russ, P. Elvati, T. L. Parsonage, A. Dews, J. A. Jarvis, M. Ray, B. Schneider, P. J. S. Smith, P. T. F. Williamson, A. Violi, M. A. Philbert
There continues to be a significant increase in the number and complexity of hydrophobic nanomaterials that are engineered for a variety of commercial purposes making human exposure a significant health concern.
The content of this RSS Feed (c) The Royal Society of Chemistry

Computational design of peptide-Au cluster probe for sensitive detection of [small alpha]IIb[small beta]3 integrin

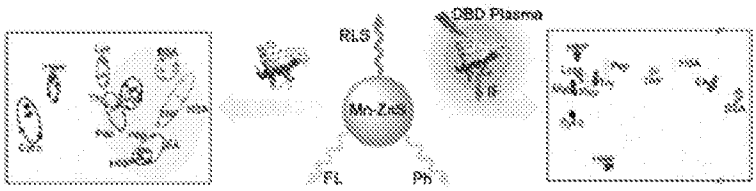


Nanoscale, 2016, **8**,4203-4208
DOI: 10.1039/C5NR09175F, Paper
Lina Zhao, Jiao Zhai, Xuejie Zhang, Xueyun Gao, Xiaohong Fang, Jingyuan Li
We have designed a novel peptide-Au cluster probe to specifically bind to [small alpha]$_{IIb}$[small beta]$_3$ integrin.
The content of this RSS Feed (c) The Royal Society of Chemistry

Plasma-assisted quadruple-channel optosensing of proteins and cells with Mn-

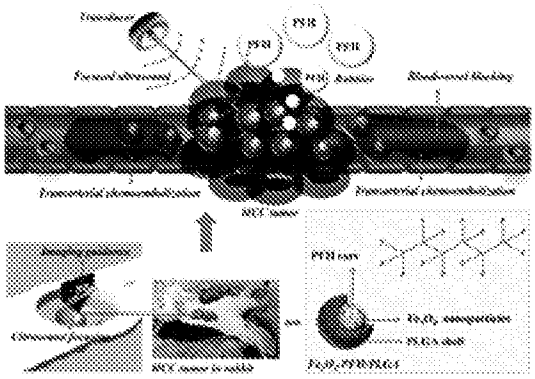
PATENT
REEL: 037821 FRAME: 0458

doped ZnS quantum dots



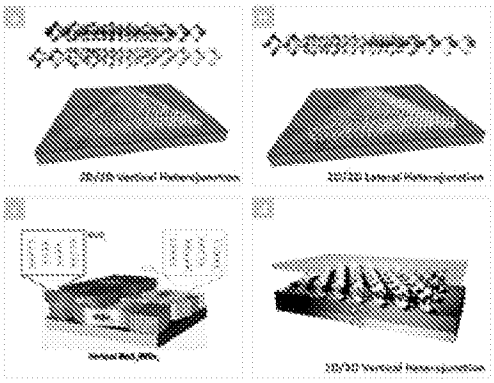
Nanoscale, 2016, **8**,4291-4298
DOI: 10.1039/C5NR09130F, Paper
Chenghui Li, Peng Wu, Xiandeng Hou
The addition of the intrinsic fluorescence of proteins to the existing triple-channel optical properties of Mn-ZnS QDs yields new quadruple-channel optosensing devices with substantially increased discrimination capacity for proteins. A low-temperature plasma for protein treatment further enforces the discrimination.
The content of this RSS Feed (c) The Royal Society of Chemistry

Nanoparticle-enhanced synergistic HIFU ablation and transarterial chemoembolization for efficient cancer therapy



Nanoscale, 2016, **8**,4324-4339
DOI: 10.1039/C5NR08292G, Paper
Yufeng You, Zhigang Wang, Haitao Ran, Yuanyi Zheng, Dong Wang, Jinshun Xu, Zhibiao Wang, Yu Chen, Pan Li
We have developed a nanoparticle-based HIFU synergistic cancer surgery enhanced by transarterial chemoembolization for high-efficient HCC treatment based on Fe_3O_4-PFH/PLGA nanocapsules.
The content of this RSS Feed (c) The Royal Society of Chemistry

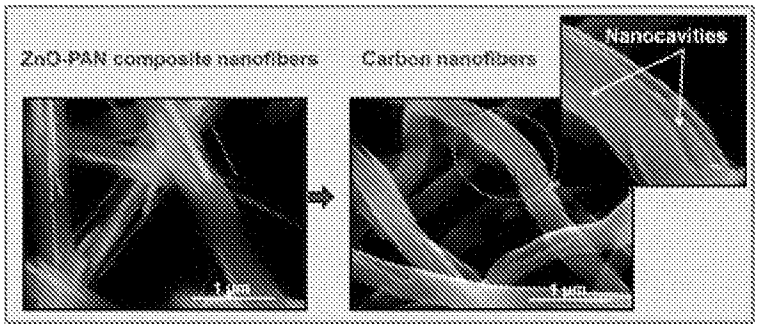
Fundamentals of lateral and vertical heterojunctions of atomically thin materials



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REEL: 037821 FRAME: 0459

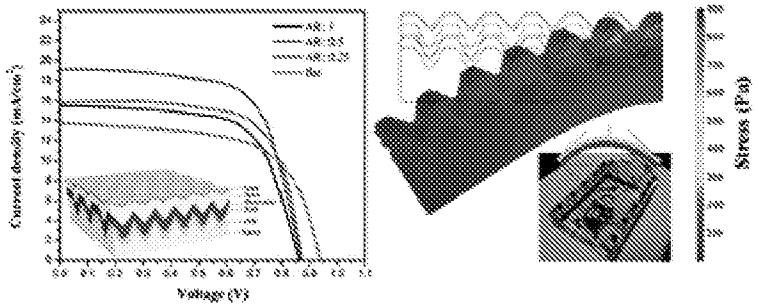
Nanoscale, 2016, **8**,3870-3887
DOI: 10.1039/C5NR08982D, Minireview
Anupum Pant, Zafer Mutlu, Darshana Wickramaratne, Hui Cai, Roger K. Lake, Cengiz Ozkan, Sefaattin Tongay
At the turn of this century, Herbert Kroemer, the 2000 Nobel Prize winner in Physics, famously commented that "the interface is the device".
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Zinc oxide nanorod assisted rapid single-step process for the conversion of electrospun poly(acrylonitrile) nanofibers to carbon nanofibers with a high graphitic content



Nanoscale, 2016, **8**,4360-4372
DOI: 10.1039/C5NR06809F, Paper
Ratyakshi Nain, Dhirendra Singh, Manjeet Jassal, Ashwini K. Agrawal
The effect of incorporation of rigid zinc oxide (ZnO) nanostructures on carbonization behavior of electrospun special acrylic fiber grade poly(acrylonitrile) (PAN-SAF) nanofibers was investigated.
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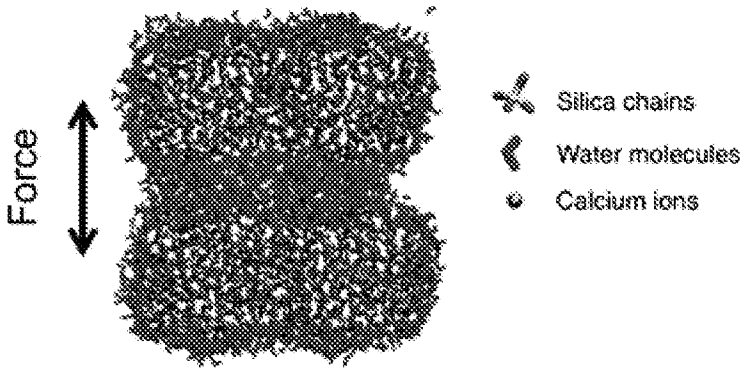
Efficient, flexible and mechanically robust perovskite solar cells on inverted nanocone plastic substrates



Nanoscale, 2016, **8**,4276-4283
DOI: 10.1039/C5NR08836D, Paper
Mohammad Mahdi Tavakoli, Qingfeng Lin, Siu-Fung Leung, Ga Ching Lui, Hao Lu, Liang Li, Bin Xiang, Zhiyong Fan
Utilization of nanostructures on photovoltaic devices can significantly improve the device energy conversion efficiency by enhancing the device light harvesting capability as well as carrier collection efficiency.
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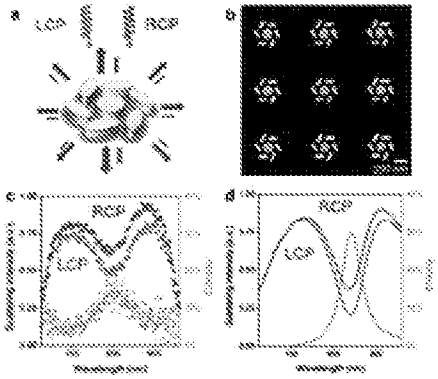
Interaction grand potential between calcium-silicate-hydrate nanoparticles at the molecular level

PATENT
REEL: 037821 FRAME: 0460



Nanoscale, 2016, **8**,4160-4172
DOI: 10.1039/C5NR08142D, Paper
Patrick A. Bonnaud, Christophe Labbez, Ryuji Miura, Ai Suzuki, Naoto Miyamoto, Nozomu Hatakeyama, Akira Miyamoto, Krystyn J. Van Vliet
Mean forces and interaction grand potentials between calcium-silicate-hydrate particles.
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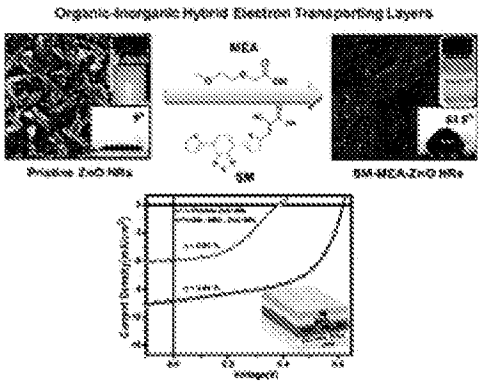
Planar plasmonic chiral nanostructures



Nanoscale, 2016, **8**,3900-3905
DOI: 10.1039/C5NR09302C, Communication
Shuai Zu, Yanjun Bao, Zheyu Fang
A strong chiral optical response induced at a plasmonic Fano resonance in a planar Au heptamer nanostructure was experimentally and theoretically demonstrated.
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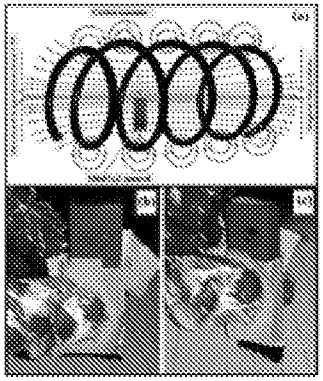
Co-functionalized organic/inorganic hybrid ZnO nanorods as electron transporting layers for inverted organic solar cells

PATENT
REEL: 037821 FRAME: 0461



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08849F, Paper
Swapnil B. Ambade, Rohan B. Ambade, Seung Hun Eom, Myung-Jin Baek, Sushil S. Bagde, Rajaram S. Mane, Soo-Hyoung Lee
The first hybrid co-functionalization of solution processed planar ZnO nanorod ETLs in iOSCs with organic small molecule based on a D-A-D configuration with meticulous control of aggregation.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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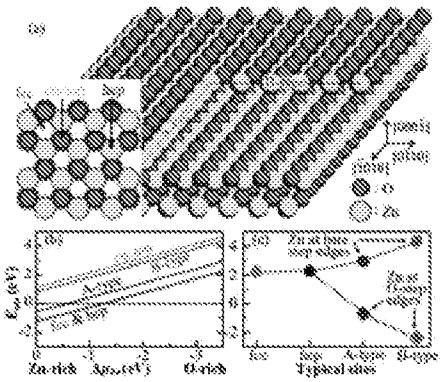
Fe3C-filled carbon nanotubes: permanent cylindrical nanomagnets possessing exotic magnetic properties



Nanoscale, 2016, **8**,4299-4310
DOI: 10.1039/C5NR09188H, Paper
Reetu Kumari, Lucky Krishnia, Vinay Kumar, Sandeep Singh, H. K. Singh, R. K. Kotnala, R. R. Juluri, U. M. Bhatta, P. V. Satyam, Brajesh S. Yadav, Zainab Naqvi, Pawan K. Tyagi
We study how confinement affects the magnetism of Fe_3C filled CNTs and stress induced structural phase transition. A model describing the growth mechanism as well as *in situ* pole formation in nanorod is discussed.
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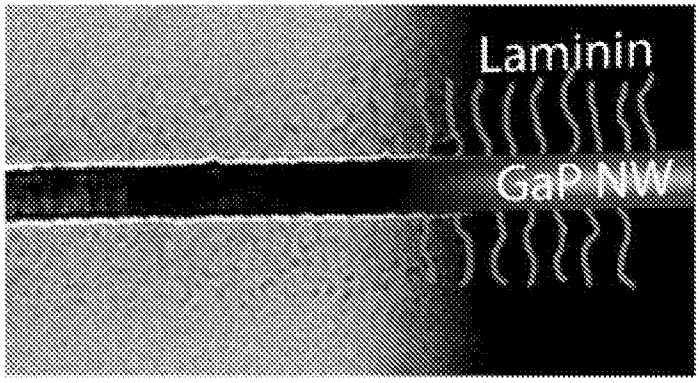
Effects of nitrogen dopants on the atomic step kinetics and electronic structures of O-polar ZnO

PATENT
REEL: 037821 FRAME: 0462



Nanoscale, 2016, **8**,4381-4386
DOI: 10.1039/C5NR09060A, Paper
Hao Wang, Huahan Zhan, Yinghui Zhou, Yaping Wu, Xiaohang Chen, Huiqiong Wang, Junyong Kang
Oxygen-polar ZnO films are grown in step flow mode by molecular beam epitaxy.
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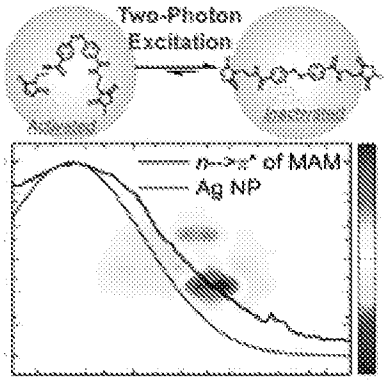
Electron microscopy imaging of proteins on gallium phosphide semiconductor nanowires



Nanoscale, 2016, **8**,3936-3943
DOI: 10.1039/C5NR08888G, Communication
Martin Hjort, Mikael Bauer, Stefan Gunnarsson, Erik Marsell, Alexei A. Zakharov, Gunnel Karlsson, Elodie Sanfins, Christelle N. Prinz, Reine Wallenberg, Tommy Cedervall, Anders Mikkelsen
We have imaged GaP nanowires (NWs) incubated with human laminin, serum albumin (HSA), and blood plasma using both cryo-transmission electron microscopy and synchrotron based X-ray photoemission electron microscopy.
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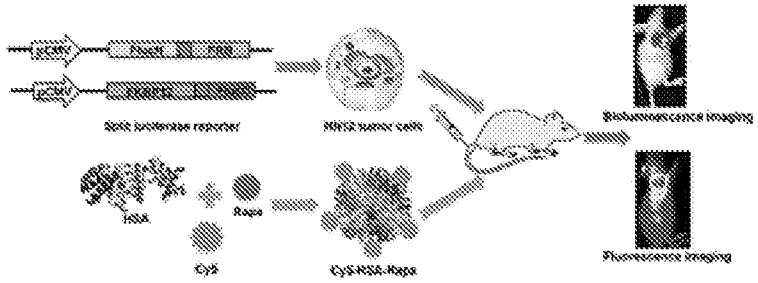
Plasmon-enhanced two-photon-induced isomerization for highly-localized light-based actuation of inorganic/organic interfaces

PATENT
REEL: 037821 FRAME: 0463



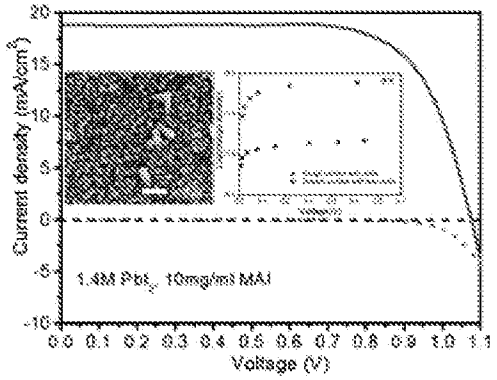
Nanoscale, 2016, **8**,4194-4202
DOI: 10.1039/C5NR07973J, Paper
Chang-Keun Lim, Xin Li, Yue Li, Kurt L. M. Drew, J. Pablo Palafox-Hernandez, Zhenghua Tang, Alexander Baev, Andrey N. Kuzmin, Marc R. Knecht, Tiffany R. Walsh, Mark T. Swihart, Hans Agren, Paras N. Prasad
Plasmon-enhanced two-photon isomerization of non-donor/acceptor modified azobenzene on Ag NPs.
The content of this RSS Feed (c) The Royal Society of Chemistry

Combined image guided monitoring the pharmacokinetics of rapamycin loaded human serum albumin nanoparticles with a split luciferase reporter



Nanoscale, 2016, **8**,3991-4000
DOI: 10.1039/C5NR07308A, Paper
Fu Wang, Kai Yang, Zhe Wang, Ying Ma, J. Silvio Gutkind, Naoki Hida, Gang Niu, Jie Tian
This integrated imaging platform could provide more reliable respective PK profiles of a loaded drug and its carrier.
The content of this RSS Feed (c) The Royal Society of Chemistry

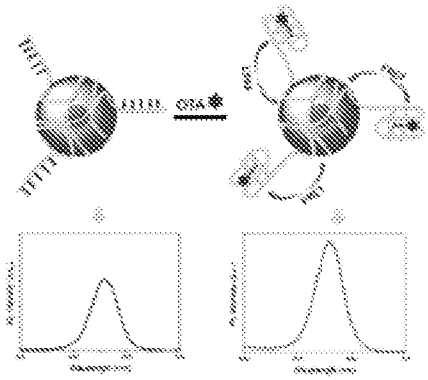
Influence of void-free perovskite capping layer on the charge recombination process in high performance CH3NH3PbI3 perovskite solar cells



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REEL: 037821 FRAME: 0464

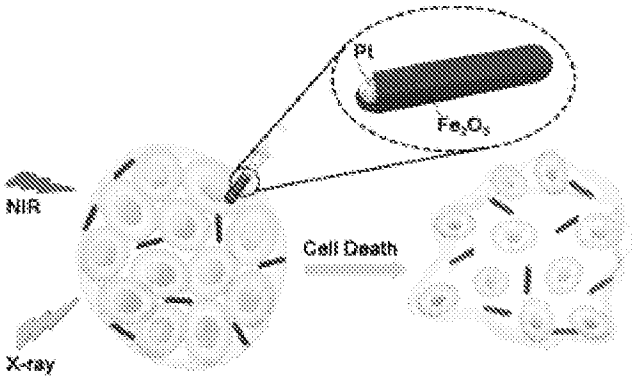
Nanoscale, 2016, **8**,4181-4193
DOI: 10.1039/C5NR06362K, Paper
Kunwu Fu, Christopher T. Nelson, Mary Cooper Scott, Andrew Minor, Nripan Mathews, Lydia Helena Wong
Uniform surface coverage of perovskite capping layer formed with less void formation reduces charge recombination and enhances device performance.
The content of this RSS Feed (c) The Royal Society of Chemistry

A self-assembly aptasensor based on thick-shell quantum dots for sensing of ochratoxin A



Nanoscale, 2016, **8**,4127-4133
DOI: 10.1039/C5NR08284F, Paper
Xianfeng Chu, Xiaowen Dou, Ruizheng Liang, Menghua Li, Weijun Kong, Xihui Yang, Jiaoyang Luo, Meihua Yang, Ming Zhao
A tunable-valency self-assembling aptasensor based on a thick-shell quantum dot was fabricated for ochratoxin A (OTA).
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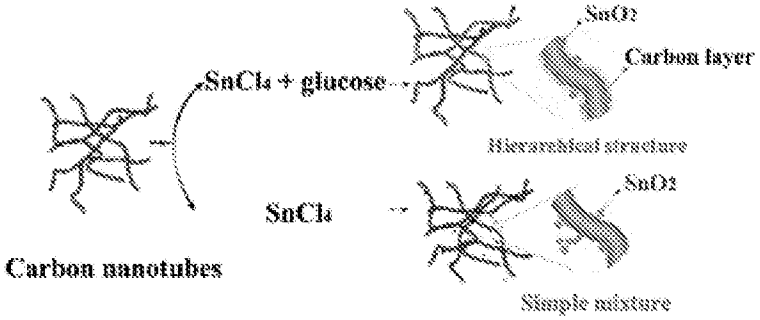
Facile preparation of hybrid core-shell nanorods for photothermal and radiation combined therapy



Nanoscale, 2016, **8**,3895-3899
DOI: 10.1039/C5NR09102K, Communication
Yaoyao Deng, Erdong Li, Xiaju Cheng, Jing Zhu, Shuanglong Lu, Cuicui Ge, Hongwei Gu, Yue Pan
Water-soluble platinum@iron oxide core-shell nanorods were synthesized and explored for NIR photothermal and X-ray radiation combined therapy.
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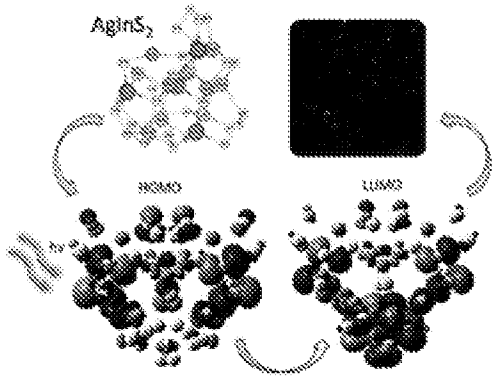
PATENT
REEL: 037821 FRAME: 0465

Carbon coated SnO2 nanoparticles anchored on CNT as a superior anode material for lithium-ion batteries



Nanoscale, 2016, **8**,4121-4126
DOI: 10.1039/C5NR07996A, Paper
Chunrong Ma, Weimin Zhang, Yu-Shi He, Qiang Gong, Haiying Che, Zi-Feng Ma
High performance hierarchically structured carbon covering SnO_2 nanoparticles on CNTs were synthesized *via* a facile glucose mediated hydrothermal method and subsequent calcination as an anode for lithium-ion batteries.
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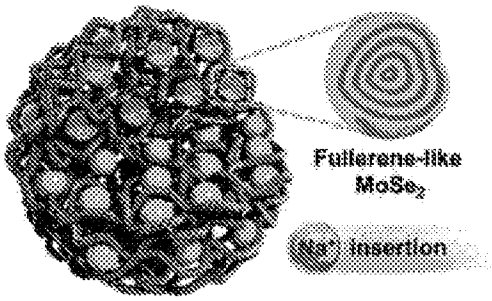
Two blinking mechanisms in highly confined AgInS2 and AgInS2/ZnS quantum dots evaluated by single particle spectroscopy



Nanoscale, 2016, **8**,4151-4159
DOI: 10.1039/C5NR07992F, Paper
B. Cichy, R. Rich, A. Olejniczak, Z. Gryczynski, W. Strek
Ternary $AgInS_2$ quantum dots (QDs) have been found as promising cadmium-free, red-shifted, and tunable luminescent bio-probes with efficient Stokes and anti-Stokes excitations and luminescence lifetimes (*ca.* 100 ns) convenient for time resolved techniques.
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Fullerene-like MoSe2 nanoparticles-embedded CNT balls with excellent structural stability for highly reversible sodium-ion storage

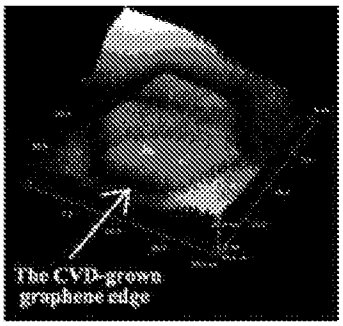
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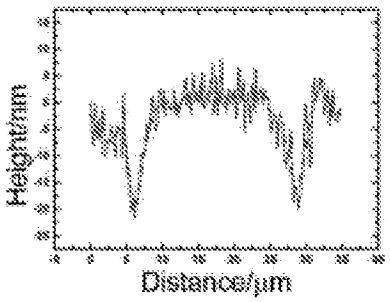


Fullerene-like $MoSe_2$ nanoparticles embedded CNT ball

Nanoscale, 2016, **8**,4209-4216
DOI: 10.1039/C5NR07733H, Paper
Seung Ho Choi, Yun Chan Kang
Three-dimensional (3D) porous-structured carbon nanotube (CNT) balls embedded with metal selenide nanocrystals were prepared by a simple two-step process. The fullerene-like $MoSe_2$/CNT composite balls, selected as the first target material, showed excellent sodium-ion storage properties.
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Edge morphology evolution of graphene domains during chemical vapor deposition cooling revealed through hydrogen etching

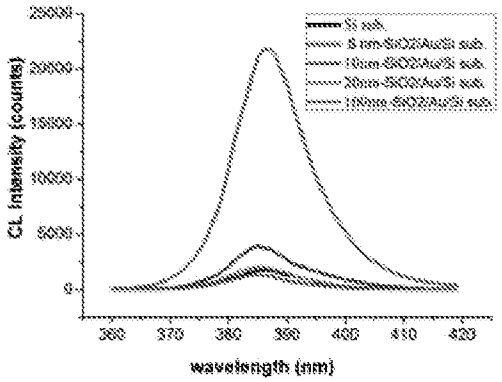




Nanoscale, 2016, **8**,4145-4150
DOI: 10.1039/C5NR06624G, Paper
Haoran Zhang, Yanhui Zhang, Yaqian Zhang, Zhiying Chen, Yanping Sui, Xiaoming Ge, Guanghui Yu, Zhi Jin, Xinyu Liu
The CVD cooling process induced graphene edge evolution, such as nanoparticle accumulation and graphene edge sinking. The results revealed the peculiar graphene-Cu movement during CVD cooling.
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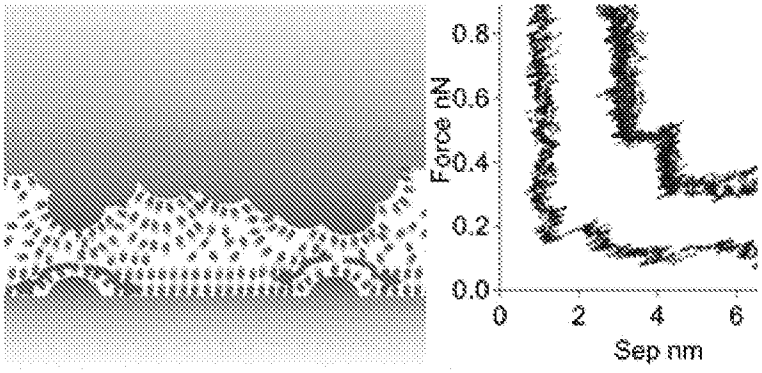
Strongly enhanced ultraviolet emission of an Au@SiO2/ZnO plasmonic hybrid nanostructure

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Nanoscale, 2016, **8**,4030-4036
DOI: 10.1039/C5NR06153A, Paper
Li Wang, Xiaodong Wang, Shengcheng Mao, Hua Wu, Xia Guo, Yuan Ji, Xiaodong Han
We present the surface plasmon polariton (SPP)-enhanced ultraviolet (UV) emission of an Au@SiO_2/ZnO hybrid nanostructure.
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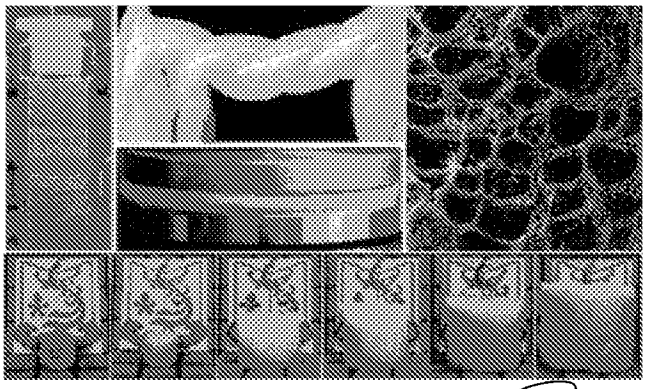
Layering of ionic liquids on rough surfaces



Nanoscale, 2016, **8**,4094-4106
DOI: 10.1039/C5NR07805A, Paper
Alexis Sheehan, L. Andres Jurado, Shivaprakash N. Ramakrishna, Andrea Arcifa, Antonella Rossi, Nicholas D. Spencer, Rosa M. Espinosa-Marzal
Structural forces reveal the ordered structure of one ionic liquid at rough interfaces of well-defined nanoscale roughness, also under nanoconfinement.
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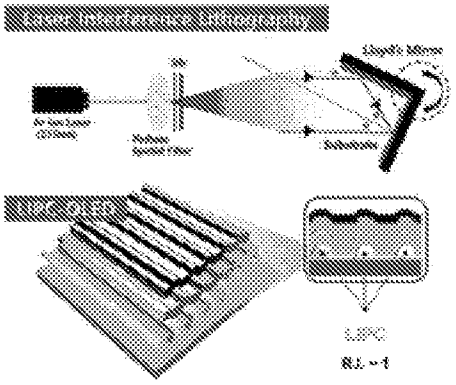
Aqueous compatible boron nitride nanosheets for high-performance hydrogels

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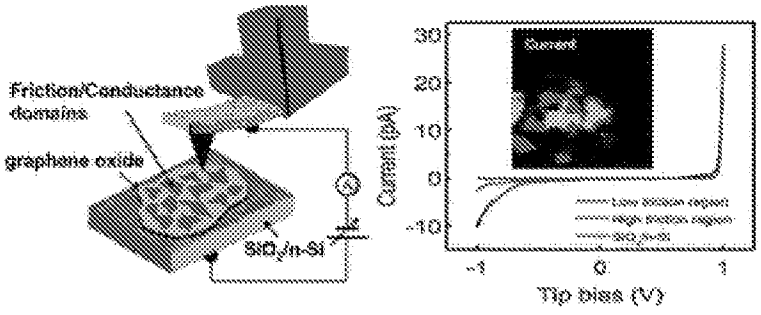
Nanoscale, 2016, **8**,4260-4266
DOI: 10.1039/C5NR07578E, Paper
Xiaozhen Hu, Jiahui Liu, Qiuju He, Yuan Meng, Liu Cao, Ya-Ping Sun, Jijie Chen, Fushen Lu
Aqueous dispersible boron nitride nanosheets were produced and used to fabricate nanocomposite hydrogels with high water retentivity and flexibility.
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An extremely low-index photonic crystal layer for enhanced light extraction from organic light-emitting diodes



Nanoscale, 2016, **8**,4113-4120
DOI: 10.1039/C5NR07312J, Paper
Yong Sub Shim, Ju Hyun Hwang, Cheol Hwee Park, Sun-Gyu Jung, Young Wook Park, Byeong-Kwon Ju
This paper reports organic light-emitting diodes (OLEDs) with improved light extraction fabricated by embedding an extremely low-index photonic crystal (LIPC) layer.
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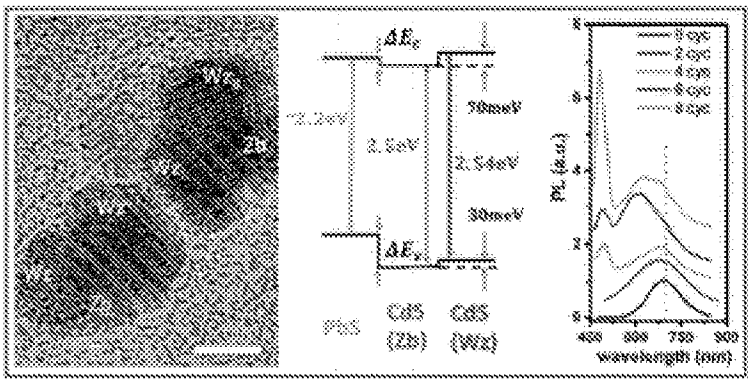
Friction and conductance imaging of sp2- and sp3-hybridized subdomains on single-layer graphene oxide



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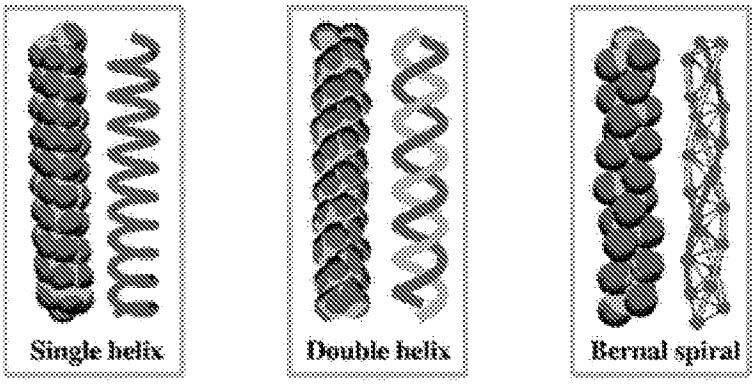
Nanoscale, 2016, **8**,4063-4069
DOI: 10.1039/C5NR06469D, Paper
Hyunsoo Lee, Narae Son, Hu Young Jeong, Tae Gun Kim, Gyeong Sook Bang, Jong Yun Kim, Gi Woong Shim, Kalyan C. Goddeti, Jong Hun Kim, Namdong Kim, Hyun-Joon Shin, Wondong Kim, Sehun Kim, Sung-Yool Choi, Jeong Young Park
We investigated the subdomain structures of graphene oxide with friction and conductance mappings.
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Dual emission in asymmetric "giant" PbS/CdS/CdS core/shell/shell quantum dots



Nanoscale, 2016, **8**,4217-4226
DOI: 10.1039/C5NR08881J, Paper
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Haiguang Zhao, Gianluca Sirigu, Andrea Parisini, Andrea Camellini, Giuseppe Nicotra, Federico Rosei, Vittorio Morandi, Margherita Zavelani-Rossi, Alberto Vomiero
Dual emission in asymmetric "giant" PbS/CdS/CdS core/shell/shell quantum dots enables color monitoring/modulation and control in the visible/NIR region for advanced applications.
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Supracolloidal helices from soft Janus particles by tuning the particle softness



Nanoscale, 2016, **8**,4070-4076
DOI: 10.1039/C5NR07011B, Paper
Qing-Zhi Zou, Zhan-Wei Li, Zhong-Yuan Lu, Zhao-Yan Sun
Supracolloidal helices including single helices, double helices, and Bernal spirals are observed through the self-

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assembly of soft Janus particles by properly tuning particle softness.
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Highly effective and uniform SERS substrates fabricated by etching multi-layered gold nanoparticle arrays

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C6NR00502K, Paper
Li Zhang, Changrong Guan, Ying Wang, Jianhui Liao
Gold nanoparticle multilayers printed on silicon substrates layer by layer were etched by gold etchant to form highly effective and uniform substrates for surface-enhanced Raman scattering (SERS). The performance of...
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Highly efficient plasmonic tip design for plasmon nanofocusing in near-field optical microscopy

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08548A, Paper
Takayuki Umakoshi, Yuika Saito, Prabhat Verma
Near-field scanning optical microscopy (NSOM) combined with plasmon nanofocusing is a powerful nano-analytical tool due to its attractive feature of efficient background suppression as well as light energy compression into...
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3D Flexible Water Channel: Stretchability of Nanoscale Water Bridge

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08072J, Paper
Jige Chen, Chunlei Wang, Ning Wei, Rongzheng Wan, Yi Gao
Artificial water channel contributes to a better understanding of natural water channel and aims to offer highly selective, advanced conductance system. Most studies use nanotubes, however it is difficult to...
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Silver Nanoparticles Confined in Carbon Nanotubes: On the Understanding of

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Confinement Effect and Promotional Catalysis for the Selective Hydrogenation of Dimethyl Oxalate

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08651E, Paper
Jianwei Zheng, Xinping Duan, Haiqiang Lin, Zhengqiang Gu, Huihuang Fang, Jianhui Li, Youzhu Yuan
Confined Ag nanomaterial in the channels of herringbone multi-wall carbon nanotubes (Ag-in/hCNT) was effectively prepared. The space restriction induces morphological changes of Ag nanoparticles into rough nanowires with an estimated...
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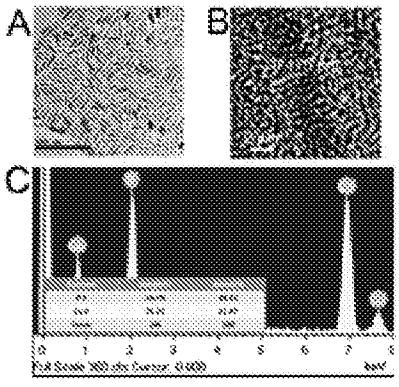
Large-area uniform and low-cost dual-mode plasmonic naked-eye colorimetry and SERS sensor with handheld Raman spectrometer

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08357E, Paper
Zhida Xu, Jing Jiang, Xinhao Wang, Kevin Han, Abid Ameen, Ibrahim Khan, Te-Wei Chang, Logan Liu
We demonstrated a highly-sensitive, wafer-scale, high-uniform plasmonic nano-mushroom substrate based on plastic for naked-eye plasmonic colorimetry and surface-enhanced Raman spectroscopy (SERS). We gave it the name FlexBrite. The dual-mode functionality...
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Elevated Gold Ellipse Nanoantenna Dimers as Sensitive and Tunable Surface Enhanced Raman Spectroscopy Substrates

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08920D, Paper
Aaron M Jubb, Yang Jiao, Gyula Eres, Scott Thomas Retterer, Baohua Gu
We demonstrate large area arrays of elevated gold ellipse dimers with precisely controlled gaps for use as sensitive and highly controllable surface enhanced Raman scattering (SERS) substrates. The significantly enhanced...
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A facile solution-phase synthesis of cobalt phosphide nanorods/hollow nanoparticles

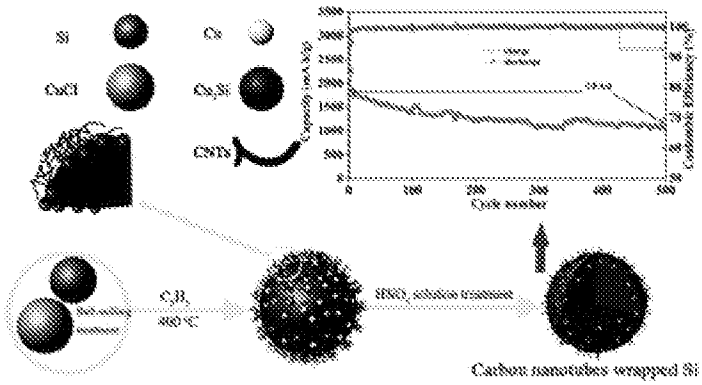


Nanoscale, 2016, Advance Article
DOI: 10.1039/C6NR00208K, Communication
Weiwei Yang, Yarong Huang, Jinlong Fan, Yongsheng Yu, Chunhui Yang, Haibo Li
A simple one-step solution-phase synthesis of cobalt phosphide nanorods (NRs) and hollow nanoparticles

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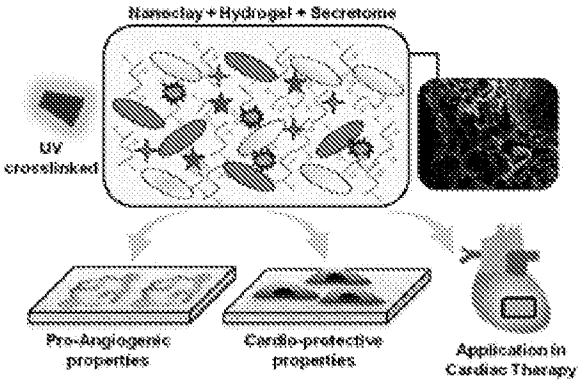
(NPs) has been reported in this paper.
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In situ growth of carbon nanotube wrapped Si composites as anodes for high performance lithium ion batteries



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08961A, Communication
Jianbin Zhou, Yang Lan, Kailong Zhang, Guoliang Xia, Jin Du, Yongchun Zhu, Yitai Qian
Carbon nanotube wrapped Si was synthesized *in situ* by using the CCVD method at 400 [degree]C and shows high electrochemical performance.
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Stem cell secretome-rich nanoclay hydrogel: a dual action therapy for cardiovascular regeneration

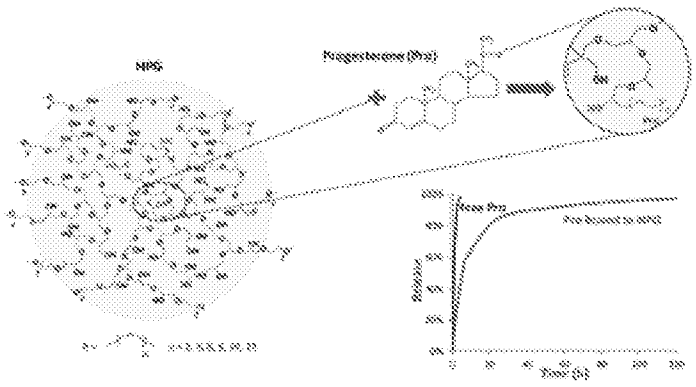


Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07806G, Communication
Renae Waters, Settimio Pacelli, Ryan Maloney, Indrani Medhi, Rafeeq P. H. Ahmed, Arghya Paul
We report development of a nanocomposite hydrogel platform using nanoclay materials and stem cell derived secretome for cardiac tissue repair and therapy.
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Progesterone binding nano-carriers based on hydrophobically modified

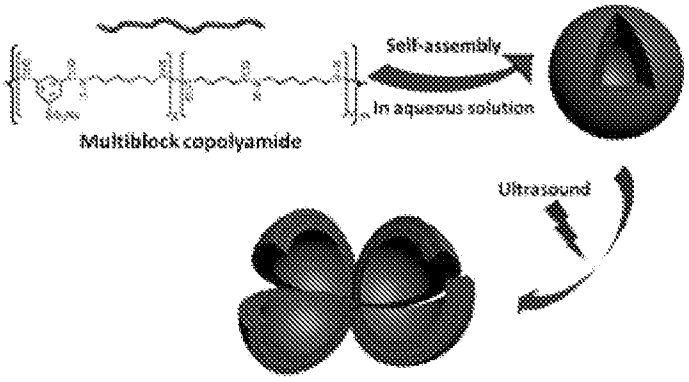
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hyperbranched polyglycerols



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08175K, Paper
M. Alizadeh Noghani, D. E. Brooks
A family of hydrophobically derivatized HPGs is assessed as a potential carrier for progesterone, an important steroid. Molecular determinants of binding and the release kinetics are investigated and the surprising role of non-freezing water on release kinetics described.
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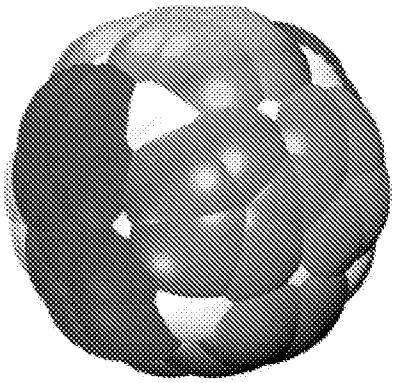
Ultrasound-responsive ultrathin multiblock copolyamide vesicles



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08596A, Communication
Lei Huang, Chunyang Yu, Tong Huang, Shuting Xu, Yongping Bai, Yongfeng Zhou
Novel ultrasound-responsive polymer vesicles with ultrathin walls and a special packing model were generated from an amphiphilic multiblock copolyamide.
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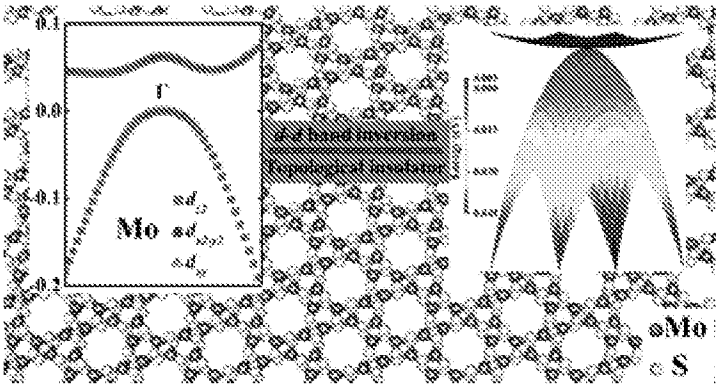
Sc20C60: a volleyballene

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Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07784B, Paper
Jing Wang, Hong-Man Ma, Ying Liu
A stable volleyball-like molecular cluster, *Volleyballene* $Sc_{20}C_{60}$, was identified. It possesses relatively high symmetry and a hollow space that can be used to accommodate other atoms or molecules for the purpose of studying fundamental chemistry.
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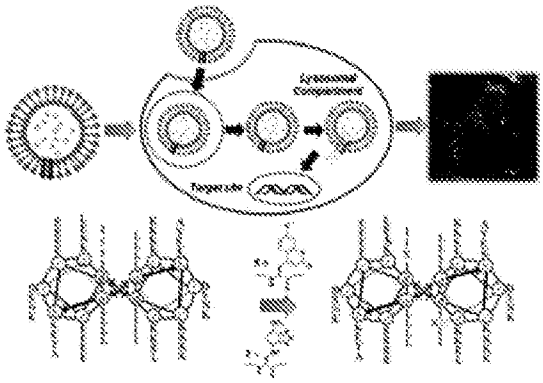
New quantum spin Hall insulator in two-dimensional MoS2 with periodically distributed pores



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08842A, Communication
Peng-Fei Liu, Liujiang Zhou, Thomas Frauenheim, Li-Ming Wu
A new two-dimensional topological insulator in two-dimensional MoS_2 with periodically distributed pores is predicted. Pure d-d band inversion is responsible for the quantum spin Hall effect. Theoretical analysis shows the largest nontrivial gap among MoS_2 isomers.
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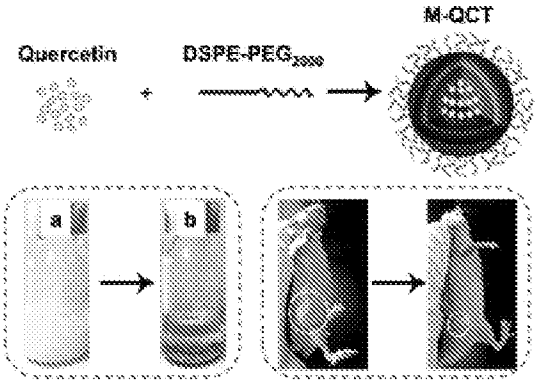
pH sensitive coiled coils: a strategy for enhanced liposomal drug delivery

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Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07734F, Paper
Rahi M. Reja, Mohsina Khan, Sumeet K. Singh, Rajkumar Misra, Anjali Shiras, Hosahudya N. Gopi
Design of pH sensitive coiled coils and their incorporation into the liposome vesicles as triggers for the controlled release of encapsulated drugs are reported.
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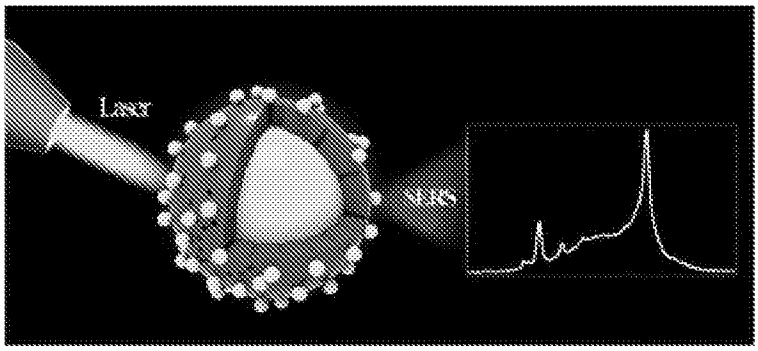
Quercetin-loaded nanomicelles to circumvent human castration-resistant prostate cancer in vitro and in vivo



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08966B, Paper
Jing Zhao, Juan Liu, Tuo Wei, Xiaowei Ma, Qiang Cheng, Shuaidong Huo, Chunqiu Zhang, Yanan Zhang, Xianglin Duan, Xing-Jie Liang
We develop a nanomicelle-based quercetin delivery system, which exhibits superior anticancer activity in the castration-resistant prostate cancer model.
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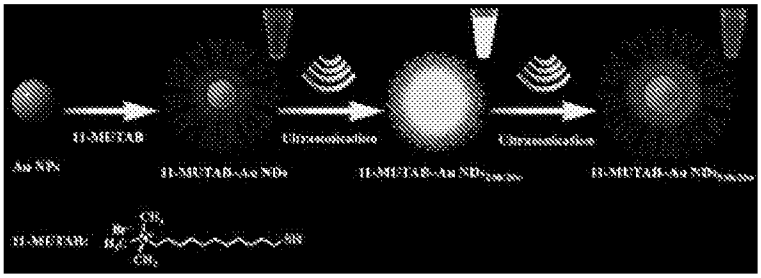
Hydrothermal synthesis of Ag@MSiO2@Ag three core-shell nanoparticles and their sensitive and stable SERS properties

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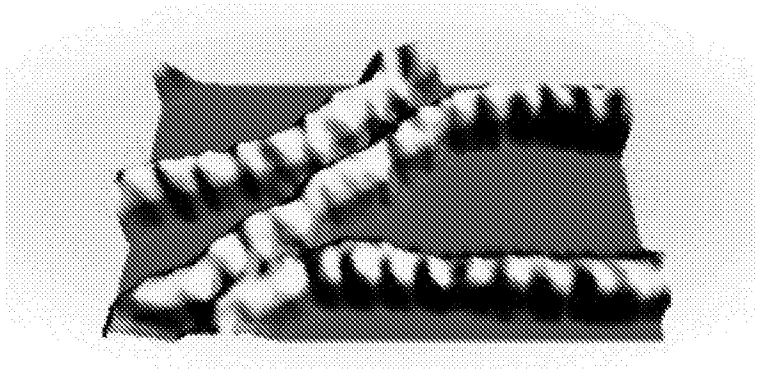
Nanoscale, 2016, Advance Article
DOI: 10.1039/C6NR00006A, Communication
Tao Jiang, Xiaolong Wang, Jun Zhou, Dong Chen, Ziqi Zhao
We report a unique Ag@$MSiO_2$@Ag three core-shell nanostructure as a SERS substrate with both sensitivity and stability.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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Ultrasound-mediated modulation of the emission of gold nanodots



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08387G, Paper
Yu-Ting Tseng, Rochelle Cherng, Zhiqin Yuan, Chien-Wei Wu, Huan-Tsung Chang, Chih-Ching Huang
Ultrasonication treatment of (11-mercaptoundecyl)-*N*,*N*,*N*-trimethylammonium bromide-capped gold nanodots (11-MUTAB-Au NDs) boosts a >1000-fold enhancement in its photoluminescence due to the smaller size and the higher 11-MUTAB ligand density on the surfaces.
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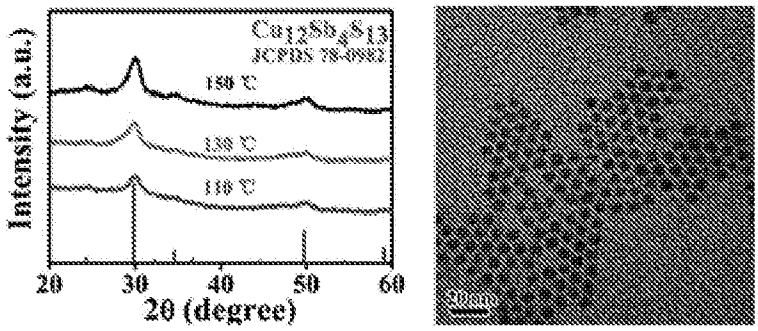
High resolution atomic force microscopy of double-stranded RNA



PATENT
REEL: 037821 FRAME: 0478

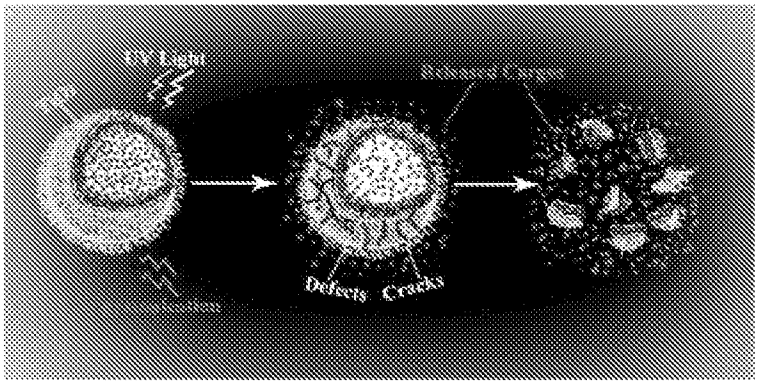
Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07445B, Paper
Pablo Ares, Maria Eugenia Fuentes-Perez, Elias Herrero-Galan, Jose M. Valpuesta, Adriana Gil, Julio Gomez-Herrero, Fernando Moreno-Herrero
Imaging double-stranded RNA at sub-helical pitch resolution with atomic force microscopy in liquid.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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A green synthesis route for the phase and size tunability of copper antimony sulfide nanocrystals with high yield



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR09097K, Paper
Keqiang Chen, Jing Zhou, Wen Chen, Qiao Chen, Peng Zhou, Yueli Liu
Typical XRD patterns of $Cu_{12}Sb_4S_{13}$ NCs with various sizes and a TEM image of 5.76 nm $Cu_{12}Sb_4S_{13}$ NCs.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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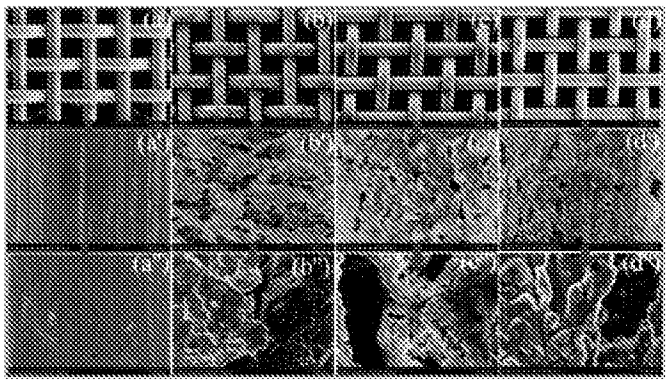
Bifunctional ultraviolet/ultrasound responsive composite TiO2/polyelectrolyte microcapsules



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR06666B, Paper
Hui Gao, Dongsheng Wen, Nadezda V. Tarakina, Jierong Liang, Andy J. Bushby, Gleb B. Sukhorukov
Functional composite TiO_2/polyelectrolyte microcapsules encapsulated with payloads are controllably opened by either ultraviolet or ultrasound treatment.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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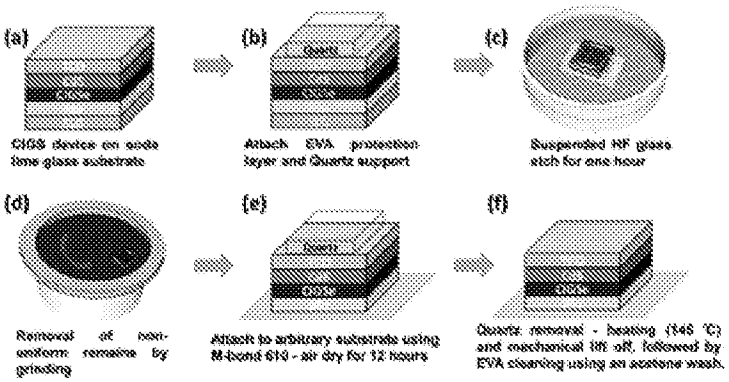
PATENT
REEL: 037821 FRAME: 0479

A multifunctional polymeric nanofilm with robust chemical performances for special wettability



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07601C, Paper
Yabin Wang, Feng Lin, Yaping Dong, Zhong Liu, Wu Li, Yudong Huang
A multifunctional polymeric nanofilm of a triazinedithiolsilane compound, which can protect metallic substrates and activate the corresponding surface simultaneously, is introduced onto a copper mesh surface *via* facile solution-immersion approaches.
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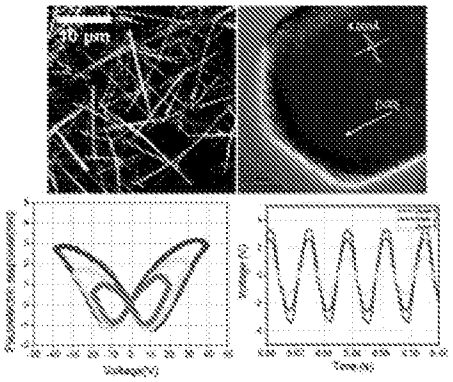
A facile chemical-mechanical polishing lift-off transfer process toward large scale Cu(In,Ga)Se2 thin-film solar cells on arbitrary substrates



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07008B, Paper
Kuan-Chun Tseng, Yu-Ting Yen, Stuart R. Thomas, Hung-Wei Tsai, Cheng-Hung Hsu, Wen-Chi Tsai, Chang-Hong Shen, Jia-Min Shieh, Zhiming M. Wang, Yu-Lun Chueh
The fabrication of Cu(In,Ga)Se_2 (CIGS) solar cells on flexible substrates is a non-trivial task due to thermal and ion diffusion related issues.
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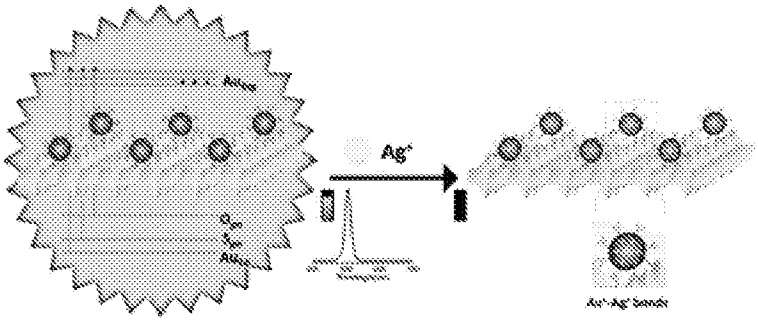
Lead-free 0.5Ba(Zr0.2Ti0.8)O3-0.5(Ba0.7Ca0.3)TiO3 nanowires for energy harvesting

PATENT
REEL: 037821 FRAME: 0480



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR09029F, Paper
Zhi Zhou, Christopher C. Bowland, Mohammad H. Malakooti, Haixiong Tang, Henry A. Sodano
$0.5Ba(Zr_{0.2}Ti_{0.8})O_3$-$0.5(Ba_{0.7}Ca_{0.3})TiO_3$ (BZT-BCT) nanowires with high piezoelectric coupling coefficient (90 +/- 5 pm V^{-1}) are utilized to fabricate a flexible, energy harvesting nanocomposite producing an open circuit voltage of 6.25 V and a power density of 2.25 [small mu]W cm^{-3}.
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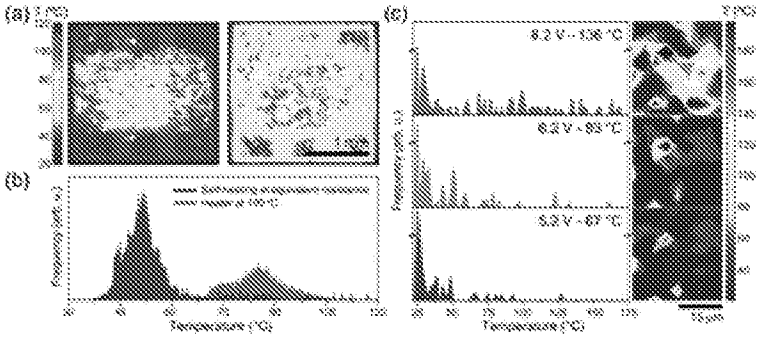
Green emission and Ag+ sensing of hydroxy double salt supported gold nanoclusters



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07029E, Paper
Jinyang Lu, Chunxiang Xu, Zhengshan Tian, Junfeng Lu, Yi Lin, Zengliang Shi
This work demonstrates a green-emitting complex of Zn-containing hydroxy double salt supported gold nanoclusters and its application for sensing Ag^+.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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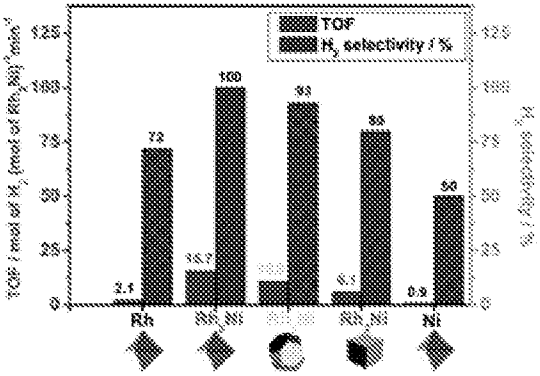
Localized self-heating in large arrays of 1D nanostructures

PATENT
REEL: 037821 FRAME: 0481



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07158E, Paper
O. Monereo, S. Illera, A. Varea, M. Schmidt, T. Sauerwald, A. Schutze, A. Cirera, J. D. Prades
Thermographic image of a CNFs film heated up by means of self-heating (left image) and external heater (right image). Raman mapping of the temperature distribution in a CNFs self-heated region at three different nominal temperatures with each corresponding temperature histogram.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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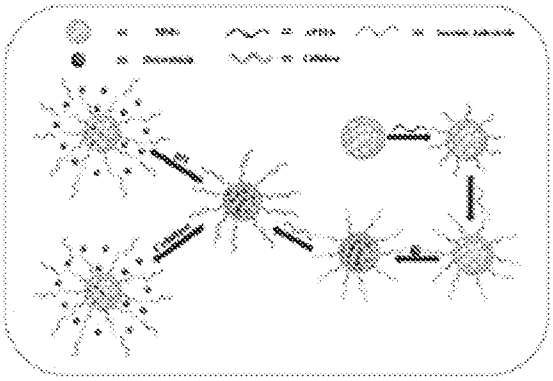
Synthesis of octahedral, truncated octahedral, and cubic Rh2Ni nanocrystals and their structure-activity relationship for the decomposition of hydrazine in aqueous solution to hydrogen



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR09227B, Paper
Chun Li, Tao Wang, Wei Chu, Ping Wu, Dong Ge Tong
Rh_2Ni nanocrystals with a higher percentage of {111} facets exhibited higher activity and H_2 selectivity during hydrazine dehydrogenation in aqueous solution.
To cite this article before page numbers are assigned, use the DOI form of citation above.
The content of this RSS Feed (c) The Royal Society of Chemistry

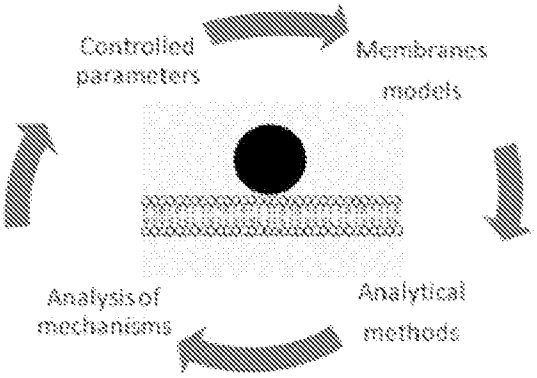
Cellulose conjugated FITC-labelled mesoporous silica nanoparticles: intracellular accumulation and stimuli responsive doxorubicin release

PATENT
REEL: 037821 FRAME: 0482



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08753H, Paper
Abdul Hakeem, Fouzia Zahid, Ruixue Duan, Muhammad Asif, Tianchi Zhang, Zhenyu Zhang, Yong Cheng, Xiaoding Lou, Fan Xia
Novel cellulose conjugated mesoporous silica nanoparticles (CLS-MSPs) for stimuli responsive intracellular doxorubicin (DOX) delivery were designed.
To cite this article before page numbers are assigned, use the DOI form of citation above.
The content of this RSS Feed (c) The Royal Society of Chemistry

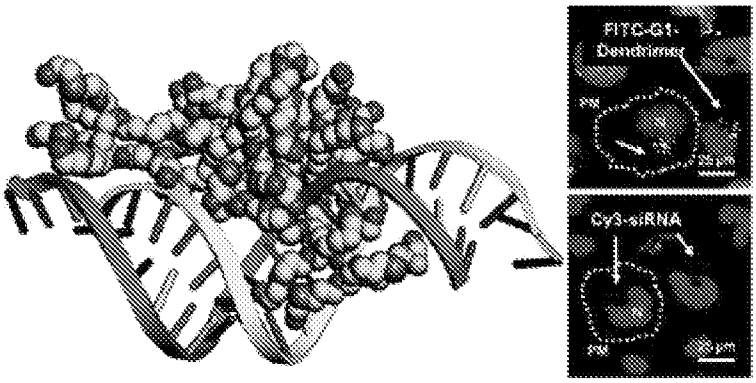
The relevance of membrane models to understand nanoparticles-cell membrane interactions



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07954C, Review Article
Estelle Rascol, Jean-Marie Devoisselle, Joel Chopineau
Membrane models are pertinent tools to explore and analyze nanoparticles-membrane interactions occurring at the cellular level.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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Low generation polyamine dendrimers bearing flexible tetraethylene glycol as nanocarriers for plasmids and siRNA

PATENT
REEL: 037821 FRAME: 0483



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR06757J, Paper
Rishi Sharma, Issan Zhang, Tze Chieh Shiao, Giovanni M. Pavan, Dusica Maysinger, Rene Roy
Polycationic tetraethyleneglycol dendrimers of low generation successfully deliver siRNA in human cells, with transfection efficiency comparable to that of Lipofectamine.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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DNA Origami Based Au-Ag-Core-Shell Nanoparticle Dimers with Single-Molecule SERS Sensitivity

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08674D, Paper
Julia Prinz, Christian Heck, Lisa Ellerik, virginia merk, Ilko Bald
DNA origami nanostructures are a versatile tool to arrange metal nanostructures and other chemical entities with nanometer precision. In this way gold nanoparticle dimers with defined distance can be constructed,...
The content of this RSS Feed (c) The Royal Society of Chemistry

Surface energy and wettability of van der Waals structures

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR06705G, Paper
Meenakshi Annamalai, Kalon Gopinadhan, Sang A Han, Surajit Saha, Hye-Jeong Park, Eun Bi Cho, Brijesh Kumar, Abhijeet Patra, Sang-Woo Kim, Thirumalai Venkatesan
Wetting behaviour of surfaces is believed to be affected by van der Waals (vdW) forces; however, there is no clear demonstration of this. With the isolation of two-dimensional vdW layered...
The content of this RSS Feed (c) The Royal Society of Chemistry

Quantitative characterization of conformational-specific protein-DNA binding using a dual-spectral interferometric imaging biosensor

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR06785E, Paper
Xirui Zhang, George Daaboul, Philipp Sphuler, Peter Droege, Selim Unlu
DNA-binding proteins play crucial roles in the maintenance and functions of the genome and yet, their specific binding mechanisms are not fully understood. Recently, it was discovered that DNA-binding proteins...
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Sequential protein unfolding through a carbon nanotube pore

PATENT
REEL: 037821 FRAME: 0484

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C6NR00410E, Paper
Zhonghe Xu, Shuang Zhang, Jeffrey K Weber, Binquan Luan, Ruhong Zhou, Jingyuan Li
An assortment of biological processes, like protein degradation and the transport of proteins across membranes, depend on protein unfolding events mediated by nanopore interfaces. In this work, we exploit fully...
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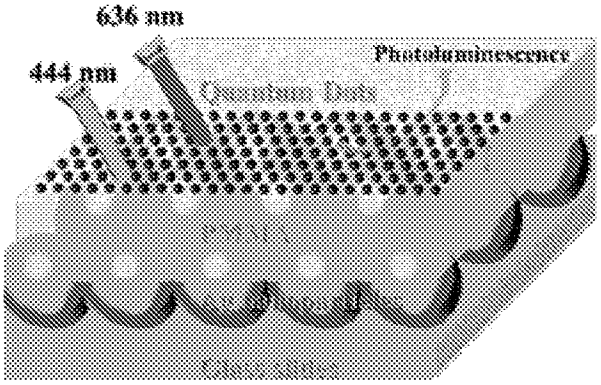
Charge Effects and Nanoparticle Pattern Formation in Electrohydrodynamic NanoDrip Printing of Colloids

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08783J, Paper
Patrizia Richner, Stephan J. P. Kress, David Norris, Dimos Poulikakos
Advancing open atmosphere printing technologies to produce features in the nanoscale range has important and broad applications ranging from electronics, to photonics, plasmonics and biology. Recently an electrohydrodynamic printing regime...
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Correction: CoPt/CeO2 catalysts for the growth of narrow diameter semiconducting single-walled carbon nanotubes

Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR90226F, Correction
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Lei Tang, Taotao Li, Chaowei Li, Lin Ling, Kai Zhang, Yagang Yao
To cite this article before page numbers are assigned, use the DOI form of citation above.
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Silver nanoparticle film induced photoluminescence enhancement of near-infrared emitting PbS and PbS/CdS core/shell quantum dots: observation of different enhancement mechanisms

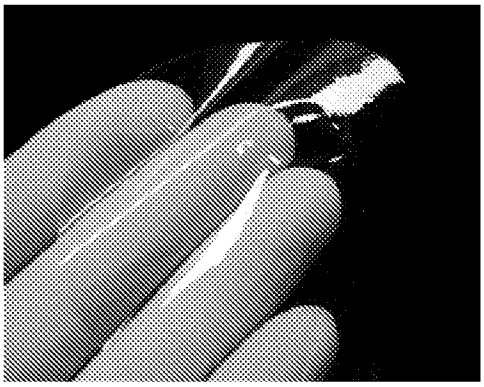


Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR05906B, Communication
H. Y. Liang, H. G. Zhao, Z. P. Li, C. Harnagea, D. L. Ma
A plasmon/fluorophore system consisting of Ag nanoparticles and near-infrared quantum dots (QDs) is investigated for photoluminescence (PL) enhancement.

PATENT
REEL: 037821 FRAME: 0485

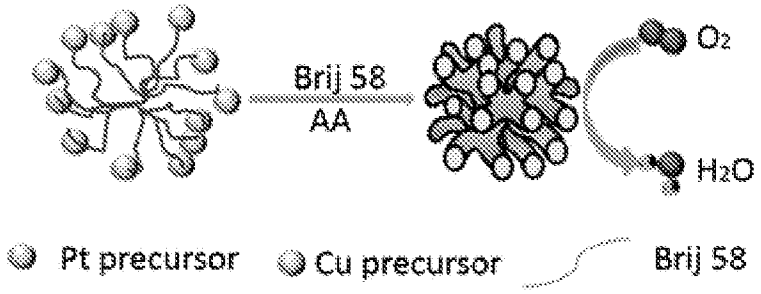
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Combinatorial release of dexamethasone and amiodarone from a nano-structured parylene-C film to reduce perioperative inflammation and atrial fibrillation



Nanoscale, 2016, **8**,4267-4275
DOI: 10.1039/C5NR07456H, Paper
Erik Robinson, Sunjay Kaushal, Justice Alaboson, Sudhish Sharma, Amogh Belagodu, Claire Watkins, Brandon Walker, Gregory Webster, Patrick McCarthy, Dean Ho
Suppressing perioperative inflammation and post-operative atrial fibrillation requires effective drug delivery platforms (DDP).
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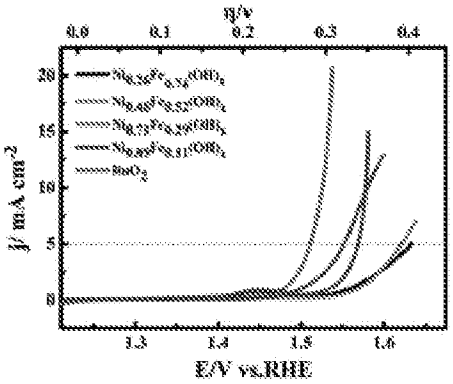
Highly branched PtCu bimetallic alloy nanodendrites with superior electrocatalytic activities for oxygen reduction reactions



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07682J, Paper
Shaofang Fu, Chengzhou Zhu, Qiurong Shi, Haibing Xia, Dan Du, Yuehe Lin
The highly branched PtCu bimetallic alloy nanodendrites were synthesized by a facile chemical reduction method using Brij 58 as the soft template. The as-prepared alloys presented superior electrocatalytic activities for oxygen reduction reactions.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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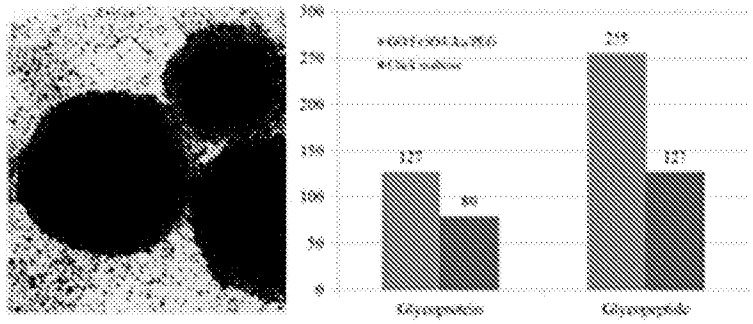
Amorphous mixed-metal hydroxide nanostructures for advanced water oxidation catalysts

PATENT
REEL: 037821 FRAME: 0486



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08989A, Paper
Y. Q. Gao, X. Y. Liu, G. W. Yang
We have synthesized amorphous mixed-metal (Ni-Fe) hydroxide nanostructures with a homogeneous distribution of Ni/Fe as well as a tunable Ni/Fe ratio by a simple, facile, green and low-cost electrochemical technique, and we have also demonstrated that the synthesized amorphous nanomaterials possess ultrahigh activity and super long-term cycle stability in the OER process.
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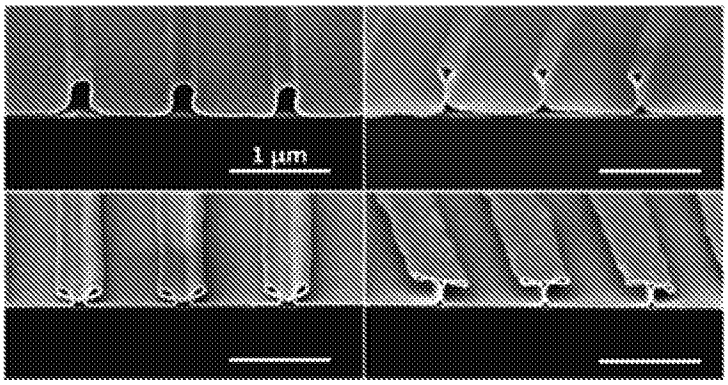
Hydrophilic GO/Fe3O4/Au/PEG nanocomposites for highly selective enrichment of glycopeptides



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08126B, Communication
Bo Jiang, Qi Wu, Nan Deng, Yuanbo Chen, Lihua Zhang, Zhen Liang, Yukui Zhang
GO/Fe_3O_4/Au/PEG nanocomposites were synthesized, and exhibited high selectivity to capture glycopeptides.
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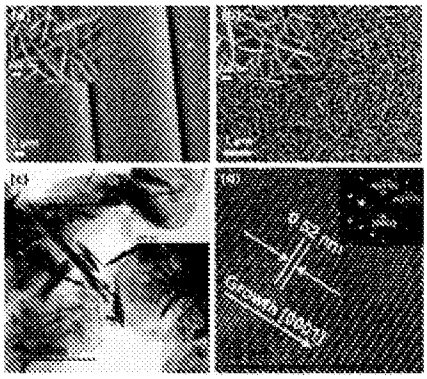
Fabrication and design of metal nano-accordion structures using atomic layer deposition and interference lithography

PATENT
REEL: 037821 FRAME: 0487



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08566G, Paper
J.-H. Min, A. Bagal, J. Z. Mundy, C. J. Oldham, B.-I. Wu, G. N. Parsons, C.-H. Chang
Fabricated free-standing platinum nano-accordion structures with a wide variety of cross-sectional profiles using a combination of ALD and IL.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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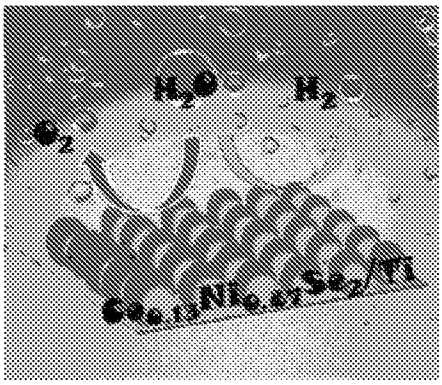
Flexible, transparent and exceptionally high power output nanogenerators based on ultrathin ZnO nanoflakes



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08324A, Paper
Huynh Van Ngoc, Dae Joon Kang
Novel nanogenerator structures composed of ZnO nanoflakes of less than 10 nm thickness were fabricated using a novel method involving a facile synthetic route and a rational design.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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Electrodeposited Co-doped NiSe2 nanoparticles film: a good electrocatalyst for efficient water splitting

PATENT
REEL: 037821 FRAME: 0488

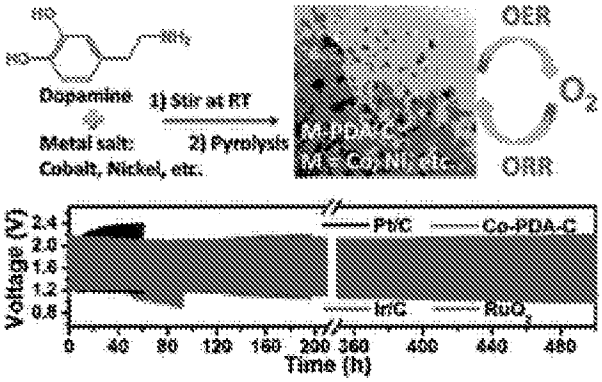


Nanoscale, 2016, **8**,3911-3915
DOI: 10.1039/C5NR07170D, Communication
Tingting Liu, Abdullah M. Asiri, Xuping Sun
Co-doped $NiSe_2$ nanoparticles film electrodeposited on Ti plate ($Co_{0.13}Ni_{0.87}Se_2$/Ti) acts as a robust water-splitting electrocatalyst in 1.0 M KOH, driving 10 mA cm^{-2} at HER overpotential of 64 mV and 100 mA cm^{-2} at OER overpotential of 320 mV.
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Correction: Polyol synthesis, functionalisation, and biocompatibility studies of superparamagnetic iron oxide nanoparticles as potential MRI contrast agents

Nanoscale, 2016, **8**,4395-4395
DOI: 10.1039/C5NR90206A, Correction
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Roxanne Hachani, Mark Lowdell, Martin Birchall, Aziliz Hervault, Damien Mertz, Sylvie Begin-Colin, Nguyen Thị Kim Thanh
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Mussel-inspired one-pot synthesis of transition metal and nitrogen co-doped carbon (M/N-C) as efficient oxygen catalysts for Zn-air batteries

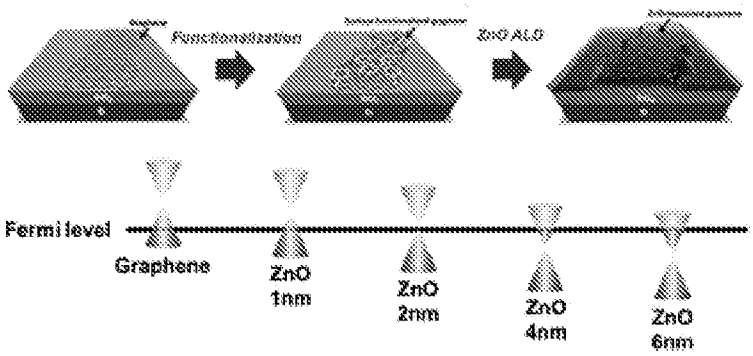


Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR06538K, Paper
Bing Li, Ye Chen, Xiaoming Ge, Jianwei Chai, Xiao Zhang, T. S. Andy Hor, Guojun Du, Zhaolin Liu, Hua Zhang, Yun Zong
Transition metal and nitrogen co-doped nanostructured carbons, synthesized *via* a simple and scalable room

PATENT
REEL: 037821 FRAME: 0489

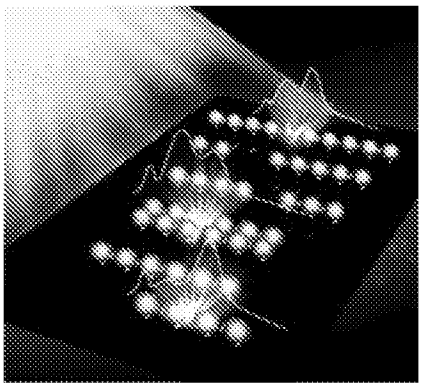
temperature approach inspired by mussels, have enabled robust cycling of Zn-air batteries.
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A non-destructive n-doping method for graphene with precise control of electronic properties via atomic layer deposition



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08016A, Paper
Kyu Seok Han, Pranav Y. Kalode, Yong-Eun Koo Lee, Hongbum Kim, Lynn Lee, Myung Mo Sung
A precise n-doping technique for graphene *via* atomic layer deposition (ALD) of ZnO thin films is presented.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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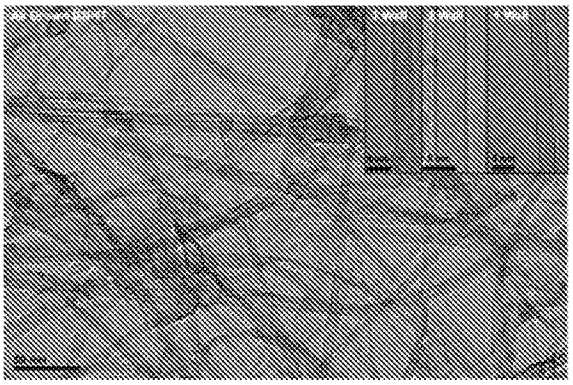
Strong plasmon coupling in self-assembled superparamagnetic nanoshell chains



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR09101B, Paper
Min Xiong, Xiulong Jin, Jian Ye
Construction of plasmonic superparamagnetic nanoshell chains by using a magnetic field is described. Strong plasmon coupling effects in the chains result in large electric field enhancements. Taking advantage of low-cost and large-area fabrication methods, these nanoshell chains are promising for biosensing, metamaterials, electromagnetic energy transport, and optical waveguide.
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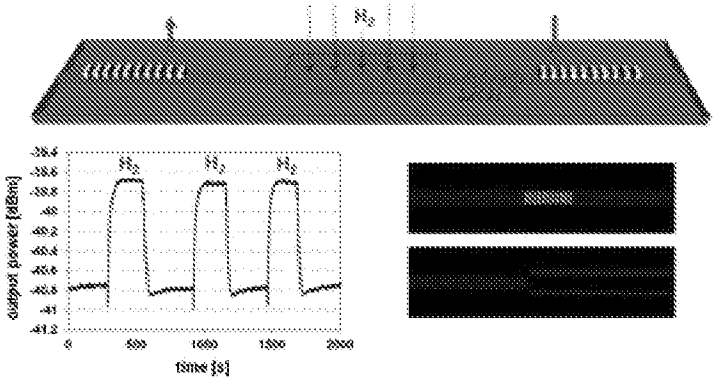
Thermodynamic approach to boron nitride nanotube solubility and dispersion

PATENT
REEL: 037821 FRAME: 0490



Nanoscale, 2016, **8**,4348-4359
DOI: 10.1039/C5NR08259E, Paper
A. L. Tiano, L. Gibbons, M. Tsui, S. I. Applin, R. Silva, C. Park, C. C. Fay
Inadequate dispersion of nanomaterials is a critical issue that significantly limits the potential properties of nanocomposites and when overcome, will enable further enhancement of material properties.
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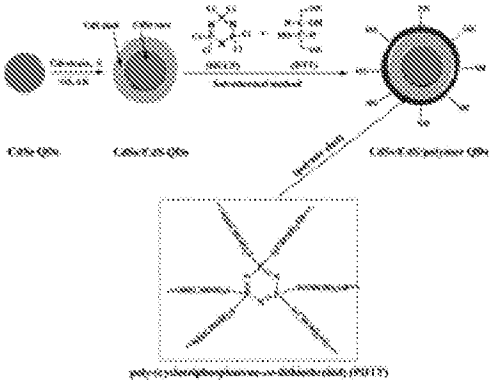
Hydrogen sensing with Pd-coated long-range surface plasmon membrane waveguides



Nanoscale, 2016, **8**,4284-4290
DOI: 10.1039/C5NR08001K, Paper
Norman R. Fong, Pierre Berini, R. N. Tait
A low power optical hydrogen sensor using a Pd film on a flexible LRSPP membrane waveguide with grating couplers.
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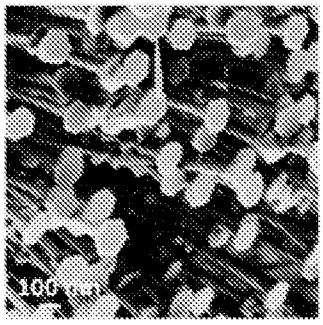
Suppressed blinking behavior of CdSe/CdS QDs by polymer coating

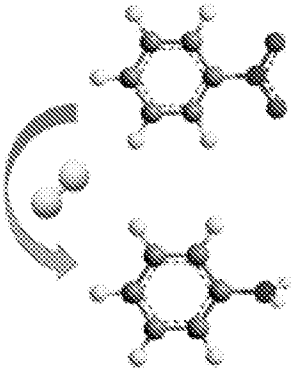
PATENT
REEL: 037821 FRAME: 0491



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08504G, Paper
Aidi Zhang, Yannan Bian, Jinjie Wang, Kuiyong Chen, Chaoqing Dong, Jicun Ren
Semiconductor quantum dots (QDs) are very important fluorescent nanocrystals with excellent optical properties.
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Designing axial growth of Co-Ni bimetallic nanowires with hexagon-like caps and their catalytic hydrogenation for nitrobenzene

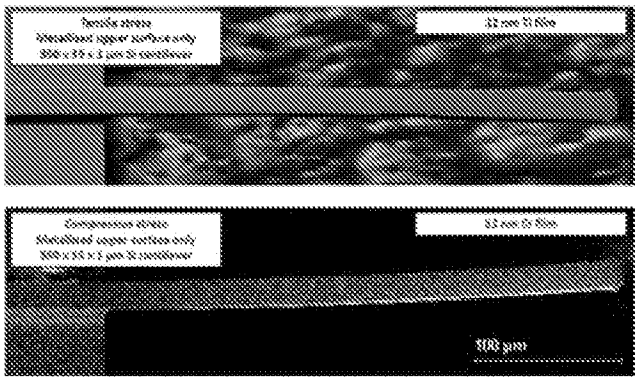




Nanoscale, 2016, **8**,3949-3953
DOI: 10.1039/C5NR09131D, Communication
Jiawen Wang, Jingwei Liu, Nating Yang, Shuangshuang Huang, Yuhan Sun, Yan Zhu
Co-Ni bimetal nanowires with hexagonal caps are more effective than corresponding nanoparticles for the nitrobenzene hydrogenation to produce aniline.
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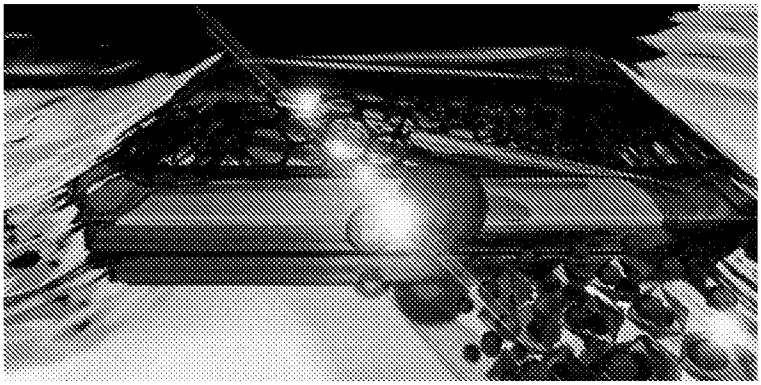
On the origin and magnitude of surface stresses due to metal nanofilms

PATENT
REEL: 037821 FRAME: 0492



Nanoscale, 2016, **8**,4245-4251
DOI: 10.1039/C5NR08789A, Paper
James Bowen, David Cheneler
Metallisation is a vital process for micro- and nanofabrication. We investigate the metallisation of silicon cantilevers with nano-films of chromium and titanium. Surface stresses acting in opposite directions were measured for these two metals.
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Ultrasensitive 1D field-effect phototransistors: CH3NH3PbI3 nanowire sensitized individual carbon nanotubes

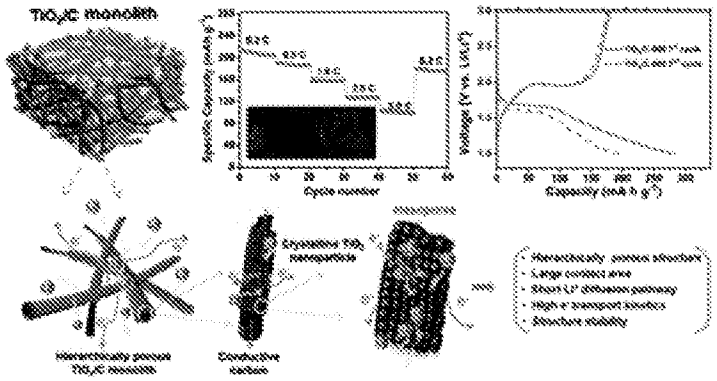


Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR06727H, Communication
M. Spina, B. Nafradi, H. M. Tohati, K. Kamaras, E. Bonvin, R. Gaal, L. Forro, E. Horvath
Field-effect phototransistors were fabricated based on individual carbon nanotubes (CNTs) sensitized by $CH_3NH_3PbI_3$ nanowires ($MAPbI_3NWs$).

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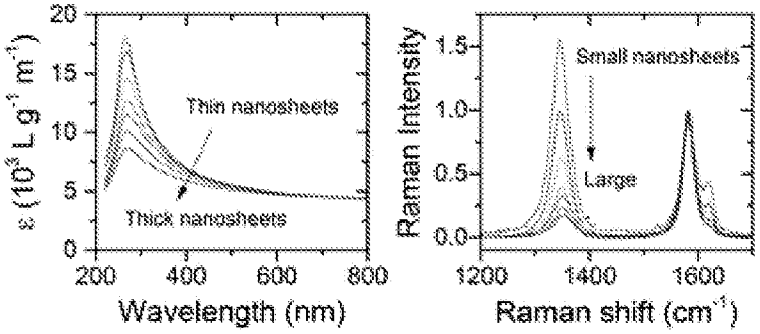
Hierarchical TiO2/C nanocomposite monoliths with a robust scaffolding architecture, mesopore-macropore network and TiO2-C heterostructure for high-performance lithium ion batteries

PATENT
REEL: 037821 FRAME: 0493



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR09149G, Paper
Hai-Bo Huang, Yue Yang, Li-Hua Chen, Yun Wang, Shao-Zhuan Huang, Jia-Wei Tao, Xiao-Ting Ma, Tawfique Hasan, Yu Li, Yan Xu, Bao-Lian Su
A general approach for the design of TiO_2/C nanocomposites with structural stability, and tunable and interconnected hierarchical porosity that leads to a new high electrochemical performance electrode.
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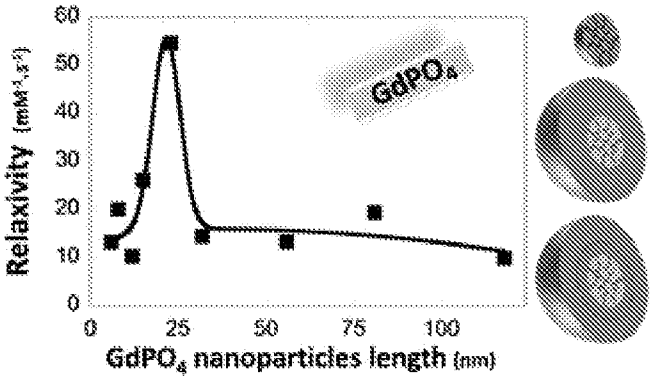
Spectroscopic metrics allow in situ measurement of mean size and thickness of liquid-exfoliated few-layer graphene nanosheets



Nanoscale, 2016, **8**,4311-4323
DOI: 10.1039/C5NR08047A, Paper
Claudia Backes, Keith R. Paton, Damien Hanlon, Shengjun Yuan, Mikhail I. Katsnelson, James Houston, Ronan J. Smith, David McCloskey, John F. Donegan, Jonathan N. Coleman
Quantitative spectroscopic metrics based on absorbance and Raman spectroscopy are presented for size-selected liquid-exfoliated graphene.
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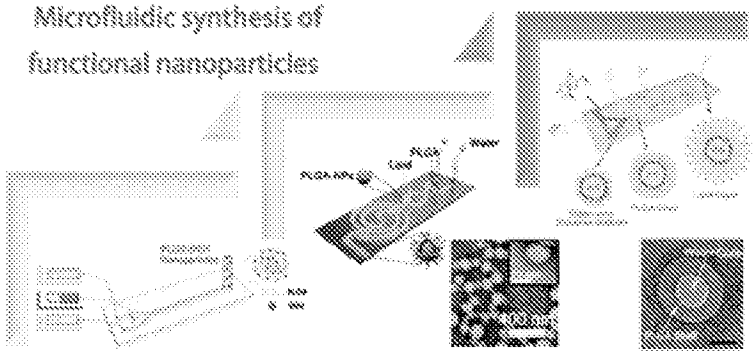
Hyperbranched polymer mediated size-controlled synthesis of gadolinium phosphate nanoparticles: colloidal properties and particle size-dependence on MRI relaxivity

PATENT
REEL: 037821 FRAME: 0494



Nanoscale, 2016, **8**,4252-4259
DOI: 10.1039/C5NR05064B, Paper
Camille Frangville, Maylis Gallois, Yichen Li, Hong Hanh Nguyen, Nancy Lauth-de Viguerie, Daniel R. Talham, Christophe Mingotaud, Jean-Daniel Marty
Core-shell(s) hyperbranched polymers were used to synthesize size-controlled gadolinium phosphate nanowires. An optimum particle size with high relaxivity values was evidenced.
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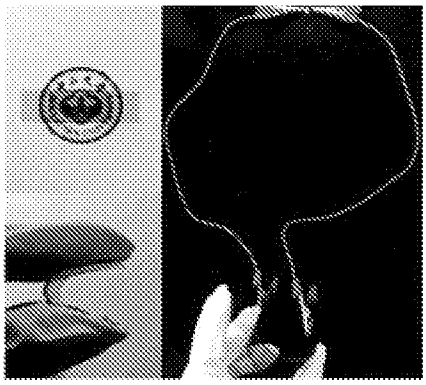
Microfluidics-mediated assembly of functional nanoparticles for cancer-related pharmaceutical applications



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07964K, Review Article
Qiang Feng, Jiashu Sun, Xingyu Jiang
This review focuses on microfluidic synthesis of functional nanoparticles with tunable structures and properties for cancer treatment and diagnosis.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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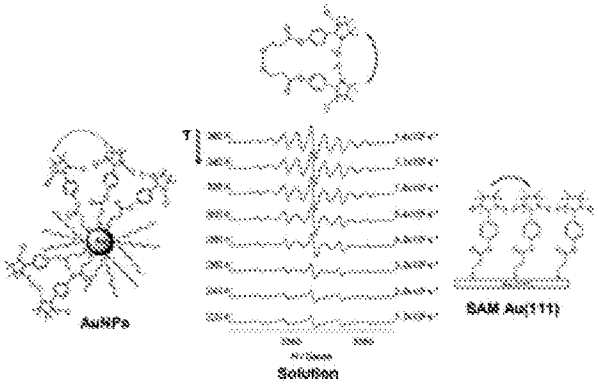
A flexible, transparent and super-long-life supercapacitor based on ultrafine Co3O4 nanocrystal electrodes

PATENT
REEL: 037821 FRAME: 0495



Nanoscale, 2016, **8**,4227-4235
DOI: 10.1039/C5NR09145D, Paper
X. Y. Liu, Y. Q. Gao, G. W. Yang
A flexible, transparent and super-long-life supercapacitor has been fabricated based on ultrafine Co_3O_4 nanocrystal electrodes.
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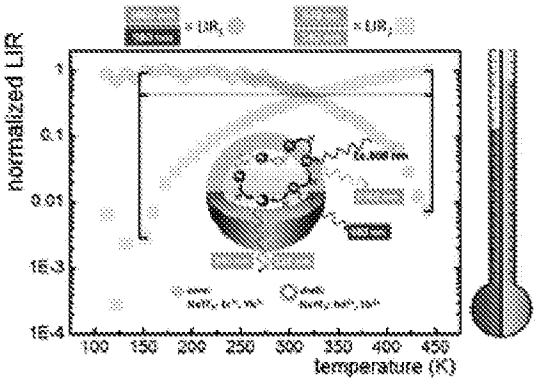
Dynamics of intramolecular spin exchange interaction of a nitronyl nitroxide diradical in solution and on surfaces



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08824K, Paper
V. Lloveras, E. Badetti, J. Veciana, J. Vidal-Gancedo
It is possible to preserve the same dynamic behaviour observed for a diradical in solution in AuNP surface-anchored radicals.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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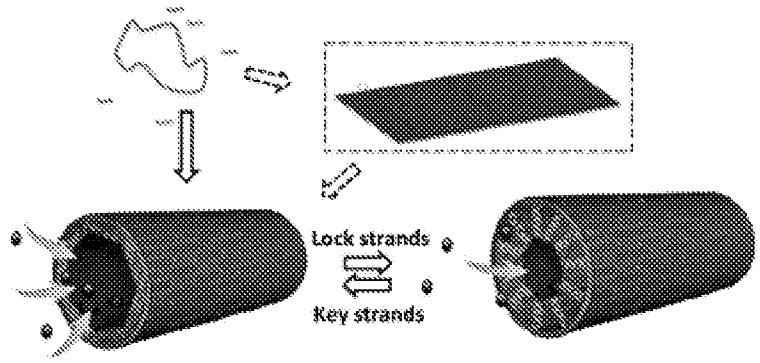
A broadening temperature sensitivity range with a core-shell YbEr@YbNd double ratiometric optical nanothermometer

PATENT
REEL: 037821 FRAME: 0496



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08223D, Paper
L. Marciniak, K. Prorok, L. Frances-Soriano, J. Perez-Prieto, A. Bednarkiewicz
The chemical architecture of lanthanide doped core-shell up-converting nanoparticles can be engineered to purposely design the properties of luminescent nanomaterials, which are typically inaccessible to their homogeneous counterparts.
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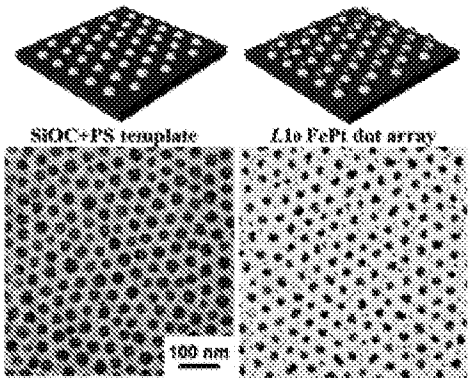
A switchable DNA origami nanochannel for regulating molecular transport at the nanometer scale



Nanoscale, 2016, **8**,3944-3948
DOI: 10.1039/C5NR08206D, Communication
Dianming Wang, Yiyang Zhang, Miao Wang, Yuanchen Dong, Chao Zhou, Mark Antonin Isbell, Zhongqiang Yang, Huajie Liu, Dongsheng Liu
A nanochannel with a shutter at one end was built by DNA nanotechnology.
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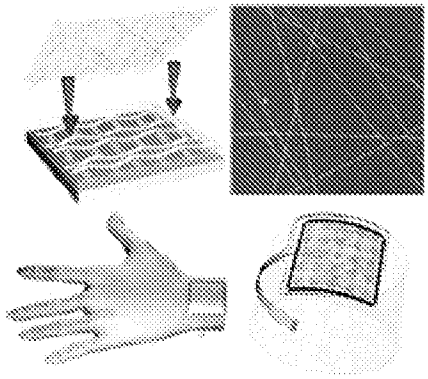
Thermal dewetting with a chemically heterogeneous nano-template for self-assembled L10 FePt nanoparticle arrays

PATENT
REEL: 037821 FRAME: 0497



Nanoscale, 2016, **8**,3926-3935
DOI: 10.1039/C5NR08339G, Communication
Liang-Wei Wang, Chung-Fu Cheng, Jung-Wei Liao, Chiu-Yen Wang, Ding-Shuo Wang, Kuo-Feng Huang, Tzu-Ying Lin, Rong-Ming Ho, Lih-Juann Chen, Chih-Huang Lai
The self-assembled $L1_0$ FePt nanoparticles are fabricated by thermal dewetting with a chemically heterogeneous nano-template.
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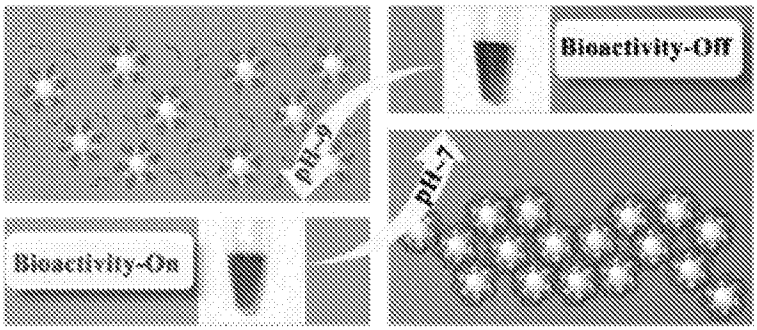
A high-performance, flexible and robust metal nanotrough-embedded transparent conducting film for wearable touch screen panels



Nanoscale, 2016, **8**,3916-3922
DOI: 10.1039/C5NR07657A, Communication
Hyeon-Gyun Im, Byeong Wan An, Jungho Jin, Junho Jang, Young-Geun Park, Jang-Ung Park, Byeong-Soo Bae
A junction resistance-free continuous metal nanotrough-embedded transparent conducting electrode (TCE) composite film (metal nanotrough-GFRHybrimer film) is reported.
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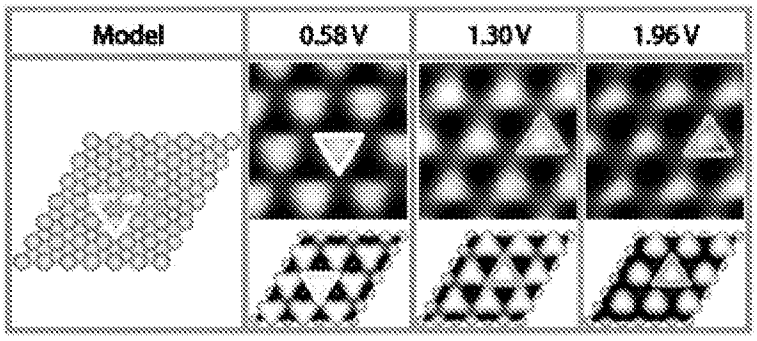
Multifunctional nanoparticle-protein conjugates with controllable bioactivity and pH responsiveness

PATENT
REEL: 037821 FRAME: 0498



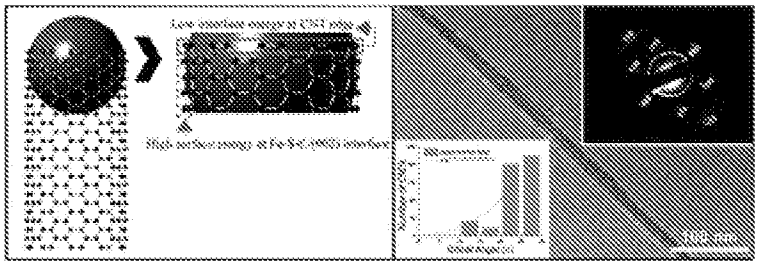
Nanoscale, 2016, **8**,4387-4394
DOI: 10.1039/C5NR07436C, Paper
Feng Liu, Lulu Xue, Yuqi Yuan, Jingjing Pan, Chenjie Zhang, Hongwei Wang, John L. Brash, Lin Yuan, Hong Chen
With the interaction of polymers, the nanoparticle-protein conjugates show controllable bioactivity and pH responsiveness.
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Tuning the surface electronic structure of a Pt3Ti(111) electro catalyst



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08420B, Paper
M. Pa[German sz ligature}ens, V. Caciuc, N. Atodiresei, M. Moors, S. Blugel, R. Waser, S. Karthauser
Combining voltage dependent STM imaging with *ab initio* DFT calculations to identify the exact termination of an electro catalyst.
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Inherent predominance of high chiral angle metallic carbon nanotubes in continuous fibers grown from a molten catalyst

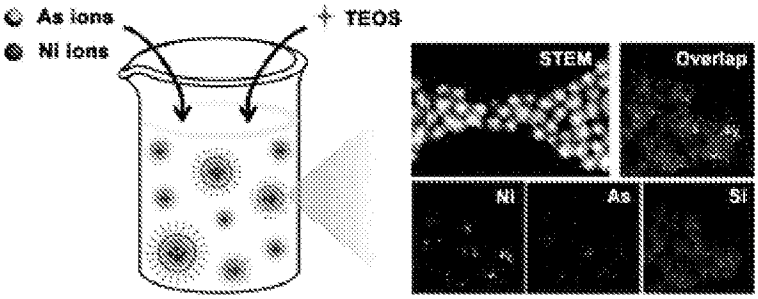


Nanoscale, 2016, **8**,4236-4244
DOI: 10.1039/C5NR07455J, Paper

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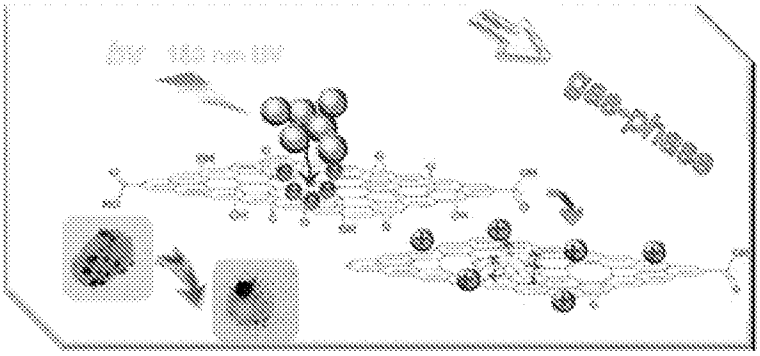
B. Aleman, M. Mar Bernal, B. Mas, Emilio M. Perez, V. Reguero, G. Xu, Y. Cui, Juan J. Vilatela
The armchair-biased chiral angle distribution in continuous fibres of CNTs is controlled by the molten state of the Fe-S-C alloy catalyst.
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A facile route to core-shell nanoparticulate formation of arsenic trioxide for effective solid tumor treatment



Nanoscale, 2016, **8**,4373-4380
DOI: 10.1039/C5NR07860A, Paper
Zongjun Zhang, Hanyu Liu, Hualu Zhou, Xianglong Zhu, Zhenghuan Zhao, Xiaoqin Chi, Hong Shan, Jinhao Gao
The facile synthesis of pH-sensitive arsenic-based nanodrugs by a "one-pot" reverse microemulsion method was reported.
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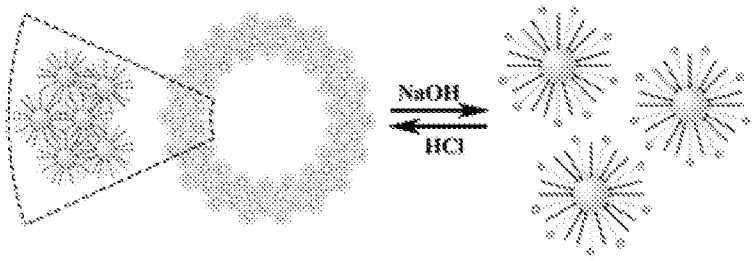
Gas-phase rapid reduction of graphene oxide through photoionization of gold nanoparticles



Nanoscale, 2016, **8**,3906-3910
DOI: 10.1039/C5NR08509H, Communication
Jeong Hoon Byeon
This work introduces for the first time a rapid reduction of graphene oxide *via* the photoionization of gold nanoparticles in a continuous gas-phase process.
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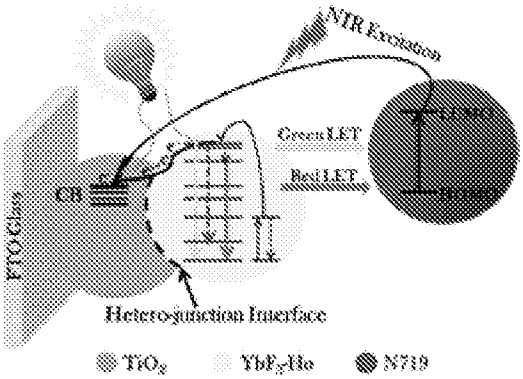
pH-Responsive reversible self-assembly of gold nanoparticles into nanovesicles

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REEL: 037821 FRAME: 0500



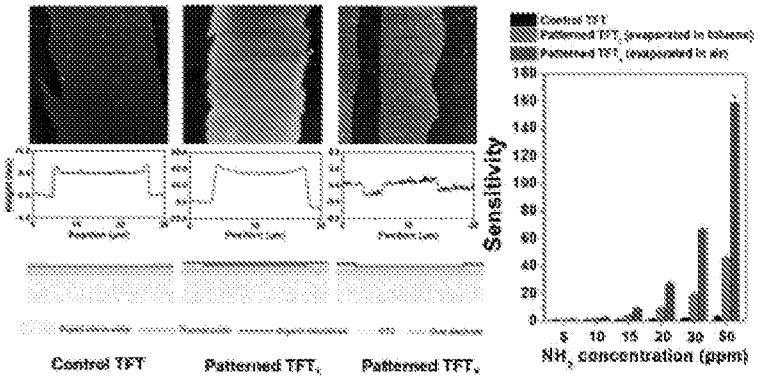
Nanoscale, 2016, **8**,3923-3925
DOI: 10.1039/C6NR00044D, Communication
Chunfang Fan, Tong Bian, Lu Shang, Run Shi, Li-Zhu Wu, Chen-Ho Tung, Tierui Zhang
pH-Responsive Au nanovesicles with reversible self-assembly and disassembly performance were developed by adjusting protonation and deprotonation of surface ligands.
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Enhanced photovoltaic performance of dye-sensitized solar cells using a new photoelectrode material: upconversion YbF3-Ho/TiO2 nanoheterostructures



Nanoscale, 2016, **8**,4173-4180
DOI: 10.1039/C5NR08319B, Paper
Jia Yu, Yulin Yang, Ruiqing Fan, Ping Wang, Yuwei Dong
UC/TiO_2 nanoheterostructures induce electron-injection from YbF_3-Ho to TiO_2 by utilizing near-infrared light, and further improve the existing merits of TiO_2.
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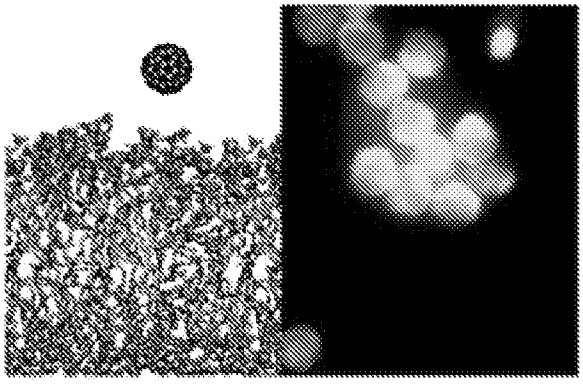
Fast patterning of oriented organic microstripes for field-effect ammonia gas sensors



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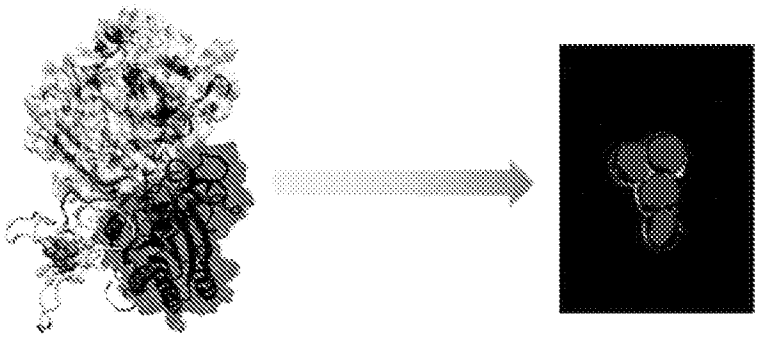
Nanoscale, 2016, **8**,3954-3961
DOI: 10.1039/C5NR09001F, Communication
Binghao Wang, Jinqiang Ding, Tao Zhu, Wei Huang, Zequn Cui, Jianmei Chen, Lizhen Huang, Lifeng Chi
A series of organic field-effect transistors (OFETs) with patterned ultra-thin films for NH_3 detection are achieved *via* fast dip-coating.
The content of this RSS Feed (c) The Royal Society of Chemistry

C60 fullerene localization and membrane interactions in RAW 264.7 immortalized mouse macrophages



Nanoscale, 2016, **8**,4134-4144
DOI: 10.1039/C5NR07003A, Paper
K. A. Russ, P. Elvati, T. L. Parsonage, A. Dews, J. A. Jarvis, M. Ray, B. Schneider, P. J. S. Smith, P. T. F. Williamson, A. Violi, M. A. Philbert
There continues to be a significant increase in the number and complexity of hydrophobic nanomaterials that are engineered for a variety of commercial purposes making human exposure a significant health concern.
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Computational design of peptide-Au cluster probe for sensitive detection of [small alpha]IIb[small beta]3 integrin

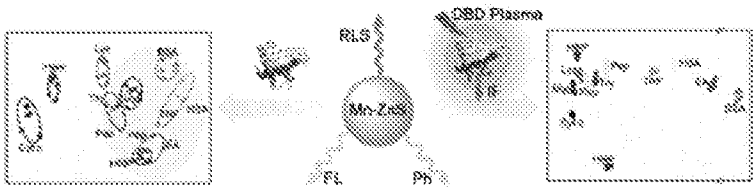


Nanoscale, 2016, **8**,4203-4208
DOI: 10.1039/C5NR09175F, Paper
Lina Zhao, Jiao Zhai, Xuejie Zhang, Xueyun Gao, Xiaohong Fang, Jingyuan Li
We have designed a novel peptide-Au cluster probe to specifically bind to [small alpha]$_{IIb}$[small beta]$_3$ integrin.
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Plasma-assisted quadruple-channel optosensing of proteins and cells with Mn-

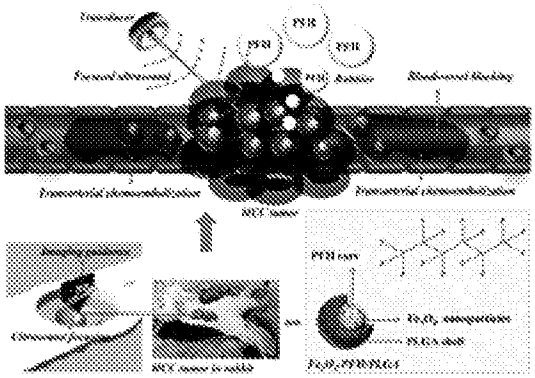
PATENT
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doped ZnS quantum dots



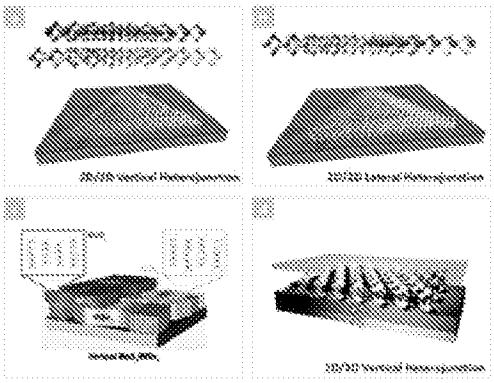
Nanoscale, 2016, **8**,4291-4298
DOI: 10.1039/C5NR09130F, Paper
Chenghui Li, Peng Wu, Xiandeng Hou
The addition of the intrinsic fluorescence of proteins to the existing triple-channel optical properties of Mn-ZnS QDs yields new quadruple-channel optosensing devices with substantially increased discrimination capacity for proteins. A low-temperature plasma for protein treatment further enforces the discrimination.
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Nanoparticle-enhanced synergistic HIFU ablation and transarterial chemoembolization for efficient cancer therapy



Nanoscale, 2016, **8**,4324-4339
DOI: 10.1039/C5NR08292G, Paper
Yufeng You, Zhigang Wang, Haitao Ran, Yuanyi Zheng, Dong Wang, Jinshun Xu, Zhibiao Wang, Yu Chen, Pan Li
We have developed a nanoparticle-based HIFU synergistic cancer surgery enhanced by transarterial chemoembolization for high-efficient HCC treatment based on Fe_3O_4-PFH/PLGA nanocapsules.
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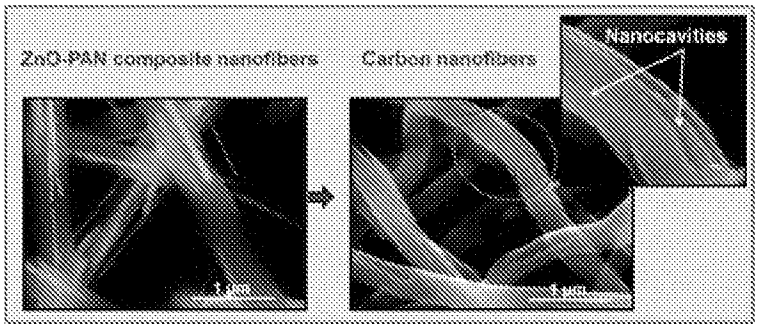
Fundamentals of lateral and vertical heterojunctions of atomically thin materials



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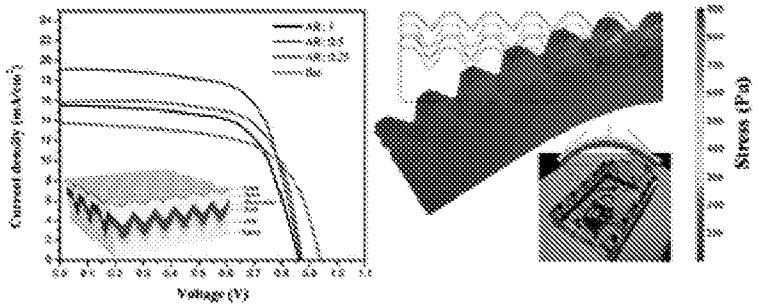
Nanoscale, 2016, **8**,3870-3887
DOI: 10.1039/C5NR08982D, Minireview
Anupum Pant, Zafer Mutlu, Darshana Wickramaratne, Hui Cai, Roger K. Lake, Cengiz Ozkan, Sefaattin Tongay
At the turn of this century, Herbert Kroemer, the 2000 Nobel Prize winner in Physics, famously commented that "the interface is the device".
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Zinc oxide nanorod assisted rapid single-step process for the conversion of electrospun poly(acrylonitrile) nanofibers to carbon nanofibers with a high graphitic content



Nanoscale, 2016, **8**,4360-4372
DOI: 10.1039/C5NR06809F, Paper
Ratyakshi Nain, Dhirendra Singh, Manjeet Jassal, Ashwini K. Agrawal
The effect of incorporation of rigid zinc oxide (ZnO) nanostructures on carbonization behavior of electrospun special acrylic fiber grade poly(acrylonitrile) (PAN-SAF) nanofibers was investigated.
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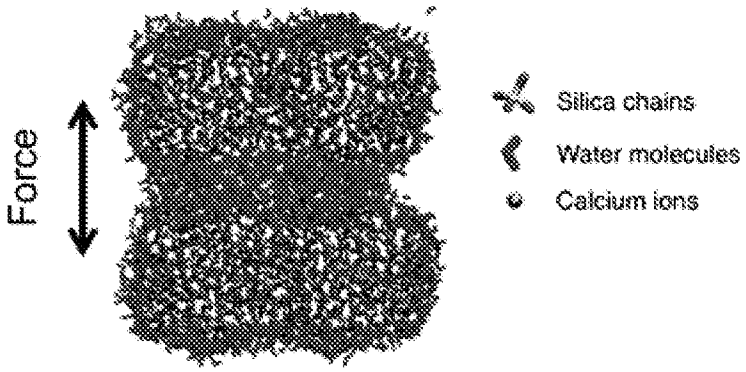
Efficient, flexible and mechanically robust perovskite solar cells on inverted nanocone plastic substrates



Nanoscale, 2016, **8**,4276-4283
DOI: 10.1039/C5NR08836D, Paper
Mohammad Mahdi Tavakoli, Qingfeng Lin, Siu-Fung Leung, Ga Ching Lui, Hao Lu, Liang Li, Bin Xiang, Zhiyong Fan
Utilization of nanostructures on photovoltaic devices can significantly improve the device energy conversion efficiency by enhancing the device light harvesting capability as well as carrier collection efficiency.
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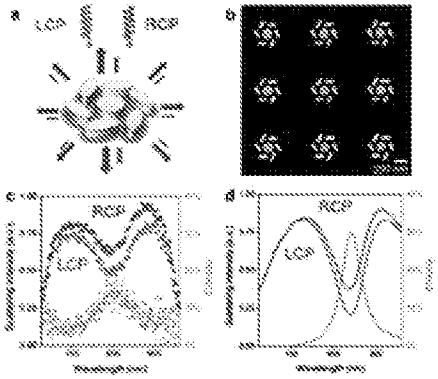
Interaction grand potential between calcium-silicate-hydrate nanoparticles at the molecular level

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Nanoscale, 2016, **8**,4160-4172
DOI: 10.1039/C5NR08142D, Paper
Patrick A. Bonnaud, Christophe Labbez, Ryuji Miura, Ai Suzuki, Naoto Miyamoto, Nozomu Hatakeyama, Akira Miyamoto, Krystyn J. Van Vliet
Mean forces and interaction grand potentials between calcium-silicate-hydrate particles.
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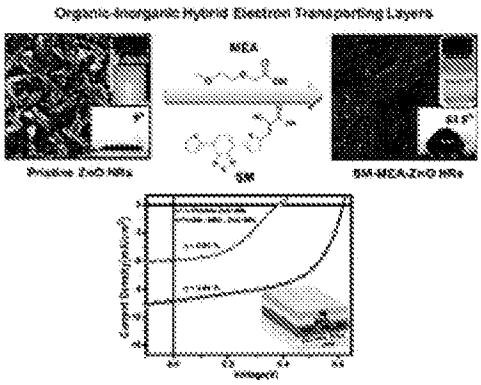
Planar plasmonic chiral nanostructures



Nanoscale, 2016, **8**,3900-3905
DOI: 10.1039/C5NR09302C, Communication
Shuai Zu, Yanjun Bao, Zheyu Fang
A strong chiral optical response induced at a plasmonic Fano resonance in a planar Au heptamer nanostructure was experimentally and theoretically demonstrated.
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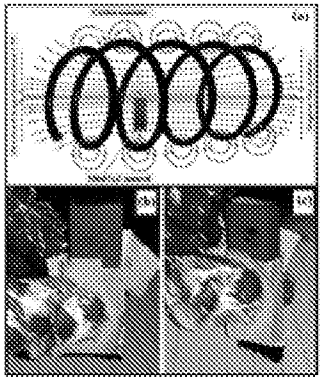
Co-functionalized organic/inorganic hybrid ZnO nanorods as electron transporting layers for inverted organic solar cells

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Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08849F, Paper
Swapnil B. Ambade, Rohan B. Ambade, Seung Hun Eom, Myung-Jin Baek, Sushil S. Bagde, Rajaram S. Mane, Soo-Hyoung Lee
The first hybrid co-functionalization of solution processed planar ZnO nanorod ETLs in iOSCs with organic small molecule based on a D-A-D configuration with meticulous control of aggregation.
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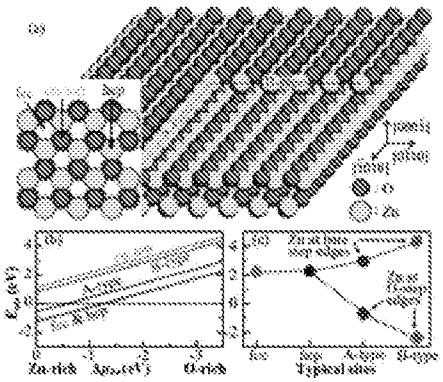
Fe3C-filled carbon nanotubes: permanent cylindrical nanomagnets possessing exotic magnetic properties



Nanoscale, 2016, **8**,4299-4310
DOI: 10.1039/C5NR09188H, Paper
Reetu Kumari, Lucky Krishnia, Vinay Kumar, Sandeep Singh, H. K. Singh, R. K. Kotnala, R. R. Juluri, U. M. Bhatta, P. V. Satyam, Brajesh S. Yadav, Zainab Naqvi, Pawan K. Tyagi
We study how confinement affects the magnetism of Fe_3C filled CNTs and stress induced structural phase transition. A model describing the growth mechanism as well as *in situ* pole formation in nanorod is discussed.
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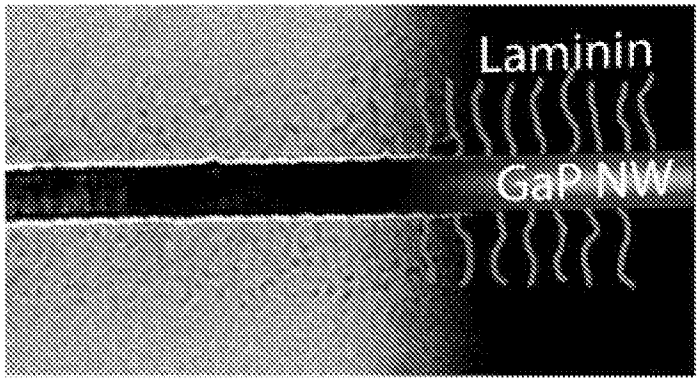
Effects of nitrogen dopants on the atomic step kinetics and electronic structures of O-polar ZnO

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Nanoscale, 2016, **8**,4381-4386
DOI: 10.1039/C5NR09060A, Paper
Hao Wang, Huahan Zhan, Yinghui Zhou, Yaping Wu, Xiaohang Chen, Huiqiong Wang, Junyong Kang
Oxygen-polar ZnO films are grown in step flow mode by molecular beam epitaxy.
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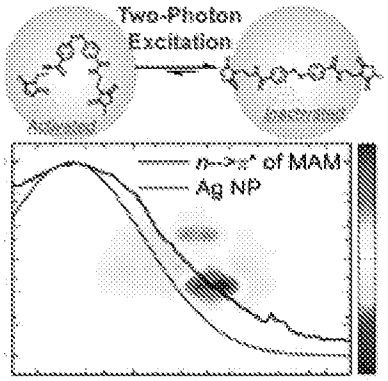
Electron microscopy imaging of proteins on gallium phosphide semiconductor nanowires



Nanoscale, 2016, **8**,3936-3943
DOI: 10.1039/C5NR08888G, Communication
Martin Hjort, Mikael Bauer, Stefan Gunnarsson, Erik Marsell, Alexei A. Zakharov, Gunnel Karlsson, Elodie Sanfins, Christelle N. Prinz, Reine Wallenberg, Tommy Cedervall, Anders Mikkelsen
We have imaged GaP nanowires (NWs) incubated with human laminin, serum albumin (HSA), and blood plasma using both cryo-transmission electron microscopy and synchrotron based X-ray photoemission electron microscopy.
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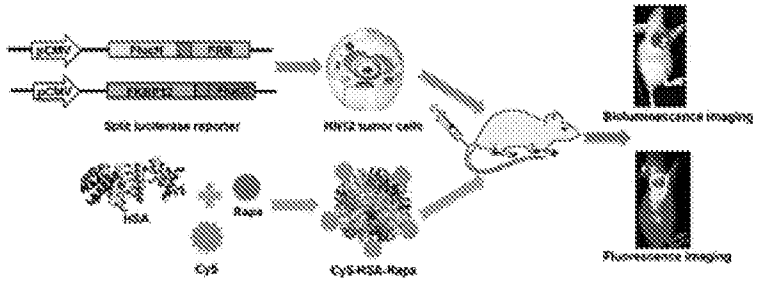
Plasmon-enhanced two-photon-induced isomerization for highly-localized light-based actuation of inorganic/organic interfaces

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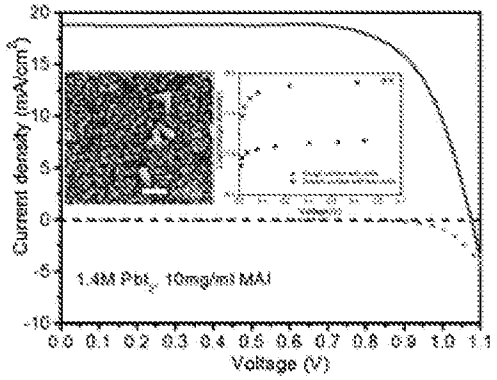
Nanoscale, 2016, **8**,4194-4202
DOI: 10.1039/C5NR07973J, Paper
Chang-Keun Lim, Xin Li, Yue Li, Kurt L. M. Drew, J. Pablo Palafox-Hernandez, Zhenghua Tang, Alexander Baev, Andrey N. Kuzmin, Marc R. Knecht, Tiffany R. Walsh, Mark T. Swihart, Hans Agren, Paras N. Prasad
Plasmon-enhanced two-photon isomerization of non-donor/acceptor modified azobenzene on Ag NPs.
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Combined image guided monitoring the pharmacokinetics of rapamycin loaded human serum albumin nanoparticles with a split luciferase reporter



Nanoscale, 2016, **8**,3991-4000
DOI: 10.1039/C5NR07308A, Paper
Fu Wang, Kai Yang, Zhe Wang, Ying Ma, J. Silvio Gutkind, Naoki Hida, Gang Niu, Jie Tian
This integrated imaging platform could provide more reliable respective PK profiles of a loaded drug and its carrier.
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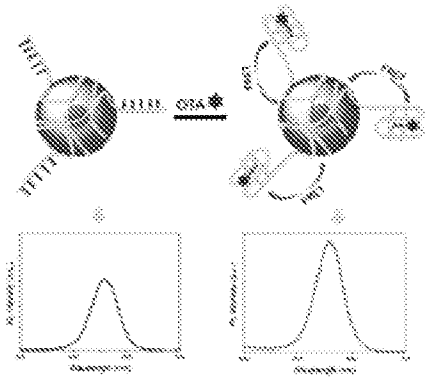
Influence of void-free perovskite capping layer on the charge recombination process in high performance CH3NH3PbI3 perovskite solar cells



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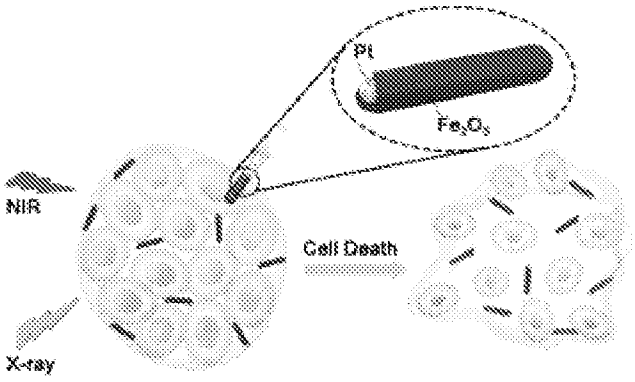
Nanoscale, 2016, **8**,4181-4193
DOI: 10.1039/C5NR06362K, Paper
Kunwu Fu, Christopher T. Nelson, Mary Cooper Scott, Andrew Minor, Nripan Mathews, Lydia Helena Wong
Uniform surface coverage of perovskite capping layer formed with less void formation reduces charge recombination and enhances device performance.
The content of this RSS Feed (c) The Royal Society of Chemistry

A self-assembly aptasensor based on thick-shell quantum dots for sensing of ochratoxin A



Nanoscale, 2016, **8**,4127-4133
DOI: 10.1039/C5NR08284F, Paper
Xianfeng Chu, Xiaowen Dou, Ruizheng Liang, Menghua Li, Weijun Kong, Xihui Yang, Jiaoyang Luo, Meihua Yang, Ming Zhao
A tunable-valency self-assembling aptasensor based on a thick-shell quantum dot was fabricated for ochratoxin A (OTA).
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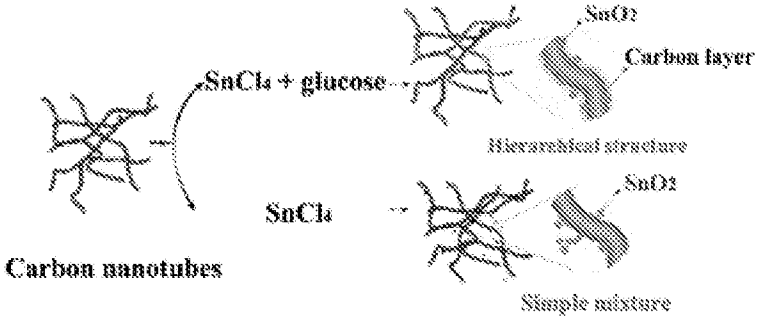
Facile preparation of hybrid core-shell nanorods for photothermal and radiation combined therapy



Nanoscale, 2016, **8**,3895-3899
DOI: 10.1039/C5NR09102K, Communication
Yaoyao Deng, Erdong Li, Xiaju Cheng, Jing Zhu, Shuanglong Lu, Cuicui Ge, Hongwei Gu, Yue Pan
Water-soluble platinum@iron oxide core-shell nanorods were synthesized and explored for NIR photothermal and X-ray radiation combined therapy.
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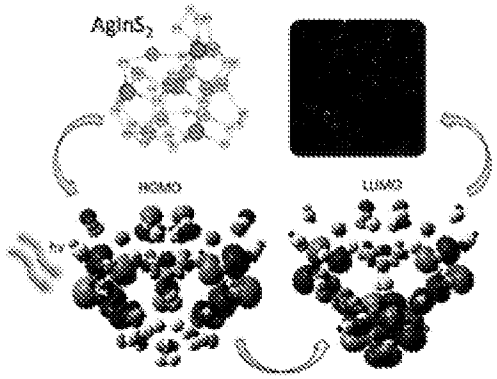
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Carbon coated SnO2 nanoparticles anchored on CNT as a superior anode material for lithium-ion batteries



Nanoscale, 2016, **8**,4121-4126
DOI: 10.1039/C5NR07996A, Paper
Chunrong Ma, Weimin Zhang, Yu-Shi He, Qiang Gong, Haiying Che, Zi-Feng Ma
High performance hierarchically structured carbon covering SnO_2 nanoparticles on CNTs were synthesized *via* a facile glucose mediated hydrothermal method and subsequent calcination as an anode for lithium-ion batteries.
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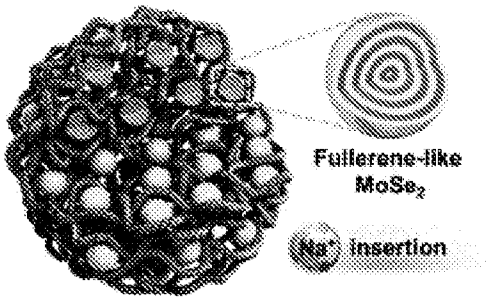
Two blinking mechanisms in highly confined AgInS2 and AgInS2/ZnS quantum dots evaluated by single particle spectroscopy



Nanoscale, 2016, **8**,4151-4159
DOI: 10.1039/C5NR07992F, Paper
B. Cichy, R. Rich, A. Olejniczak, Z. Gryczynski, W. Strek
Ternary $AgInS_2$ quantum dots (QDs) have been found as promising cadmium-free, red-shifted, and tunable luminescent bio-probes with efficient Stokes and anti-Stokes excitations and luminescence lifetimes (*ca.* 100 ns) convenient for time resolved techniques.
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Fullerene-like MoSe2 nanoparticles-embedded CNT balls with excellent structural stability for highly reversible sodium-ion storage

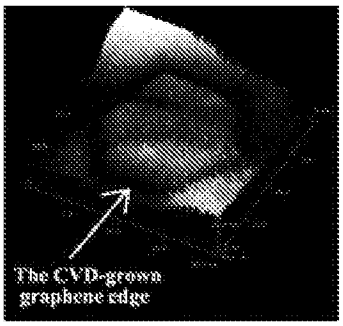
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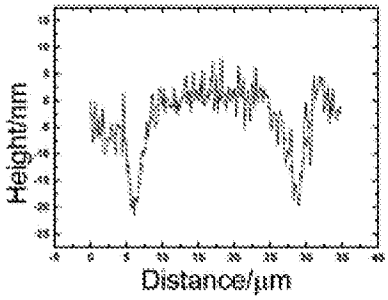


Fullerene-like $MoSe_2$ nanoparticles embedded CNT ball

Nanoscale, 2016, **8**,4209-4216
DOI: 10.1039/C5NR07733H, Paper
Seung Ho Choi, Yun Chan Kang
Three-dimensional (3D) porous-structured carbon nanotube (CNT) balls embedded with metal selenide nanocrystals were prepared by a simple two-step process. The fullerene-like $MoSe_2$/CNT composite balls, selected as the first target material, showed excellent sodium-ion storage properties.
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Edge morphology evolution of graphene domains during chemical vapor deposition cooling revealed through hydrogen etching

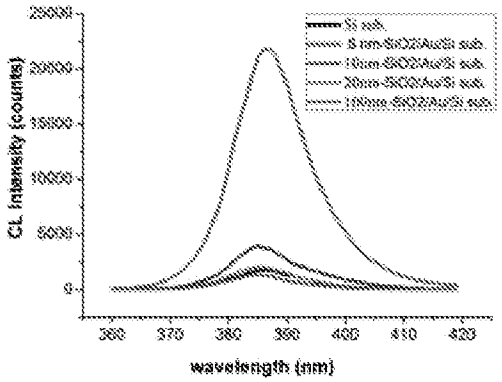




Nanoscale, 2016, **8**,4145-4150
DOI: 10.1039/C5NR06624G, Paper
Haoran Zhang, Yanhui Zhang, Yaqian Zhang, Zhiying Chen, Yanping Sui, Xiaoming Ge, Guanghui Yu, Zhi Jin, Xinyu Liu
The CVD cooling process induced graphene edge evolution, such as nanoparticle accumulation and graphene edge sinking. The results revealed the peculiar graphene-Cu movement during CVD cooling.
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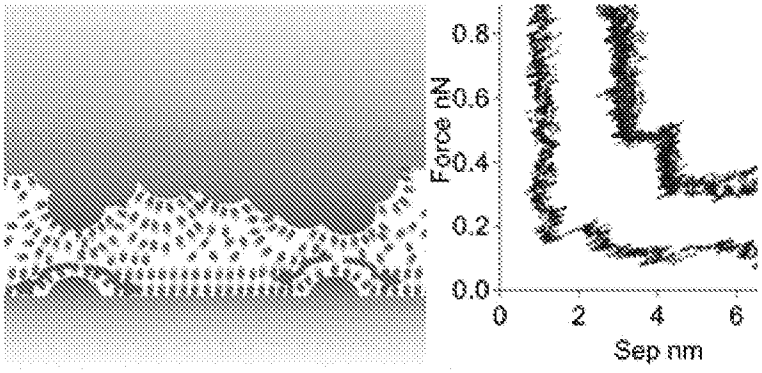
Strongly enhanced ultraviolet emission of an Au@SiO2/ZnO plasmonic hybrid nanostructure

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Nanoscale, 2016, **8**,4030-4036
DOI: 10.1039/C5NR06153A, Paper
Li Wang, Xiaodong Wang, Shengcheng Mao, Hua Wu, Xia Guo, Yuan Ji, Xiaodong Han
We present the surface plasmon polariton (SPP)-enhanced ultraviolet (UV) emission of an Au@SiO_2/ZnO hybrid nanostructure.
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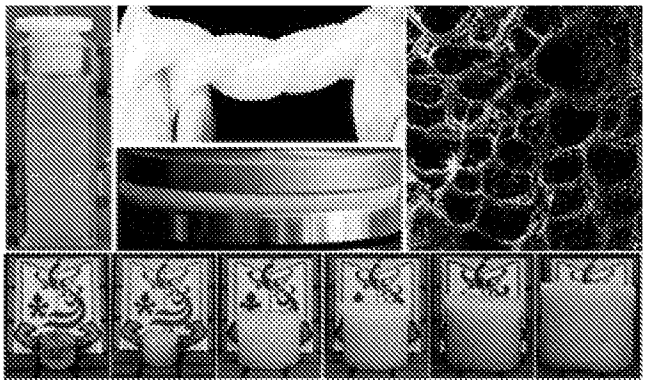
Layering of ionic liquids on rough surfaces



Nanoscale, 2016, **8**,4094-4106
DOI: 10.1039/C5NR07805A, Paper
Alexis Sheehan, L. Andres Jurado, Shivaprakash N. Ramakrishna, Andrea Arcifa, Antonella Rossi, Nicholas D. Spencer, Rosa M. Espinosa-Marzal
Structural forces reveal the ordered structure of one ionic liquid at rough interfaces of well-defined nanoscale roughness, also under nanoconfinement.
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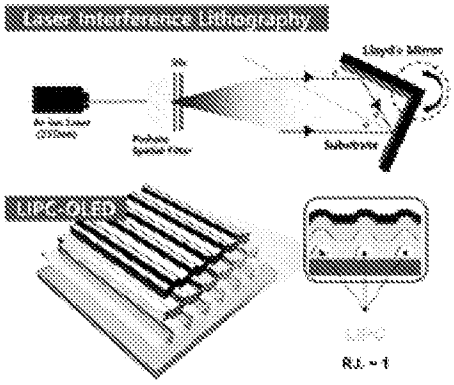
Aqueous compatible boron nitride nanosheets for high-performance hydrogels

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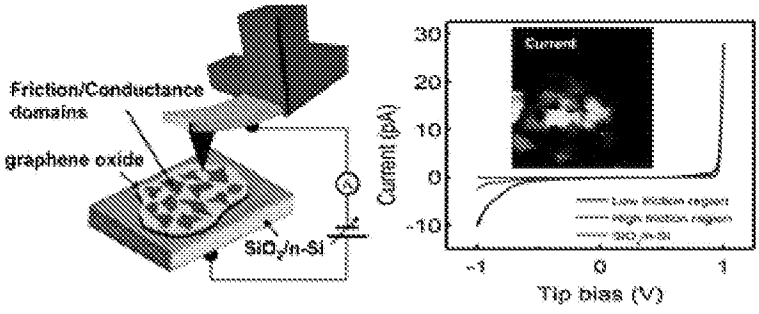
Nanoscale, 2016, **8**,4260-4266
DOI: 10.1039/C5NR07578E, Paper
Xiaozhen Hu, Jiahui Liu, Qiuju He, Yuan Meng, Liu Cao, Ya-Ping Sun, Jijie Chen, Fushen Lu
Aqueous dispersible boron nitride nanosheets were produced and used to fabricate nanocomposite hydrogels with high water retentivity and flexibility.
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An extremely low-index photonic crystal layer for enhanced light extraction from organic light-emitting diodes



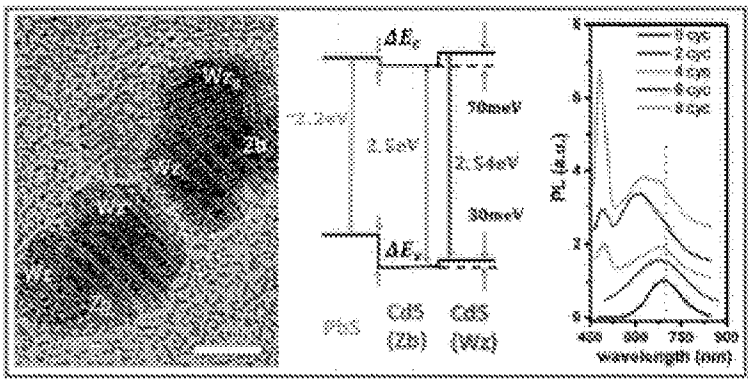
Nanoscale, 2016, **8**,4113-4120
DOI: 10.1039/C5NR07312J, Paper
Yong Sub Shim, Ju Hyun Hwang, Cheol Hwee Park, Sun-Gyu Jung, Young Wook Park, Byeong-Kwon Ju
This paper reports organic light-emitting diodes (OLEDs) with improved light extraction fabricated by embedding an extremely low-index photonic crystal (LIPC) layer.
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Friction and conductance imaging of sp2- and sp3-hybridized subdomains on single-layer graphene oxide



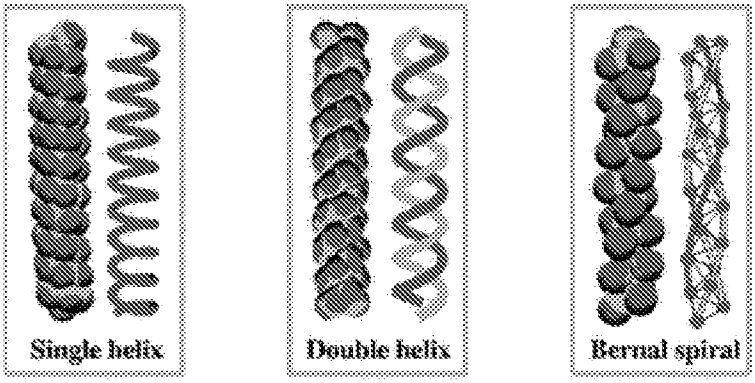
Nanoscale, 2016, **8**,4063-4069
DOI: 10.1039/C5NR06469D, Paper
Hyunsoo Lee, Narae Son, Hu Young Jeong, Tae Gun Kim, Gyeong Sook Bang, Jong Yun Kim, Gi Woong Shim, Kalyan C. Goddeti, Jong Hun Kim, Namdong Kim, Hyun-Joon Shin, Wondong Kim, Sehun Kim, Sung-Yool Choi, Jeong Young Park
We investigated the subdomain structures of graphene oxide with friction and conductance mappings.
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Dual emission in asymmetric "giant" PbS/CdS/CdS core/shell/shell quantum dots



Nanoscale, 2016, **8**,4217-4226
DOI: 10.1039/C5NR08881J, Paper
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Haiguang Zhao, Gianluca Sirigu, Andrea Parisini, Andrea Camellini, Giuseppe Nicotra, Federico Rosei, Vittorio Morandi, Margherita Zavelani-Rossi, Alberto Vomiero
Dual emission in asymmetric "giant" PbS/CdS/CdS core/shell/shell quantum dots enables color monitoring/modulation and control in the visible/NIR region for advanced applications.
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Supracolloidal helices from soft Janus particles by tuning the particle softness



Nanoscale, 2016, **8**,4070-4076
DOI: 10.1039/C5NR07011B, Paper
Qing-Zhi Zou, Zhan-Wei Li, Zhong-Yuan Lu, Zhao-Yan Sun
Supracolloidal helices including single helices, double helices, and Bernal spirals are observed through the self-

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assembly of soft Janus particles by properly tuning particle softness.
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Highly effective and uniform SERS substrates fabricated by etching multi-layered gold nanoparticle arrays

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C6NR00502K, Paper
Li Zhang, Changrong Guan, Ying Wang, Jianhui Liao
Gold nanoparticle multilayers printed on silicon substrates layer by layer were etched by gold etchant to form highly effective and uniform substrates for surface-enhanced Raman scattering (SERS). The performance of...
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Highly efficient plasmonic tip design for plasmon nanofocusing in near-field optical microscopy

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08548A, Paper
Takayuki Umakoshi, Yuika Saito, Prabhat Verma
Near-field scanning optical microscopy (NSOM) combined with plasmon nanofocusing is a powerful nano-analytical tool due to its attractive feature of efficient background suppression as well as light energy compression into...
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3D Flexible Water Channel: Stretchability of Nanoscale Water Bridge

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08072J, Paper
Jige Chen, Chunlei Wang, Ning Wei, Rongzheng Wan, Yi Gao
Artificial water channel contributes to a better understanding of natural water channel and aims to offer highly selective, advanced conductance system. Most studies use nanotubes, however it is difficult to...
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Silver Nanoparticles Confined in Carbon Nanotubes: On the Understanding of

PATENT
REEL: 037821 FRAME: 0516

Confinement Effect and Promotional Catalysis for the Selective Hydrogenation of Dimethyl Oxalate

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08651E, Paper
Jianwei Zheng, Xinping Duan, Haiqiang Lin, Zhengqiang Gu, Huihuang Fang, Jianhui Li, Youzhu Yuan
Confined Ag nanomaterial in the channels of herringbone multi-wall carbon nanotubes (Ag-in/hCNT) was effectively prepared. The space restriction induces morphological changes of Ag nanoparticles into rough nanowires with an estimated...
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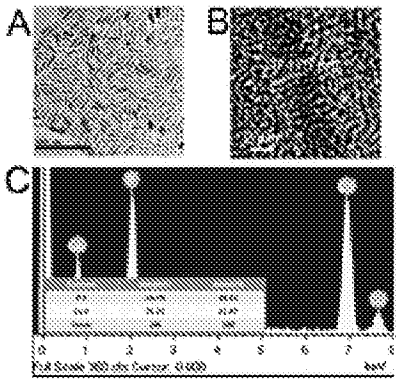
Large-area uniform and low-cost dual-mode plasmonic naked-eye colorimetry and SERS sensor with handheld Raman spectrometer

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08357E, Paper
Zhida Xu, Jing Jiang, Xinhao Wang, Kevin Han, Abid Ameen, Ibrahim Khan, Te-Wei Chang, Logan Liu
We demonstrated a highly-sensitive, wafer-scale, high-uniform plasmonic nano-mushroom substrate based on plastic for naked-eye plasmonic colorimetry and surface-enhanced Raman spectroscopy (SERS). We gave it the name FlexBrite. The dual-mode functionality...
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Elevated Gold Ellipse Nanoantenna Dimers as Sensitive and Tunable Surface Enhanced Raman Spectroscopy Substrates

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08920D, Paper
Aaron M Jubb, Yang Jiao, Gyula Eres, Scott Thomas Retterer, Baohua Gu
We demonstrate large area arrays of elevated gold ellipse dimers with precisely controlled gaps for use as sensitive and highly controllable surface enhanced Raman scattering (SERS) substrates. The significantly enhanced...
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A facile solution-phase synthesis of cobalt phosphide nanorods/hollow nanoparticles

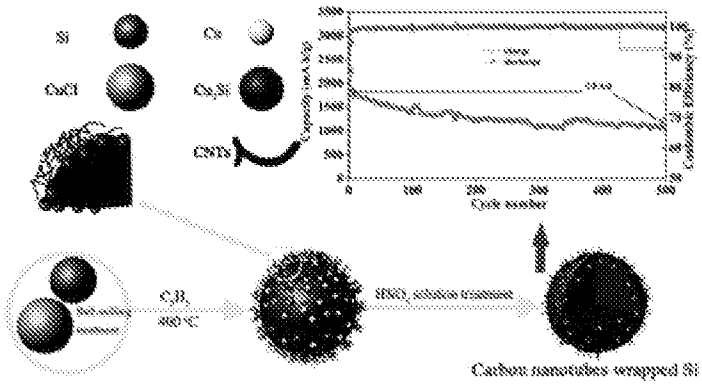


Nanoscale, 2016, Advance Article
DOI: 10.1039/C6NR00208K, Communication
Weiwei Yang, Yarong Huang, Jinlong Fan, Yongsheng Yu, Chunhui Yang, Haibo Li
A simple one-step solution-phase synthesis of cobalt phosphide nanorods (NRs) and hollow nanoparticles

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REEL: 037821 FRAME: 0517

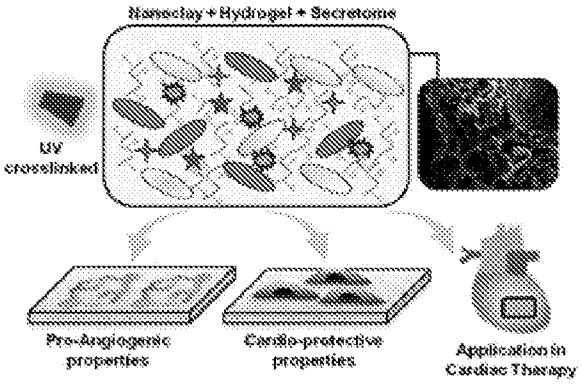
(NPs) has been reported in this paper.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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In situ growth of carbon nanotube wrapped Si composites as anodes for high performance lithium ion batteries



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08961A, Communication
Jianbin Zhou, Yang Lan, Kailong Zhang, Guoliang Xia, Jin Du, Yongchun Zhu, Yitai Qian
Carbon nanotube wrapped Si was synthesized *in situ* by using the CCVD method at 400 [degree]C and shows high electrochemical performance.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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Stem cell secretome-rich nanoclay hydrogel: a dual action therapy for cardiovascular regeneration

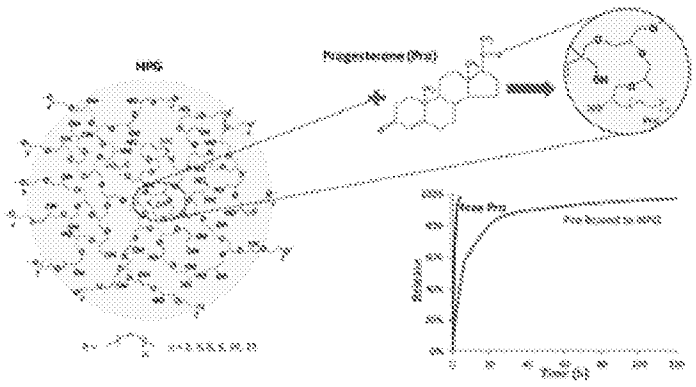


Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07806G, Communication
Renae Waters, Settimio Pacelli, Ryan Maloney, Indrani Medhi, Rafeeq P. H. Ahmed, Arghya Paul
We report development of a nanocomposite hydrogel platform using nanoclay materials and stem cell derived secretome for cardiac tissue repair and therapy.
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Progesterone binding nano-carriers based on hydrophobically modified

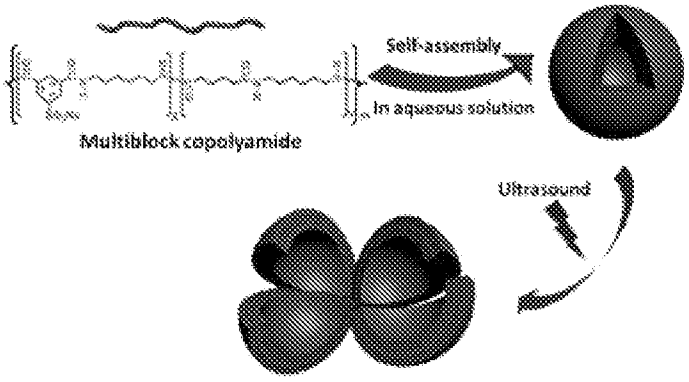
PATENT
REEL: 037821 FRAME: 0518

hyperbranched polyglycerols



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08175K, Paper
M. Alizadeh Noghani, D. E. Brooks
A family of hydrophobically derivatized HPGs is assessed as a potential carrier for progesterone, an important steroid. Molecular determinants of binding and the release kinetics are investigated and the surprising role of non-freezing water on release kinetics described.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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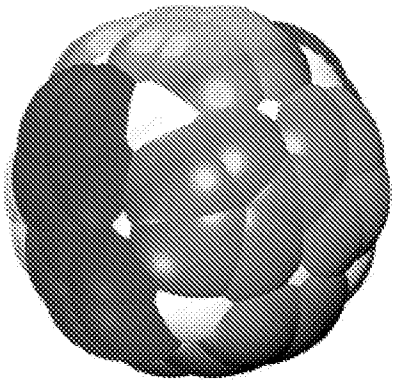
Ultrasound-responsive ultrathin multiblock copolyamide vesicles



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08596A, Communication
Lei Huang, Chunyang Yu, Tong Huang, Shuting Xu, Yongping Bai, Yongfeng Zhou
Novel ultrasound-responsive polymer vesicles with ultrathin walls and a special packing model were generated from an amphiphilic multiblock copolyamide.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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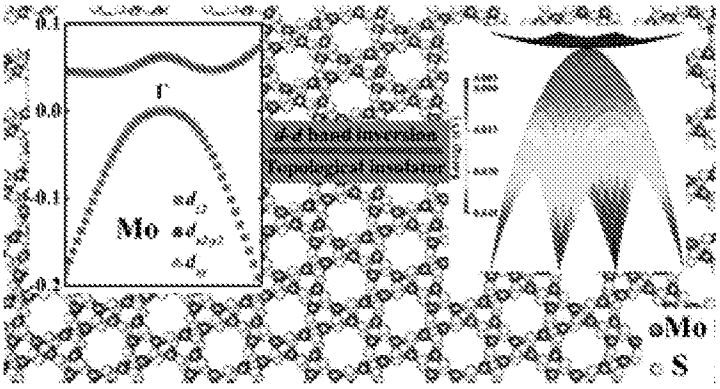
Sc20C60: a volleyballene

PATENT
REEL: 037821 FRAME: 0519



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07784B, Paper
Jing Wang, Hong-Man Ma, Ying Liu
A stable volleyball-like molecular cluster, *Volleyballene* $Sc_{20}C_{60}$, was identified. It possesses relatively high symmetry and a hollow space that can be used to accommodate other atoms or molecules for the purpose of studying fundamental chemistry.
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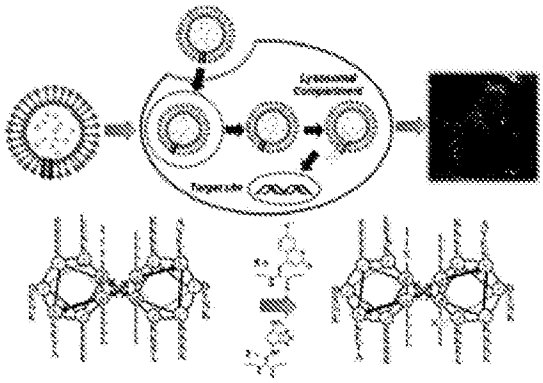
New quantum spin Hall insulator in two-dimensional MoS2 with periodically distributed pores



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08842A, Communication
Peng-Fei Liu, Liujiang Zhou, Thomas Frauenheim, Li-Ming Wu
A new two-dimensional topological insulator in two-dimensional MoS_2 with periodically distributed pores is predicted. Pure d-d band inversion is responsible for the quantum spin Hall effect. Theoretical analysis shows the largest nontrivial gap among MoS_2 isomers.
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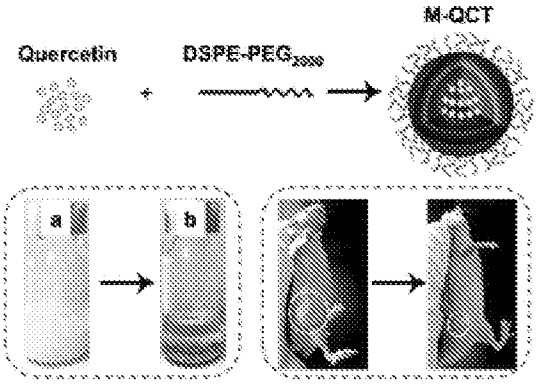
pH sensitive coiled coils: a strategy for enhanced liposomal drug delivery

PATENT
REEL: 037821 FRAME: 0520



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07734F, Paper
Rahi M. Reja, Mohsina Khan, Sumeet K. Singh, Rajkumar Misra, Anjali Shiras, Hosahudya N. Gopi
Design of pH sensitive coiled coils and their incorporation into the liposome vesicles as triggers for the controlled release of encapsulated drugs are reported.
To cite this article before page numbers are assigned, use the DOI form of citation above.
The content of this RSS Feed (c) The Royal Society of Chemistry

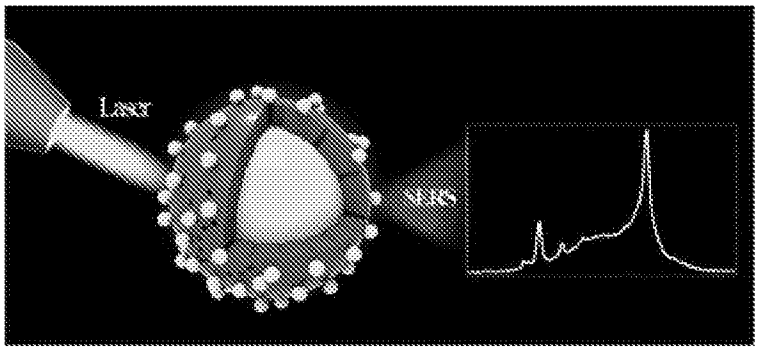
Quercetin-loaded nanomicelles to circumvent human castration-resistant prostate cancer in vitro and in vivo



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08966B, Paper
Jing Zhao, Juan Liu, Tuo Wei, Xiaowei Ma, Qiang Cheng, Shuaidong Huo, Chunqiu Zhang, Yanan Zhang, Xianglin Duan, Xing-Jie Liang
We develop a nanomicelle-based quercetin delivery system, which exhibits superior anticancer activity in the castration-resistant prostate cancer model.
To cite this article before page numbers are assigned, use the DOI form of citation above.
The content of this RSS Feed (c) The Royal Society of Chemistry

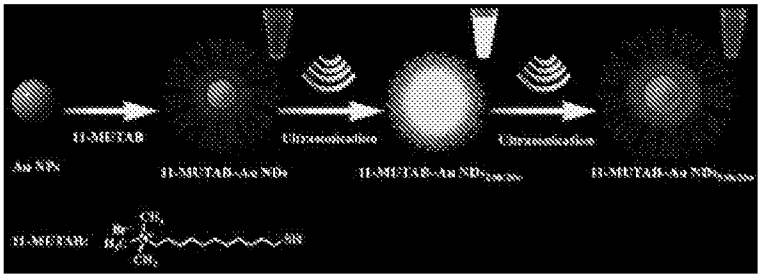
Hydrothermal synthesis of Ag@MSiO2@Ag three core-shell nanoparticles and their sensitive and stable SERS properties

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REEL: 037821 FRAME: 0521



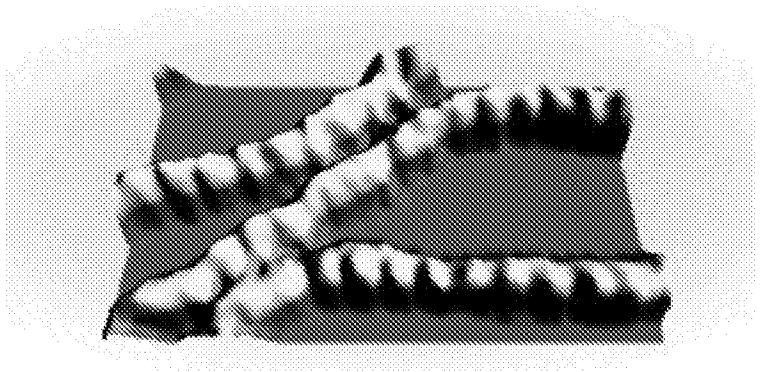
Nanoscale, 2016, Advance Article
DOI: 10.1039/C6NR00006A, Communication
Tao Jiang, Xiaolong Wang, Jun Zhou, Dong Chen, Ziqi Zhao
We report a unique Ag@MSiO$_2$@Ag three core-shell nanostructure as a SERS substrate with both sensitivity and stability.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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Ultrasound-mediated modulation of the emission of gold nanodots



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08387G, Paper
Yu-Ting Tseng, Rochelle Cherng, Zhiqin Yuan, Chien-Wei Wu, Huan-Tsung Chang, Chih-Ching Huang
Ultrasonication treatment of (11-mercaptoundecyl)-*N*,*N*,*N*-trimethylammonium bromide-capped gold nanodots (11-MUTAB-Au NDs) boosts a >1000-fold enhancement in its photoluminescence due to the smaller size and the higher 11-MUTAB ligand density on the surfaces.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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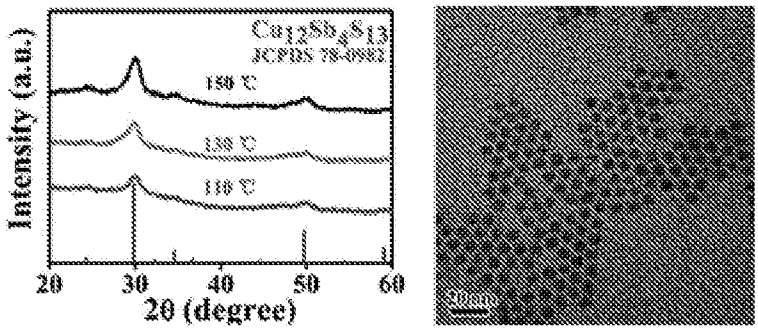
High resolution atomic force microscopy of double-stranded RNA



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REEL: 037821 FRAME: 0522

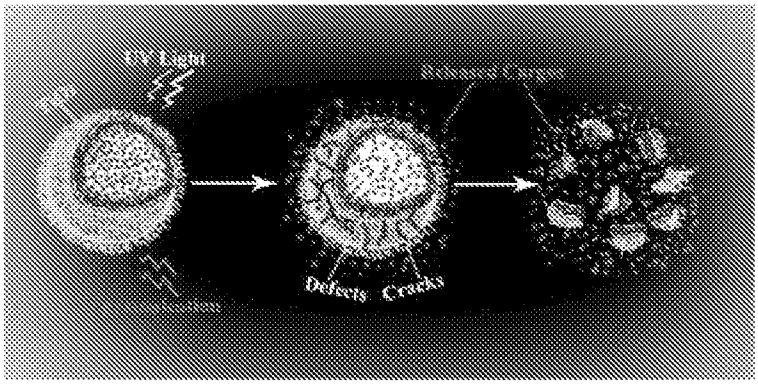
Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07445B, Paper
Pablo Ares, Maria Eugenia Fuentes-Perez, Elias Herrero-Galan, Jose M. Valpuesta, Adriana Gil, Julio Gomez-Herrero, Fernando Moreno-Herrero
Imaging double-stranded RNA at sub-helical pitch resolution with atomic force microscopy in liquid.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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A green synthesis route for the phase and size tunability of copper antimony sulfide nanocrystals with high yield



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR09097K, Paper
Keqiang Chen, Jing Zhou, Wen Chen, Qiao Chen, Peng Zhou, Yueli Liu
Typical XRD patterns of $Cu_{12}Sb_4S_{13}$ NCs with various sizes and a TEM image of 5.76 nm $Cu_{12}Sb_4S_{13}$ NCs.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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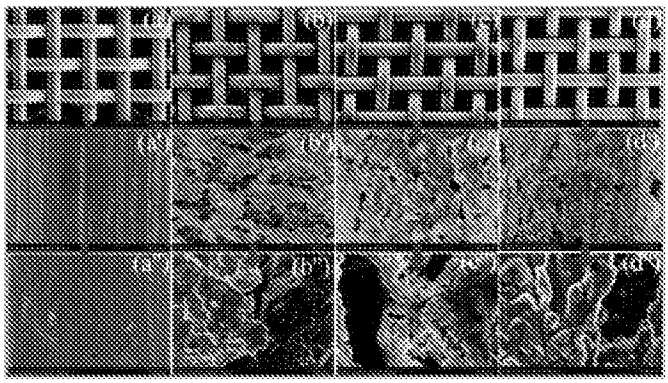
Bifunctional ultraviolet/ultrasound responsive composite TiO2/polyelectrolyte microcapsules



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR06666B, Paper
Hui Gao, Dongsheng Wen, Nadezda V. Tarakina, Jierong Liang, Andy J. Bushby, Gleb B. Sukhorukov
Functional composite TiO_2/polyelectrolyte microcapsules encapsulated with payloads are controllably opened by either ultraviolet or ultrasound treatment.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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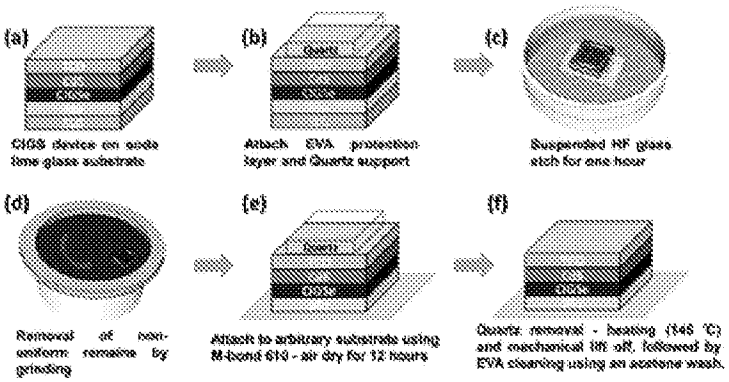
PATENT
REEL: 037821 FRAME: 0523

A multifunctional polymeric nanofilm with robust chemical performances for special wettability



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07601C, Paper
Yabin Wang, Feng Lin, Yaping Dong, Zhong Liu, Wu Li, Yudong Huang
A multifunctional polymeric nanofilm of a triazinedithiolsilane compound, which can protect metallic substrates and activate the corresponding surface simultaneously, is introduced onto a copper mesh surface *via* facile solution-immersion approaches.
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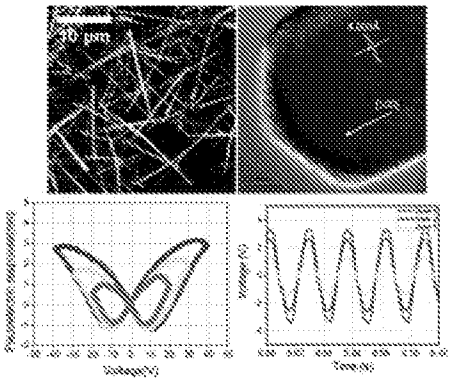
A facile chemical-mechanical polishing lift-off transfer process toward large scale Cu(In,Ga)Se2 thin-film solar cells on arbitrary substrates



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07008B, Paper
Kuan-Chun Tseng, Yu-Ting Yen, Stuart R. Thomas, Hung-Wei Tsai, Cheng-Hung Hsu, Wen-Chi Tsai, Chang-Hong Shen, Jia-Min Shieh, Zhiming M. Wang, Yu-Lun Chueh
The fabrication of Cu(In,Ga)Se_2 (CIGS) solar cells on flexible substrates is a non-trivial task due to thermal and ion diffusion related issues.
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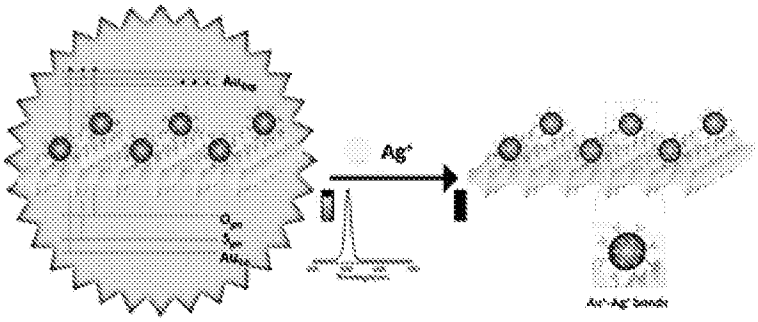
Lead-free 0.5Ba(Zr0.2Ti0.8)O3-0.5(Ba0.7Ca0.3)TiO3 nanowires for energy harvesting

PATENT
REEL: 037821 FRAME: 0524



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR09029F, Paper
Zhi Zhou, Christopher C. Bowland, Mohammad H. Malakooti, Haixiong Tang, Henry A. Sodano
$0.5Ba(Zr_{0.2}Ti_{0.8})O_3$-$0.5(Ba_{0.7}Ca_{0.3})TiO_3$ (BZT-BCT) nanowires with high piezoelectric coupling coefficient (90 +/- 5 pm V^{-1}) are utilized to fabricate a flexible, energy harvesting nanocomposite producing an open circuit voltage of 6.25 V and a power density of 2.25 [small mu]W cm^{-3}.
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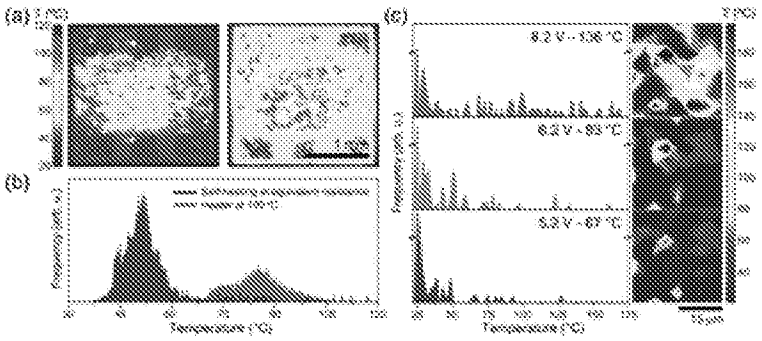
Green emission and Ag+ sensing of hydroxy double salt supported gold nanoclusters



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07029E, Paper
Jinyang Lu, Chunxiang Xu, Zhengshan Tian, Junfeng Lu, Yi Lin, Zengliang Shi
This work demonstrates a green-emitting complex of Zn-containing hydroxy double salt supported gold nanoclusters and its application for sensing Ag^+.
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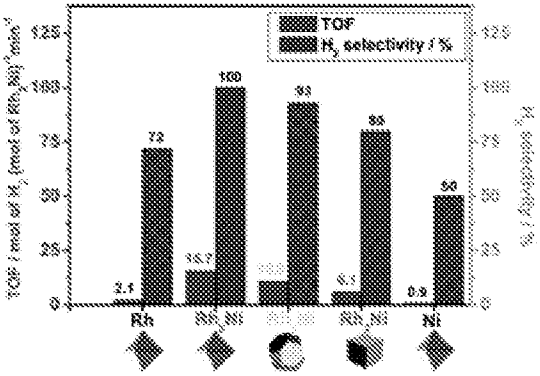
Localized self-heating in large arrays of 1D nanostructures

PATENT
REEL: 037821 FRAME: 0525



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07158E, Paper
O. Monereo, S. Illera, A. Varea, M. Schmidt, T. Sauerwald, A. Schutze, A. Cirera, J. D. Prades
Thermographic image of a CNFs film heated up by means of self-heating (left image) and external heater (right image). Raman mapping of the temperature distribution in a CNFs self-heated region at three different nominal temperatures with each corresponding temperature histogram.
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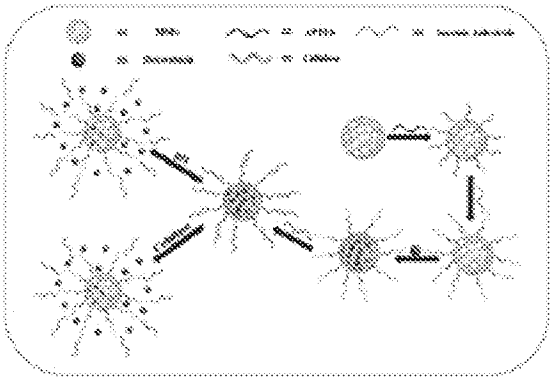
Synthesis of octahedral, truncated octahedral, and cubic Rh2Ni nanocrystals and their structure-activity relationship for the decomposition of hydrazine in aqueous solution to hydrogen



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR09227B, Paper
Chun Li, Tao Wang, Wei Chu, Ping Wu, Dong Ge Tong
Rh_2Ni nanocrystals with a higher percentage of {111} facets exhibited higher activity and H_2 selectivity during hydrazine dehydrogenation in aqueous solution.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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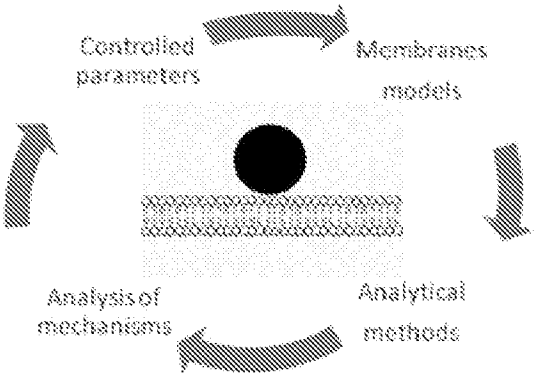
Cellulose conjugated FITC-labelled mesoporous silica nanoparticles: intracellular accumulation and stimuli responsive doxorubicin release

PATENT
REEL: 037821 FRAME: 0526



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08753H, Paper
Abdul Hakeem, Fouzia Zahid, Ruixue Duan, Muhammad Asif, Tianchi Zhang, Zhenyu Zhang, Yong Cheng, Xiaoding Lou, Fan Xia
Novel cellulose conjugated mesoporous silica nanoparticles (CLS-MSPs) for stimuli responsive intracellular doxorubicin (DOX) delivery were designed.
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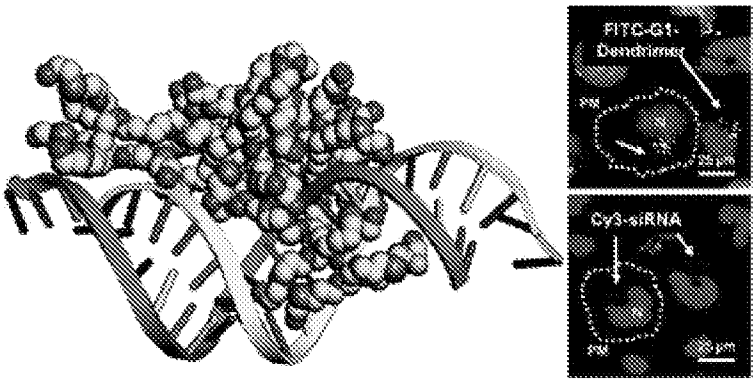
The relevance of membrane models to understand nanoparticles-cell membrane interactions



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07954C, Review Article
Estelle Rascol, Jean-Marie Devoisselle, Joel Chopineau
Membrane models are pertinent tools to explore and analyze nanoparticles-membrane interactions occurring at the cellular level.
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Low generation polyamine dendrimers bearing flexible tetraethylene glycol as nanocarriers for plasmids and siRNA

PATENT
REEL: 037821 FRAME: 0527



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR06757J, Paper
Rishi Sharma, Issan Zhang, Tze Chieh Shiao, Giovanni M. Pavan, Dusica Maysinger, Rene Roy
Polycationic tetraethyleneglycol dendrimers of low generation successfully deliver siRNA in human cells, with transfection efficiency comparable to that of Lipofectamine.
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DNA Origami Based Au-Ag-Core-Shell Nanoparticle Dimers with Single-Molecule SERS Sensitivity

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08674D, Paper
Julia Prinz, Christian Heck, Lisa Ellerik, virginia merk, Ilko Bald
DNA origami nanostructures are a versatile tool to arrange metal nanostructures and other chemical entities with nanometer precision. In this way gold nanoparticle dimers with defined distance can be constructed,...
The content of this RSS Feed (c) The Royal Society of Chemistry

Surface energy and wettability of van der Waals structures

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR06705G, Paper
Meenakshi Annamalai, Kalon Gopinadhan, Sang A Han, Surajit Saha, Hye-Jeong Park, Eun Bi Cho, Brijesh Kumar, Abhijeet Patra, Sang-Woo Kim, Thirumalai Venkatesan
Wetting behaviour of surfaces is believed to be affected by van der Waals (vdW) forces; however, there is no clear demonstration of this. With the isolation of two-dimensional vdW layered...
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Quantitative characterization of conformational-specific protein-DNA binding using a dual-spectral interferometric imaging biosensor

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR06785E, Paper
Xirui Zhang, George Daaboul, Philipp Sphuler, Peter Droege, Selim Unlu
DNA-binding proteins play crucial roles in the maintenance and functions of the genome and yet, their specific binding mechanisms are not fully understood. Recently, it was discovered that DNA-binding proteins...
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Sequential protein unfolding through a carbon nanotube pore

PATENT
REEL: 037821 FRAME: 0528

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C6NR00410E, Paper
Zhonghe Xu, Shuang Zhang, Jeffrey K Weber, Binquan Luan, Ruhong Zhou, Jingyuan Li
An assortment of biological processes, like protein degradation and the transport of proteins across membranes, depend on protein unfolding events mediated by nanopore interfaces. In this work, we exploit fully...
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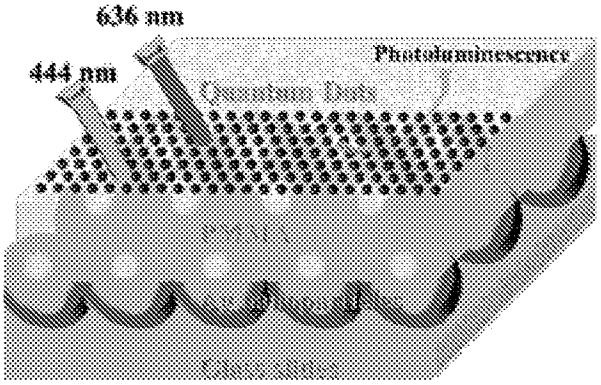
Charge Effects and Nanoparticle Pattern Formation in Electrohydrodynamic NanoDrip Printing of Colloids

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08783J, Paper
Patrizia Richner, Stephan J. P. Kress, David Norris, Dimos Poulikakos
Advancing open atmosphere printing technologies to produce features in the nanoscale range has important and broad applications ranging from electronics, to photonics, plasmonics and biology. Recently an electrohydrodynamic printing regime...
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Correction: CoPt/CeO2 catalysts for the growth of narrow diameter semiconducting single-walled carbon nanotubes

Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR90226F, Correction
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Lei Tang, Taotao Li, Chaowei Li, Lin Ling, Kai Zhang, Yagang Yao
To cite this article before page numbers are assigned, use the DOI form of citation above.
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Silver nanoparticle film induced photoluminescence enhancement of near-infrared emitting PbS and PbS/CdS core/shell quantum dots: observation of different enhancement mechanisms

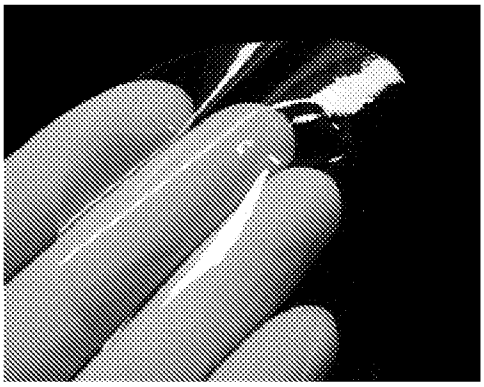


Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR05906B, Communication
H. Y. Liang, H. G. Zhao, Z. P. Li, C. Harnagea, D. L. Ma
A plasmon/fluorophore system consisting of Ag nanoparticles and near-infrared quantum dots (QDs) is investigated for photoluminescence (PL) enhancement.

PATENT
REEL: 037821 FRAME: 0529

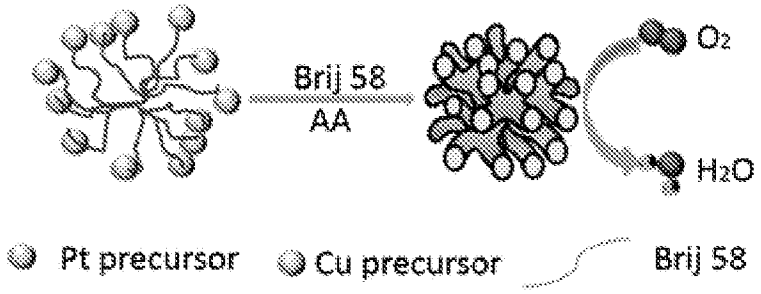
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The content of this RSS Feed (c) The Royal Society of Chemistry

Combinatorial release of dexamethasone and amiodarone from a nano-structured parylene-C film to reduce perioperative inflammation and atrial fibrillation



Nanoscale, 2016, **8**,4267-4275
DOI: 10.1039/C5NR07456H, Paper
Erik Robinson, Sunjay Kaushal, Justice Alaboson, Sudhish Sharma, Amogh Belagodu, Claire Watkins, Brandon Walker, Gregory Webster, Patrick McCarthy, Dean Ho
Suppressing perioperative inflammation and post-operative atrial fibrillation requires effective drug delivery platforms (DDP).
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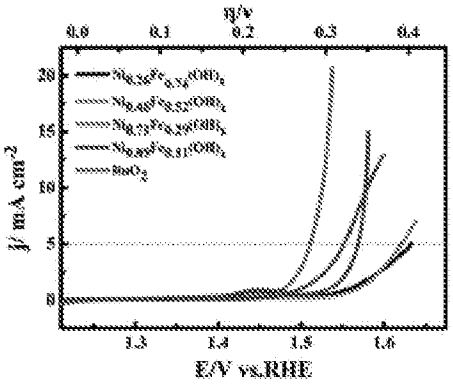
Highly branched PtCu bimetallic alloy nanodendrites with superior electrocatalytic activities for oxygen reduction reactions



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07682J, Paper
Shaofang Fu, Chengzhou Zhu, Qiurong Shi, Haibing Xia, Dan Du, Yuehe Lin
The highly branched PtCu bimetallic alloy nanodendrites were synthesized by a facile chemical reduction method using Brij 58 as the soft template. The as-prepared alloys presented superior electrocatalytic activities for oxygen reduction reactions.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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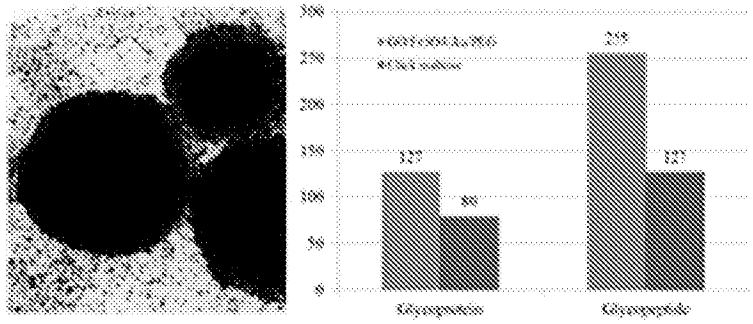
Amorphous mixed-metal hydroxide nanostructures for advanced water oxidation catalysts

PATENT
REEL: 037821 FRAME: 0530



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08989A, Paper
Y. Q. Gao, X. Y. Liu, G. W. Yang
We have synthesized amorphous mixed-metal (Ni-Fe) hydroxide nanostructures with a homogeneous distribution of Ni/Fe as well as a tunable Ni/Fe ratio by a simple, facile, green and low-cost electrochemical technique, and we have also demonstrated that the synthesized amorphous nanomaterials possess ultrahigh activity and super long-term cycle stability in the OER process.
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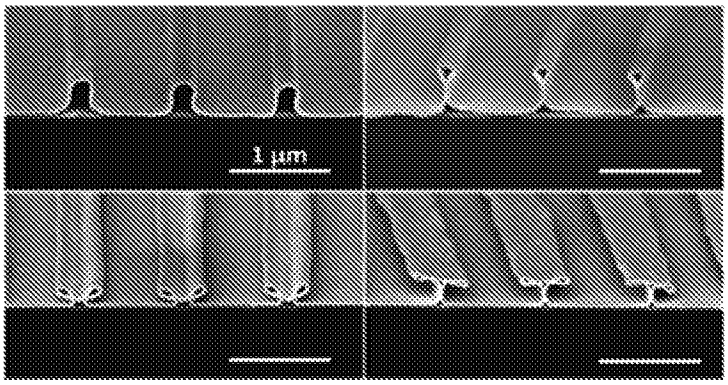
Hydrophilic GO/Fe3O4/Au/PEG nanocomposites for highly selective enrichment of glycopeptides



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08126B, Communication
Bo Jiang, Qi Wu, Nan Deng, Yuanbo Chen, Lihua Zhang, Zhen Liang, Yukui Zhang
GO/Fe_3O_4/Au/PEG nanocomposites were synthesized, and exhibited high selectivity to capture glycopeptides.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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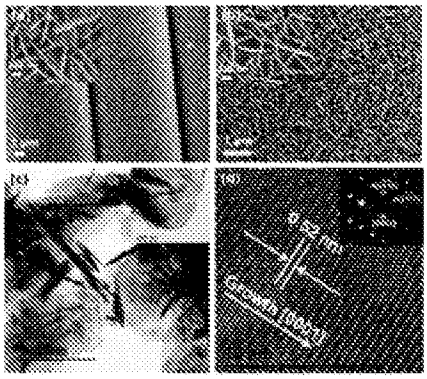
Fabrication and design of metal nano-accordion structures using atomic layer deposition and interference lithography

PATENT
REEL: 037821 FRAME: 0531



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08566G, Paper
J.-H. Min, A. Bagal, J. Z. Mundy, C. J. Oldham, B.-I. Wu, G. N. Parsons, C.-H. Chang
Fabricated free-standing platinum nano-accordion structures with a wide variety of cross-sectional profiles using a combination of ALD and IL.
To cite this article before page numbers are assigned, use the DOI form of citation above.
The content of this RSS Feed (c) The Royal Society of Chemistry

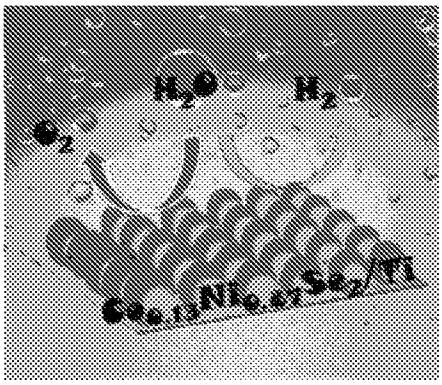
Flexible, transparent and exceptionally high power output nanogenerators based on ultrathin ZnO nanoflakes



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08324A, Paper
Huynh Van Ngoc, Dae Joon Kang
Novel nanogenerator structures composed of ZnO nanoflakes of less than 10 nm thickness were fabricated using a novel method involving a facile synthetic route and a rational design.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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Electrodeposited Co-doped NiSe2 nanoparticles film: a good electrocatalyst for efficient water splitting

PATENT
REEL: 037821 FRAME: 0532

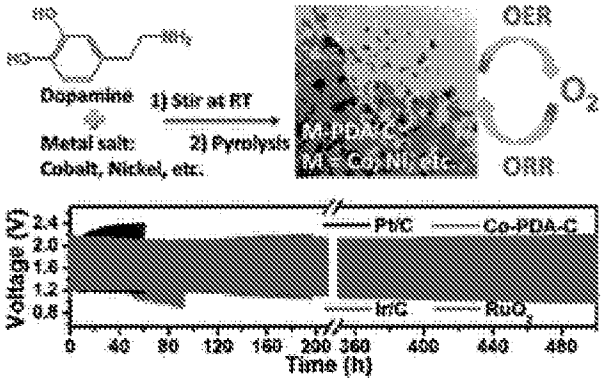


Nanoscale, 2016, **8**,3911-3915
DOI: 10.1039/C5NR07170D, Communication
Tingting Liu, Abdullah M. Asiri, Xuping Sun
Co-doped $NiSe_2$ nanoparticles film electrodeposited on Ti plate ($Co_{0.13}Ni_{0.87}Se_2$/Ti) acts as a robust water-splitting electrocatalyst in 1.0 M KOH, driving 10 mA cm^{-2} at HER overpotential of 64 mV and 100 mA cm^{-2} at OER overpotential of 320 mV.
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Correction: Polyol synthesis, functionalisation, and biocompatibility studies of superparamagnetic iron oxide nanoparticles as potential MRI contrast agents

Nanoscale, 2016, **8**,4395-4395
DOI: 10.1039/C5NR90206A, Correction
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Roxanne Hachani, Mark Lowdell, Martin Birchall, Aziliz Hervault, Damien Mertz, Sylvie Begin-Colin, Nguyen Thị Kim Thanh
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Mussel-inspired one-pot synthesis of transition metal and nitrogen co-doped carbon (M/N-C) as efficient oxygen catalysts for Zn-air batteries

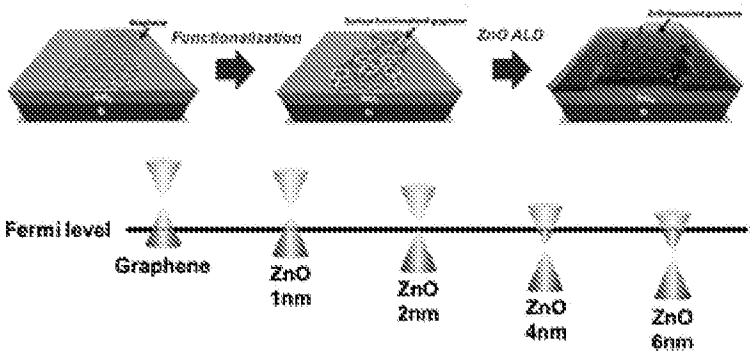


Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR06538K, Paper
Bing Li, Ye Chen, Xiaoming Ge, Jianwei Chai, Xiao Zhang, T. S. Andy Hor, Guojun Du, Zhaolin Liu, Hua Zhang, Yun Zong
Transition metal and nitrogen co-doped nanostructured carbons, synthesized *via* a simple and scalable room

PATENT
REEL: 037821 FRAME: 0533

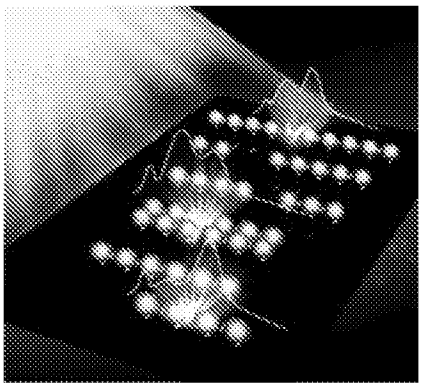
temperature approach inspired by mussels, have enabled robust cycling of Zn-air batteries.
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A non-destructive n-doping method for graphene with precise control of electronic properties via atomic layer deposition



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08016A, Paper
Kyu Seok Han, Pranav Y. Kalode, Yong-Eun Koo Lee, Hongbum Kim, Lynn Lee, Myung Mo Sung
A precise n-doping technique for graphene *via* atomic layer deposition (ALD) of ZnO thin films is presented.
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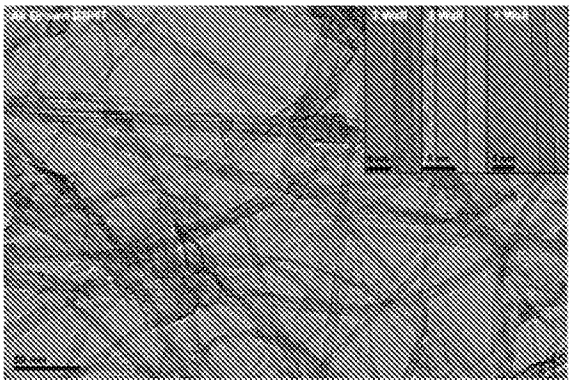
Strong plasmon coupling in self-assembled superparamagnetic nanoshell chains



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR09101B, Paper
Min Xiong, Xiulong Jin, Jian Ye
Construction of plasmonic superparamagnetic nanoshell chains by using a magnetic field is described. Strong plasmon coupling effects in the chains result in large electric field enhancements. Taking advantage of low-cost and large-area fabrication methods, these nanoshell chains are promising for biosensing, metamaterials, electromagnetic energy transport, and optical waveguide.
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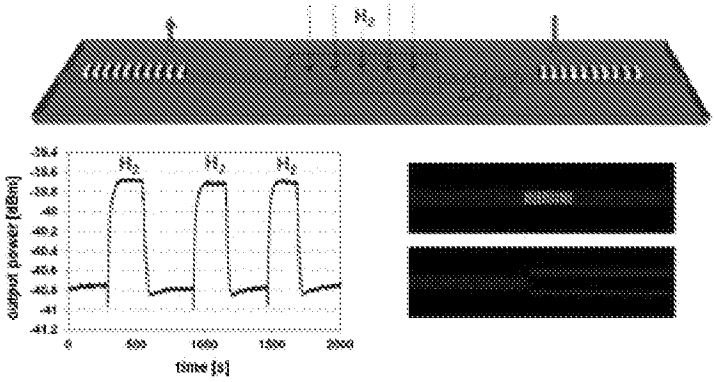
Thermodynamic approach to boron nitride nanotube solubility and dispersion

PATENT
REEL: 037821 FRAME: 0534



Nanoscale, 2016, **8**,4348-4359
DOI: 10.1039/C5NR08259E, Paper
A. L. Tiano, L. Gibbons, M. Tsui, S. I. Applin, R. Silva, C. Park, C. C. Fay
Inadequate dispersion of nanomaterials is a critical issue that significantly limits the potential properties of nanocomposites and when overcome, will enable further enhancement of material properties.
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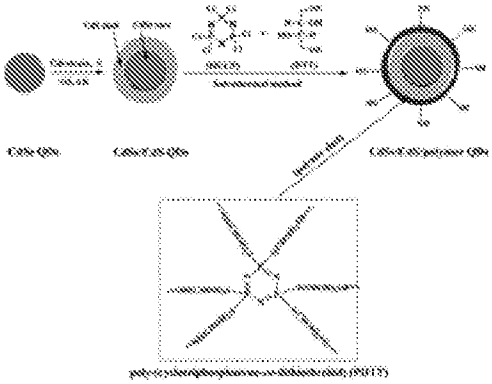
Hydrogen sensing with Pd-coated long-range surface plasmon membrane waveguides



Nanoscale, 2016, **8**,4284-4290
DOI: 10.1039/C5NR08001K, Paper
Norman R. Fong, Pierre Berini, R. N. Tait
A low power optical hydrogen sensor using a Pd film on a flexible LRSPP membrane waveguide with grating couplers.
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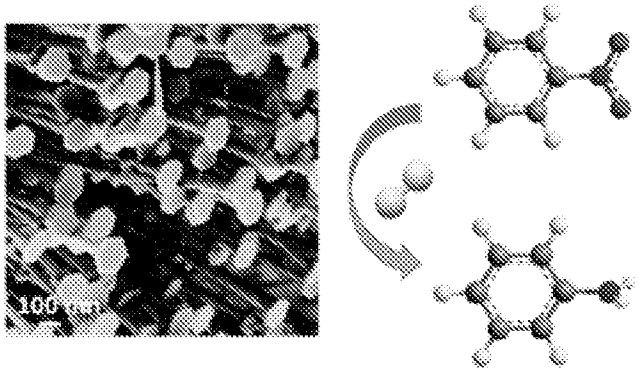
Suppressed blinking behavior of CdSe/CdS QDs by polymer coating

PATENT
REEL: 037821 FRAME: 0535



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08504G, Paper
Aidi Zhang, Yannan Bian, Jinjie Wang, Kuiyong Chen, Chaoqing Dong, Jicun Ren
Semiconductor quantum dots (QDs) are very important fluorescent nanocrystals with excellent optical properties.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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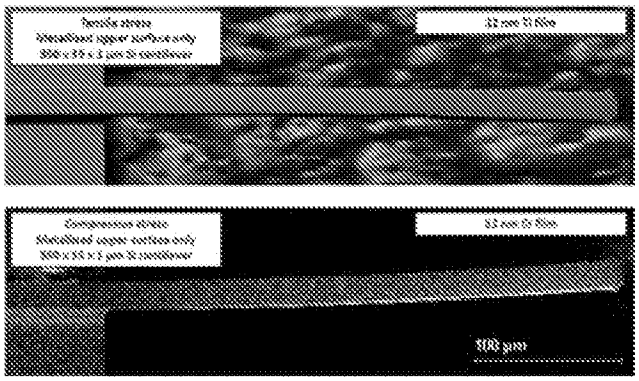
Designing axial growth of Co-Ni bimetallic nanowires with hexagon-like caps and their catalytic hydrogenation for nitrobenzene



Nanoscale, 2016, **8**,3949-3953
DOI: 10.1039/C5NR09131D, Communication
Jiawen Wang, Jingwei Liu, Nating Yang, Shuangshuang Huang, Yuhan Sun, Yan Zhu
Co-Ni bimetal nanowires with hexagonal caps are more effective than corresponding nanoparticles for the nitrobenzene hydrogenation to produce aniline.
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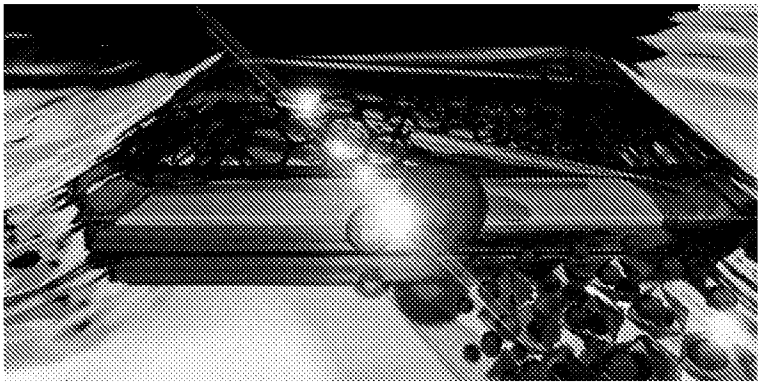
On the origin and magnitude of surface stresses due to metal nanofilms

PATENT
REEL: 037821 FRAME: 0536



Nanoscale, 2016, **8**,4245-4251
DOI: 10.1039/C5NR08789A, Paper
James Bowen, David Cheneler
Metallisation is a vital process for micro- and nanofabrication. We investigate the metallisation of silicon cantilevers with nano-films of chromium and titanium. Surface stresses acting in opposite directions were measured for these two metals.
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Ultrasensitive 1D field-effect phototransistors: CH3NH3PbI3 nanowire sensitized individual carbon nanotubes

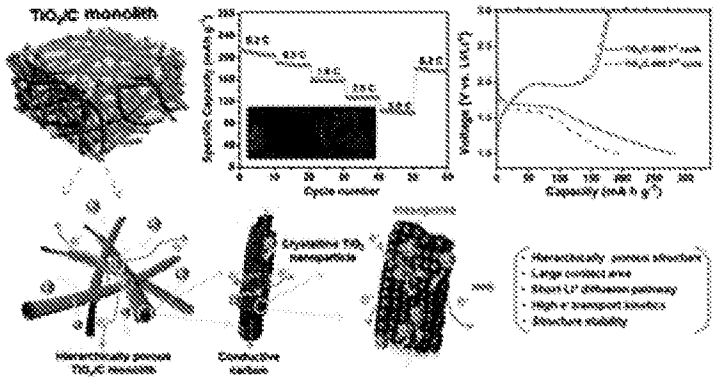


Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR06727H, Communication
M. Spina, B. Nafradi, H. M. Tohati, K. Kamaras, E. Bonvin, R. Gaal, L. Forro, E. Horvath
Field-effect phototransistors were fabricated based on individual carbon nanotubes (CNTs) sensitized by $CH_3NH_3PbI_3$ nanowires ($MAPbI_3NWs$).

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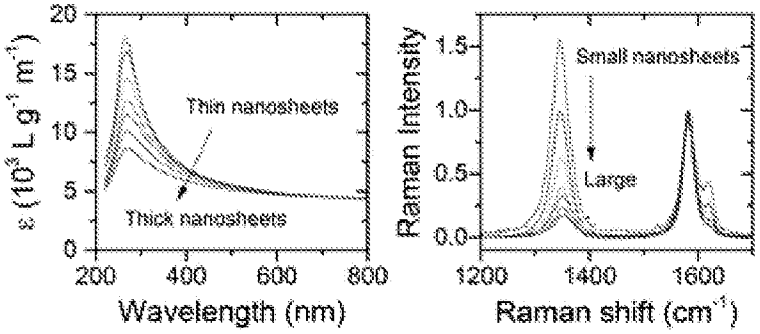
Hierarchical TiO2/C nanocomposite monoliths with a robust scaffolding architecture, mesopore-macropore network and TiO2-C heterostructure for high-performance lithium ion batteries

PATENT
REEL: 037821 FRAME: 0537



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR09149G, Paper
Hai-Bo Huang, Yue Yang, Li-Hua Chen, Yun Wang, Shao-Zhuan Huang, Jia-Wei Tao, Xiao-Ting Ma, Tawfique Hasan, Yu Li, Yan Xu, Bao-Lian Su
A general approach for the design of TiO_2/C nanocomposites with structural stability, and tunable and interconnected hierarchical porosity that leads to a new high electrochemical performance electrode.
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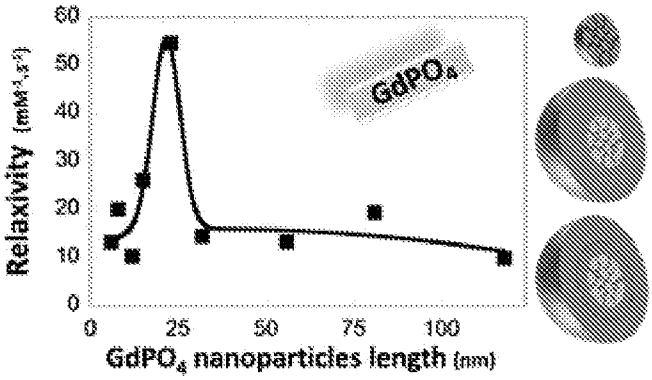
Spectroscopic metrics allow in situ measurement of mean size and thickness of liquid-exfoliated few-layer graphene nanosheets



Nanoscale, 2016, **8**,4311-4323
DOI: 10.1039/C5NR08047A, Paper
Claudia Backes, Keith R. Paton, Damien Hanlon, Shengjun Yuan, Mikhail I. Katsnelson, James Houston, Ronan J. Smith, David McCloskey, John F. Donegan, Jonathan N. Coleman
Quantitative spectroscopic metrics based on absorbance and Raman spectroscopy are presented for size-selected liquid-exfoliated graphene.
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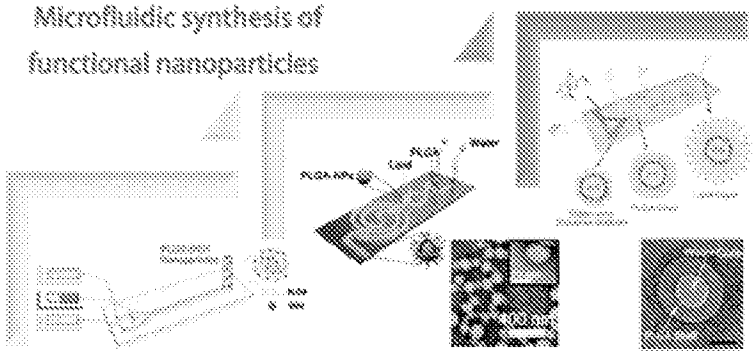
Hyperbranched polymer mediated size-controlled synthesis of gadolinium phosphate nanoparticles: colloidal properties and particle size-dependence on MRI relaxivity

PATENT
REEL: 037821 FRAME: 0538



Nanoscale, 2016, **8**,4252-4259
DOI: 10.1039/C5NR05064B, Paper
Camille Frangville, Maylis Gallois, Yichen Li, Hong Hanh Nguyen, Nancy Lauth-de Viguerie, Daniel R. Talham, Christophe Mingotaud, Jean-Daniel Marty
Core-shell(s) hyperbranched polymers were used to synthesize size-controlled gadolinium phosphate nanowires. An optimum particle size with high relaxivity values was evidenced.
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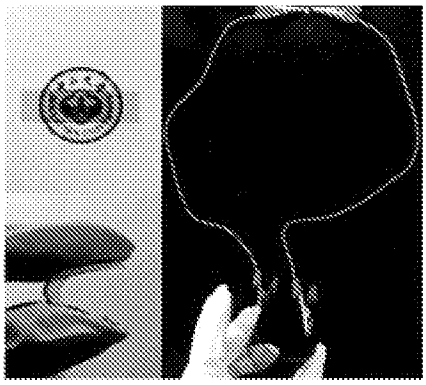
Microfluidics-mediated assembly of functional nanoparticles for cancer-related pharmaceutical applications



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07964K, Review Article
Qiang Feng, Jiashu Sun, Xingyu Jiang
This review focuses on microfluidic synthesis of functional nanoparticles with tunable structures and properties for cancer treatment and diagnosis.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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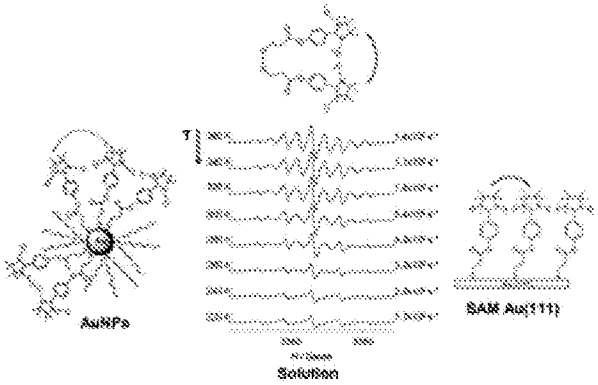
A flexible, transparent and super-long-life supercapacitor based on ultrafine Co3O4 nanocrystal electrodes

PATENT
REEL: 037821 FRAME: 0539



Nanoscale, 2016, **8**,4227-4235
DOI: 10.1039/C5NR09145D, Paper
X. Y. Liu, Y. Q. Gao, G. W. Yang
A flexible, transparent and super-long-life supercapacitor has been fabricated based on ultrafine Co_3O_4 nanocrystal electrodes.
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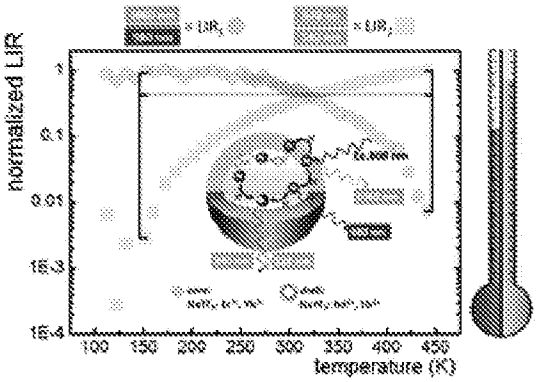
Dynamics of intramolecular spin exchange interaction of a nitronyl nitroxide diradical in solution and on surfaces



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08824K, Paper
V. Lloveras, E. Badetti, J. Veciana, J. Vidal-Gancedo
It is possible to preserve the same dynamic behaviour observed for a diradical in solution in AuNP surface-anchored radicals.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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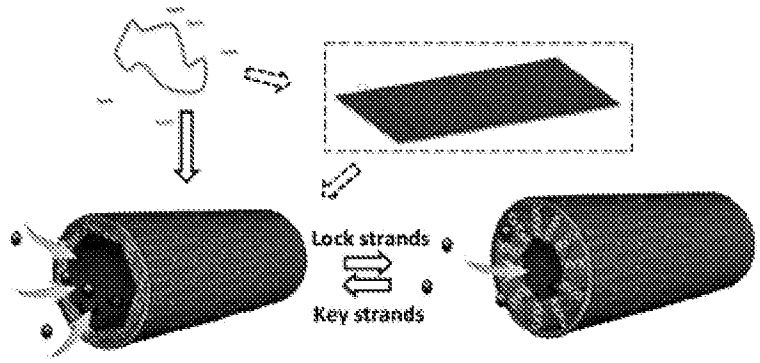
A broadening temperature sensitivity range with a core-shell YbEr@YbNd double ratiometric optical nanothermometer

PATENT
REEL: 037821 FRAME: 0540



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08223D, Paper
L. Marciniak, K. Prorok, L. Frances-Soriano, J. Perez-Prieto, A. Bednarkiewicz
The chemical architecture of lanthanide doped core-shell up-converting nanoparticles can be engineered to purposely design the properties of luminescent nanomaterials, which are typically inaccessible to their homogeneous counterparts.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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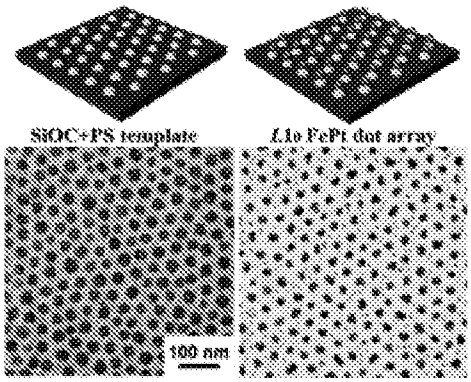
A switchable DNA origami nanochannel for regulating molecular transport at the nanometer scale



Nanoscale, 2016, **8**,3944-3948
DOI: 10.1039/C5NR08206D, Communication
Dianming Wang, Yiyang Zhang, Miao Wang, Yuanchen Dong, Chao Zhou, Mark Antonin Isbell, Zhongqiang Yang, Huajie Liu, Dongsheng Liu
A nanochannel with a shutter at one end was built by DNA nanotechnology.
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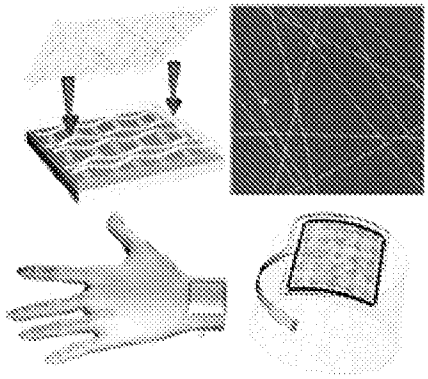
Thermal dewetting with a chemically heterogeneous nano-template for self-assembled L10 FePt nanoparticle arrays

PATENT
REEL: 037821 FRAME: 0541



Nanoscale, 2016, **8**,3926-3935
DOI: 10.1039/C5NR08339G, Communication
Liang-Wei Wang, Chung-Fu Cheng, Jung-Wei Liao, Chiu-Yen Wang, Ding-Shuo Wang, Kuo-Feng Huang, Tzu-Ying Lin, Rong-Ming Ho, Lih-Juann Chen, Chih-Huang Lai
The self-assembled $L1_0$ FePt nanoparticles are fabricated by thermal dewetting with a chemically heterogeneous nano-template.
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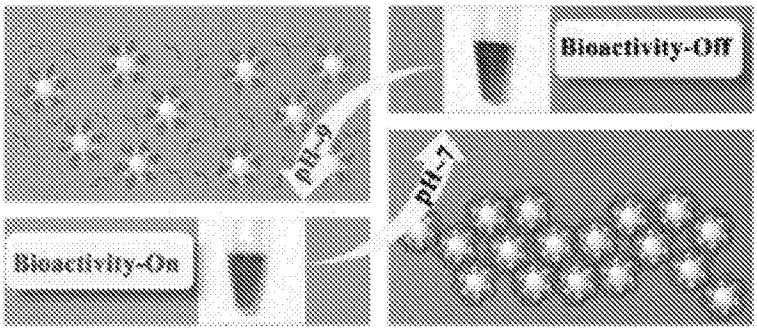
A high-performance, flexible and robust metal nanotrough-embedded transparent conducting film for wearable touch screen panels



Nanoscale, 2016, **8**,3916-3922
DOI: 10.1039/C5NR07657A, Communication
Hyeon-Gyun Im, Byeong Wan An, Jungho Jin, Junho Jang, Young-Geun Park, Jang-Ung Park, Byeong-Soo Bae
A junction resistance-free continuous metal nanotrough-embedded transparent conducting electrode (TCE) composite film (metal nanotrough-GFRHybrimer film) is reported.
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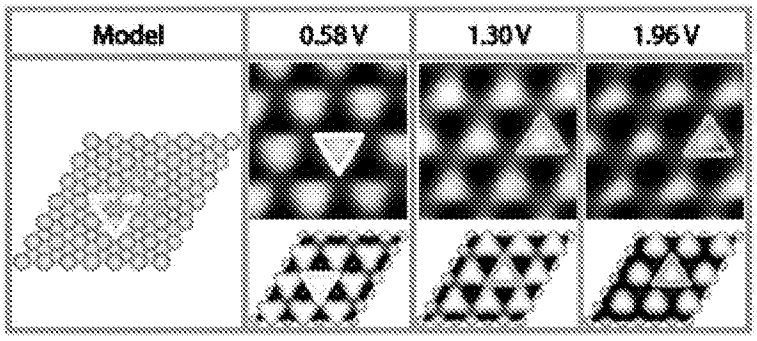
Multifunctional nanoparticle-protein conjugates with controllable bioactivity and pH responsiveness

PATENT
REEL: 037821 FRAME: 0542



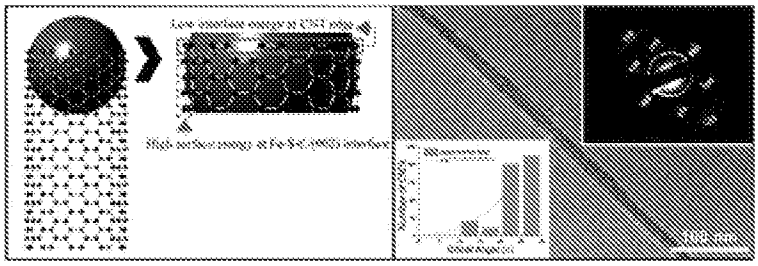
Nanoscale, 2016, **8**,4387-4394
DOI: 10.1039/C5NR07436C, Paper
Feng Liu, Lulu Xue, Yuqi Yuan, Jingjing Pan, Chenjie Zhang, Hongwei Wang, John L. Brash, Lin Yuan, Hong Chen
With the interaction of polymers, the nanoparticle-protein conjugates show controllable bioactivity and pH responsiveness.
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Tuning the surface electronic structure of a Pt3Ti(111) electro catalyst



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08420B, Paper
M. Pa[German sz ligature}ens, V. Caciuc, N. Atodiresei, M. Moors, S. Blugel, R. Waser, S. Karthauser
Combining voltage dependent STM imaging with *ab initio* DFT calculations to identify the exact termination of an electro catalyst.
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Inherent predominance of high chiral angle metallic carbon nanotubes in continuous fibers grown from a molten catalyst

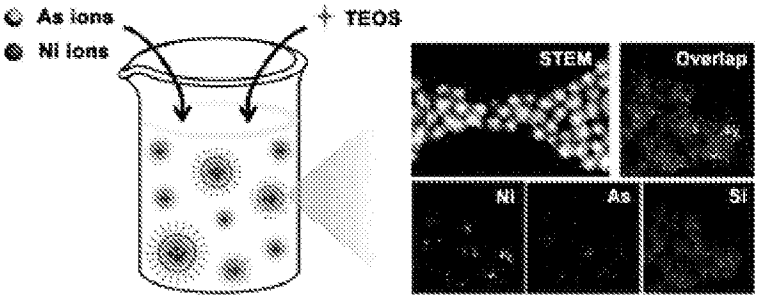


Nanoscale, 2016, **8**,4236-4244
DOI: 10.1039/C5NR07455J, Paper

PATENT
REEL: 037821 FRAME: 0543

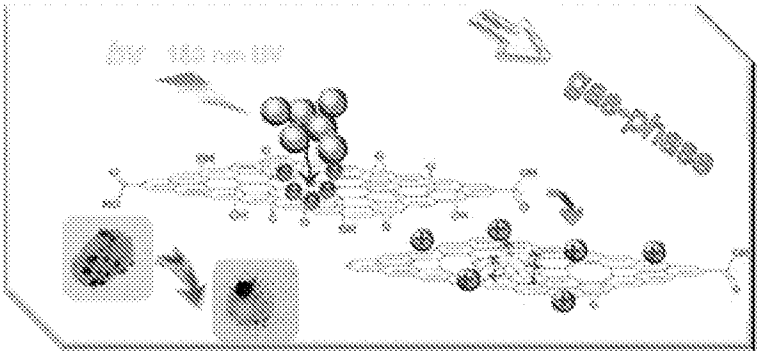
B. Aleman, M. Mar Bernal, B. Mas, Emilio M. Perez, V. Reguero, G. Xu, Y. Cui, Juan J. Vilatela
The armchair-biased chiral angle distribution in continuous fibres of CNTs is controlled by the molten state of the Fe-S-C alloy catalyst.
The content of this RSS Feed (c) The Royal Society of Chemistry

A facile route to core-shell nanoparticulate formation of arsenic trioxide for effective solid tumor treatment



Nanoscale, 2016, **8**,4373-4380
DOI: 10.1039/C5NR07860A, Paper
Zongjun Zhang, Hanyu Liu, Hualu Zhou, Xianglong Zhu, Zhenghuan Zhao, Xiaoqin Chi, Hong Shan, Jinhao Gao
The facile synthesis of pH-sensitive arsenic-based nanodrugs by a "one-pot" reverse microemulsion method was reported.
The content of this RSS Feed (c) The Royal Society of Chemistry

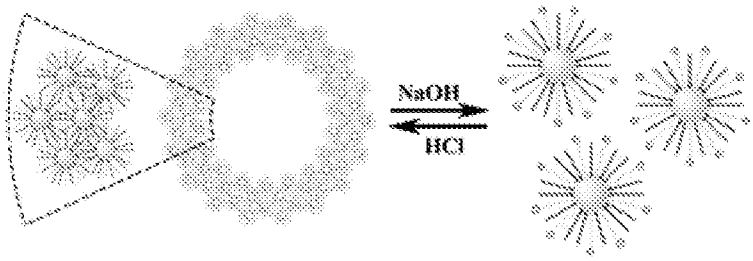
Gas-phase rapid reduction of graphene oxide through photoionization of gold nanoparticles



Nanoscale, 2016, **8**,3906-3910
DOI: 10.1039/C5NR08509H, Communication
Jeong Hoon Byeon
This work introduces for the first time a rapid reduction of graphene oxide *via* the photoionization of gold nanoparticles in a continuous gas-phase process.
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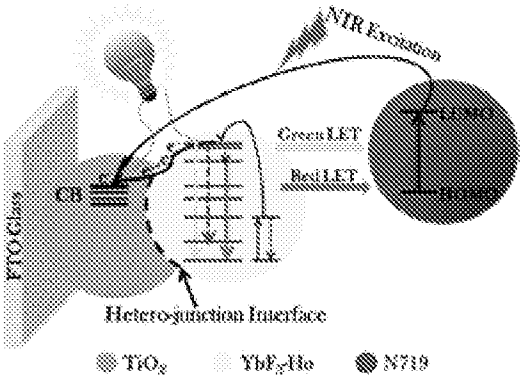
pH-Responsive reversible self-assembly of gold nanoparticles into nanovesicles

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REEL: 037821 FRAME: 0544



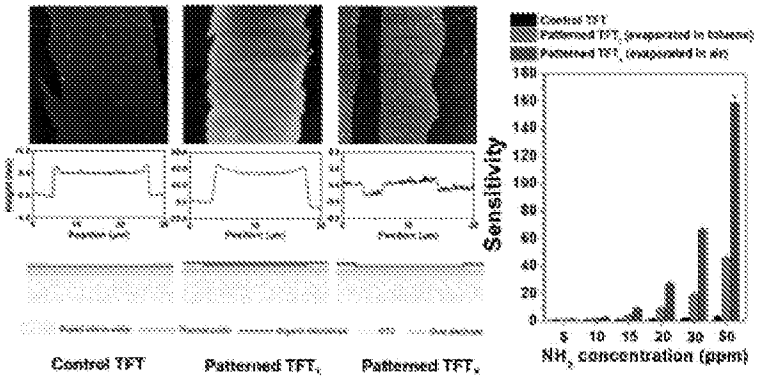
Nanoscale, 2016, **8**,3923-3925
DOI: 10.1039/C6NR00044D, Communication
Chunfang Fan, Tong Bian, Lu Shang, Run Shi, Li-Zhu Wu, Chen-Ho Tung, Tierui Zhang
pH-Responsive Au nanovesicles with reversible self-assembly and disassembly performance were developed by adjusting protonation and deprotonation of surface ligands.
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Enhanced photovoltaic performance of dye-sensitized solar cells using a new photoelectrode material: upconversion YbF3-Ho/TiO2 nanoheterostructures



Nanoscale, 2016, **8**,4173-4180
DOI: 10.1039/C5NR08319B, Paper
Jia Yu, Yulin Yang, Ruiqing Fan, Ping Wang, Yuwei Dong
UC/TiO_2 nanoheterostructures induce electron-injection from YbF_3-Ho to TiO_2 by utilizing near-infrared light, and further improve the existing merits of TiO_2.
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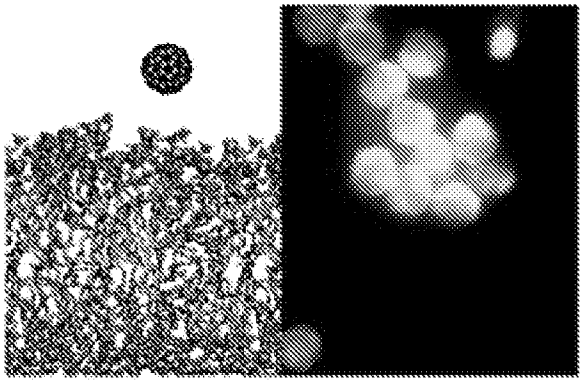
Fast patterning of oriented organic microstripes for field-effect ammonia gas sensors



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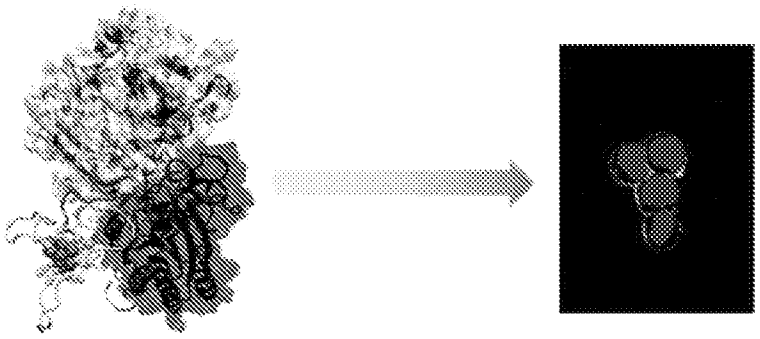
Nanoscale, 2016, **8**,3954-3961
DOI: 10.1039/C5NR09001F, Communication
Binghao Wang, Jinqiang Ding, Tao Zhu, Wei Huang, Zequn Cui, Jianmei Chen, Lizhen Huang, Lifeng Chi
A series of organic field-effect transistors (OFETs) with patterned ultra-thin films for NH_3 detection are achieved *via* fast dip-coating.
The content of this RSS Feed (c) The Royal Society of Chemistry

C60 fullerene localization and membrane interactions in RAW 264.7 immortalized mouse macrophages



Nanoscale, 2016, **8**,4134-4144
DOI: 10.1039/C5NR07003A, Paper
K. A. Russ, P. Elvati, T. L. Parsonage, A. Dews, J. A. Jarvis, M. Ray, B. Schneider, P. J. S. Smith, P. T. F. Williamson, A. Violi, M. A. Philbert
There continues to be a significant increase in the number and complexity of hydrophobic nanomaterials that are engineered for a variety of commercial purposes making human exposure a significant health concern.
The content of this RSS Feed (c) The Royal Society of Chemistry

Computational design of peptide-Au cluster probe for sensitive detection of [small alpha]IIb[small beta]3 integrin

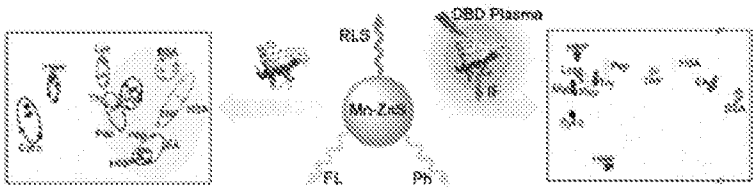


Nanoscale, 2016, **8**,4203-4208
DOI: 10.1039/C5NR09175F, Paper
Lina Zhao, Jiao Zhai, Xuejie Zhang, Xueyun Gao, Xiaohong Fang, Jingyuan Li
We have designed a novel peptide-Au cluster probe to specifically bind to [small alpha]$_{IIb}$[small beta]$_3$ integrin.
The content of this RSS Feed (c) The Royal Society of Chemistry

Plasma-assisted quadruple-channel optosensing of proteins and cells with Mn-

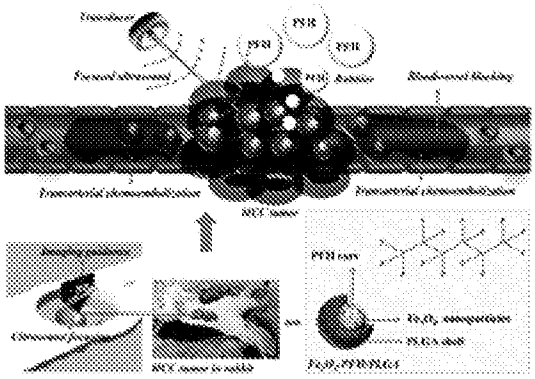
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doped ZnS quantum dots



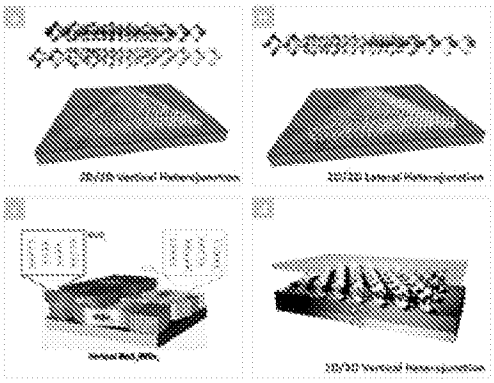
Nanoscale, 2016, **8**,4291-4298
DOI: 10.1039/C5NR09130F, Paper
Chenghui Li, Peng Wu, Xiandeng Hou
The addition of the intrinsic fluorescence of proteins to the existing triple-channel optical properties of Mn-ZnS QDs yields new quadruple-channel optosensing devices with substantially increased discrimination capacity for proteins. A low-temperature plasma for protein treatment further enforces the discrimination.
The content of this RSS Feed (c) The Royal Society of Chemistry

Nanoparticle-enhanced synergistic HIFU ablation and transarterial chemoembolization for efficient cancer therapy



Nanoscale, 2016, **8**,4324-4339
DOI: 10.1039/C5NR08292G, Paper
Yufeng You, Zhigang Wang, Haitao Ran, Yuanyi Zheng, Dong Wang, Jinshun Xu, Zhibiao Wang, Yu Chen, Pan Li
We have developed a nanoparticle-based HIFU synergistic cancer surgery enhanced by transarterial chemoembolization for high-efficient HCC treatment based on Fe_3O_4-PFH/PLGA nanocapsules.
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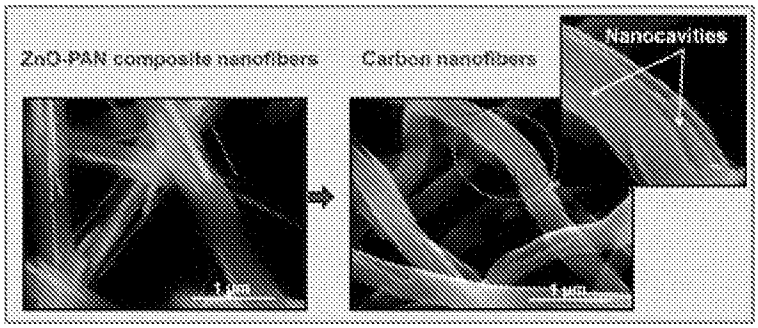
Fundamentals of lateral and vertical heterojunctions of atomically thin materials



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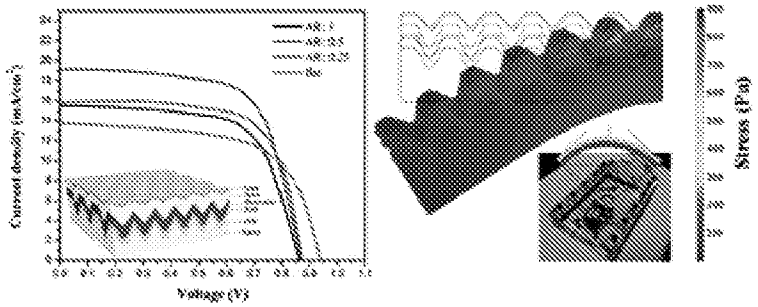
Nanoscale, 2016, **8**,3870-3887
DOI: 10.1039/C5NR08982D, Minireview
Anupum Pant, Zafer Mutlu, Darshana Wickramaratne, Hui Cai, Roger K. Lake, Cengiz Ozkan, Sefaattin Tongay
At the turn of this century, Herbert Kroemer, the 2000 Nobel Prize winner in Physics, famously commented that "the interface is the device".
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Zinc oxide nanorod assisted rapid single-step process for the conversion of electrospun poly(acrylonitrile) nanofibers to carbon nanofibers with a high graphitic content



Nanoscale, 2016, **8**,4360-4372
DOI: 10.1039/C5NR06809F, Paper
Ratyakshi Nain, Dhirendra Singh, Manjeet Jassal, Ashwini K. Agrawal
The effect of incorporation of rigid zinc oxide (ZnO) nanostructures on carbonization behavior of electrospun special acrylic fiber grade poly(acrylonitrile) (PAN-SAF) nanofibers was investigated.
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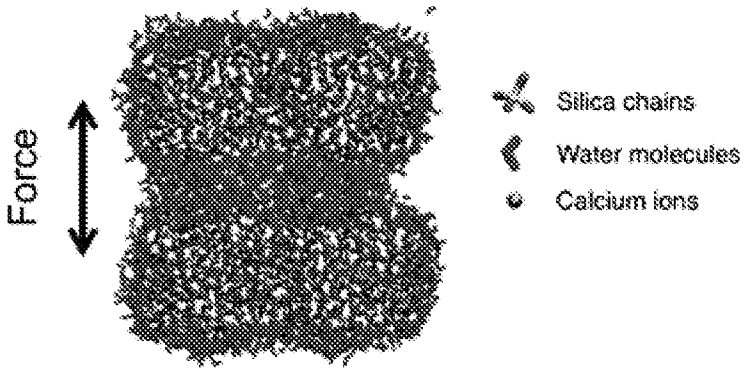
Efficient, flexible and mechanically robust perovskite solar cells on inverted nanocone plastic substrates



Nanoscale, 2016, **8**,4276-4283
DOI: 10.1039/C5NR08836D, Paper
Mohammad Mahdi Tavakoli, Qingfeng Lin, Siu-Fung Leung, Ga Ching Lui, Hao Lu, Liang Li, Bin Xiang, Zhiyong Fan
Utilization of nanostructures on photovoltaic devices can significantly improve the device energy conversion efficiency by enhancing the device light harvesting capability as well as carrier collection efficiency.
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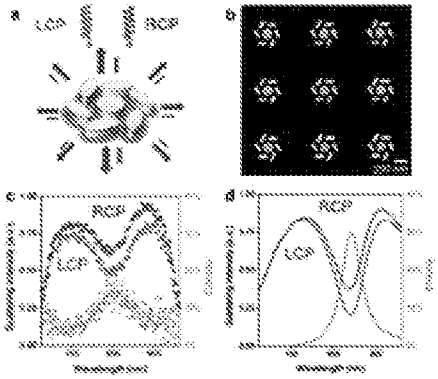
Interaction grand potential between calcium-silicate-hydrate nanoparticles at the molecular level

PATENT
REEL: 037821 FRAME: 0548



Nanoscale, 2016, **8**,4160-4172
DOI: 10.1039/C5NR08142D, Paper
Patrick A. Bonnaud, Christophe Labbez, Ryuji Miura, Ai Suzuki, Naoto Miyamoto, Nozomu Hatakeyama, Akira Miyamoto, Krystyn J. Van Vliet
Mean forces and interaction grand potentials between calcium-silicate-hydrate particles.
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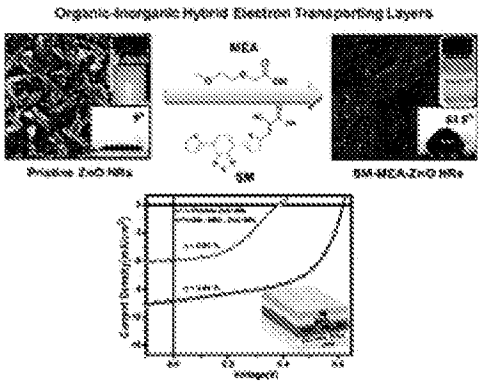
Planar plasmonic chiral nanostructures



Nanoscale, 2016, **8**,3900-3905
DOI: 10.1039/C5NR09302C, Communication
Shuai Zu, Yanjun Bao, Zheyu Fang
A strong chiral optical response induced at a plasmonic Fano resonance in a planar Au heptamer nanostructure was experimentally and theoretically demonstrated.
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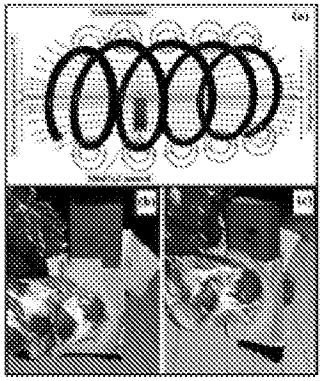
Co-functionalized organic/inorganic hybrid ZnO nanorods as electron transporting layers for inverted organic solar cells

PATENT
REEL: 037821 FRAME: 0549



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08849F, Paper
Swapnil B. Ambade, Rohan B. Ambade, Seung Hun Eom, Myung-Jin Baek, Sushil S. Bagde, Rajaram S. Mane, Soo-Hyoung Lee
The first hybrid co-functionalization of solution processed planar ZnO nanorod ETLs in iOSCs with organic small molecule based on a D-A-D configuration with meticulous control of aggregation.
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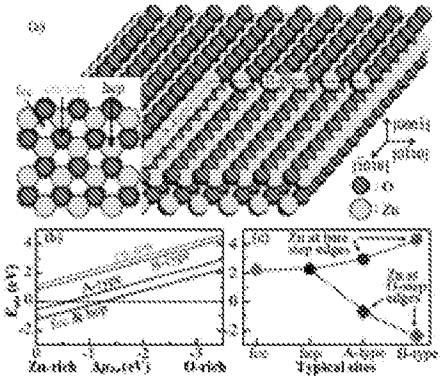
Fe3C-filled carbon nanotubes: permanent cylindrical nanomagnets possessing exotic magnetic properties



Nanoscale, 2016, **8**,4299-4310
DOI: 10.1039/C5NR09188H, Paper
Reetu Kumari, Lucky Krishnia, Vinay Kumar, Sandeep Singh, H. K. Singh, R. K. Kotnala, R. R. Juluri, U. M. Bhatta, P. V. Satyam, Brajesh S. Yadav, Zainab Naqvi, Pawan K. Tyagi
We study how confinement affects the magnetism of Fe_3C filled CNTs and stress induced structural phase transition. A model describing the growth mechanism as well as *in situ* pole formation in nanorod is discussed.
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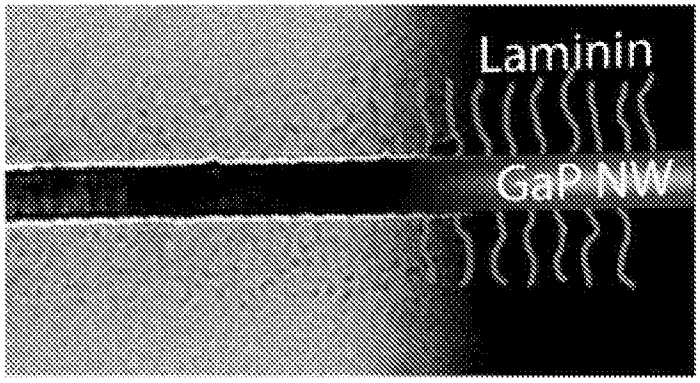
Effects of nitrogen dopants on the atomic step kinetics and electronic structures of O-polar ZnO

PATENT
REEL: 037821 FRAME: 0550



Nanoscale, 2016, **8**,4381-4386
DOI: 10.1039/C5NR09060A, Paper
Hao Wang, Huahan Zhan, Yinghui Zhou, Yaping Wu, Xiaohang Chen, Huiqiong Wang, Junyong Kang
Oxygen-polar ZnO films are grown in step flow mode by molecular beam epitaxy.
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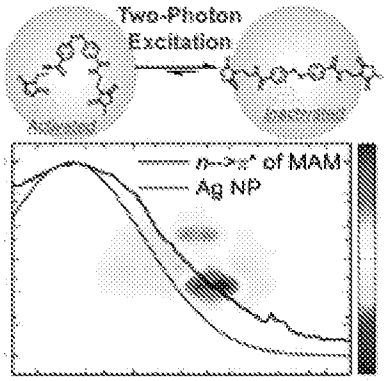
Electron microscopy imaging of proteins on gallium phosphide semiconductor nanowires



Nanoscale, 2016, **8**,3936-3943
DOI: 10.1039/C5NR08888G, Communication
Martin Hjort, Mikael Bauer, Stefan Gunnarsson, Erik Marsell, Alexei A. Zakharov, Gunnel Karlsson, Elodie Sanfins, Christelle N. Prinz, Reine Wallenberg, Tommy Cedervall, Anders Mikkelsen
We have imaged GaP nanowires (NWs) incubated with human laminin, serum albumin (HSA), and blood plasma using both cryo-transmission electron microscopy and synchrotron based X-ray photoemission electron microscopy.
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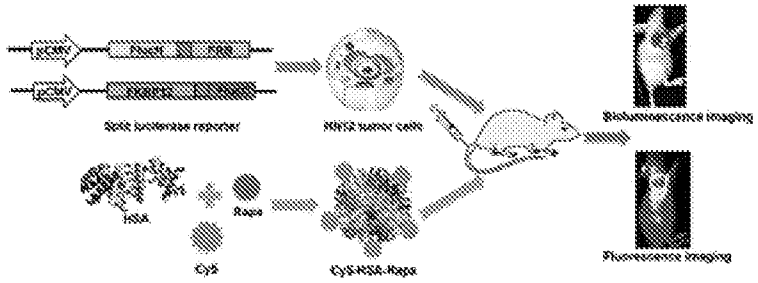
Plasmon-enhanced two-photon-induced isomerization for highly-localized light-based actuation of inorganic/organic interfaces

PATENT
REEL: 037821 FRAME: 0551



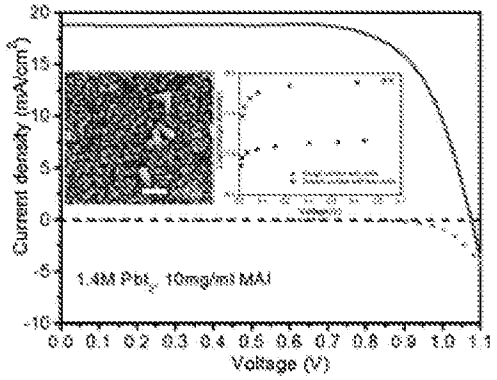
Nanoscale, 2016, **8**,4194-4202
DOI: 10.1039/C5NR07973J, Paper
Chang-Keun Lim, Xin Li, Yue Li, Kurt L. M. Drew, J. Pablo Palafox-Hernandez, Zhenghua Tang, Alexander Baev, Andrey N. Kuzmin, Marc R. Knecht, Tiffany R. Walsh, Mark T. Swihart, Hans Agren, Paras N. Prasad
Plasmon-enhanced two-photon isomerization of non-donor/acceptor modified azobenzene on Ag NPs.
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Combined image guided monitoring the pharmacokinetics of rapamycin loaded human serum albumin nanoparticles with a split luciferase reporter



Nanoscale, 2016, **8**,3991-4000
DOI: 10.1039/C5NR07308A, Paper
Fu Wang, Kai Yang, Zhe Wang, Ying Ma, J. Silvio Gutkind, Naoki Hida, Gang Niu, Jie Tian
This integrated imaging platform could provide more reliable respective PK profiles of a loaded drug and its carrier.
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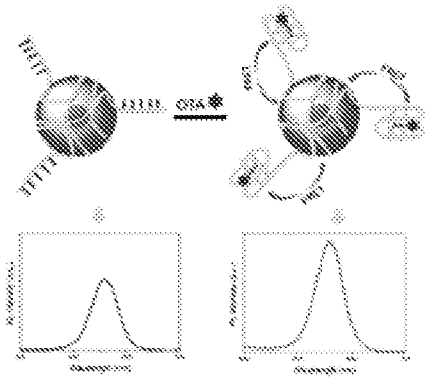
Influence of void-free perovskite capping layer on the charge recombination process in high performance CH3NH3PbI3 perovskite solar cells



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REEL: 037821 FRAME: 0552

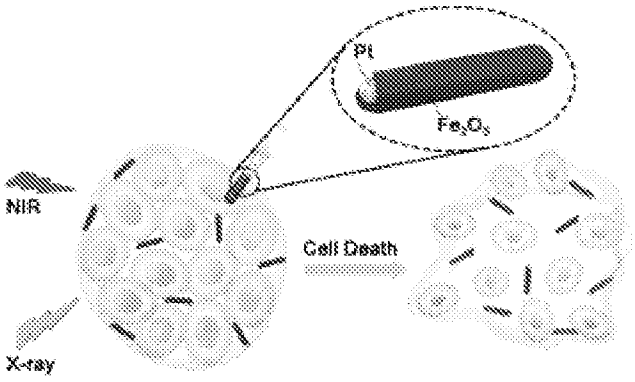
Nanoscale, 2016, **8**,4181-4193
DOI: 10.1039/C5NR06362K, Paper
Kunwu Fu, Christopher T. Nelson, Mary Cooper Scott, Andrew Minor, Nripan Mathews, Lydia Helena Wong
Uniform surface coverage of perovskite capping layer formed with less void formation reduces charge recombination and enhances device performance.
The content of this RSS Feed (c) The Royal Society of Chemistry

A self-assembly aptasensor based on thick-shell quantum dots for sensing of ochratoxin A



Nanoscale, 2016, **8**,4127-4133
DOI: 10.1039/C5NR08284F, Paper
Xianfeng Chu, Xiaowen Dou, Ruizheng Liang, Menghua Li, Weijun Kong, Xihui Yang, Jiaoyang Luo, Meihua Yang, Ming Zhao
A tunable-valency self-assembling aptasensor based on a thick-shell quantum dot was fabricated for ochratoxin A (OTA).
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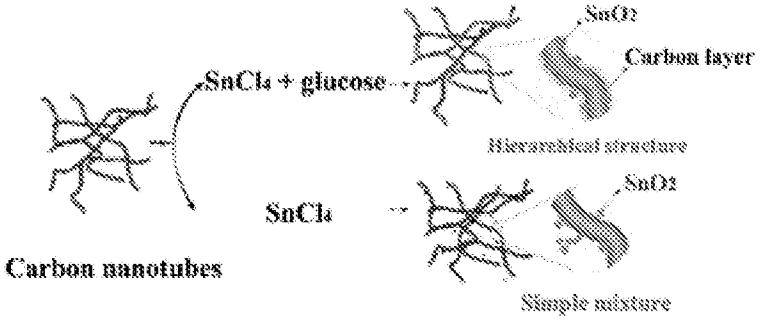
Facile preparation of hybrid core-shell nanorods for photothermal and radiation combined therapy



Nanoscale, 2016, **8**,3895-3899
DOI: 10.1039/C5NR09102K, Communication
Yaoyao Deng, Erdong Li, Xiaju Cheng, Jing Zhu, Shuanglong Lu, Cuicui Ge, Hongwei Gu, Yue Pan
Water-soluble platinum@iron oxide core-shell nanorods were synthesized and explored for NIR photothermal and X-ray radiation combined therapy.
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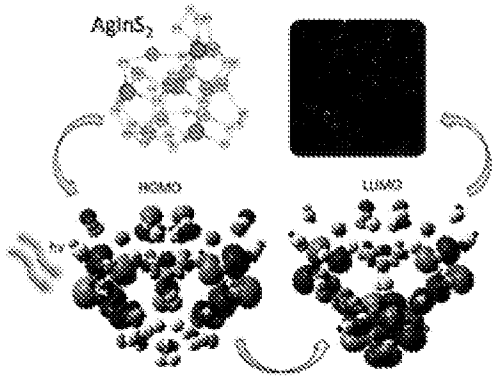
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Carbon coated SnO2 nanoparticles anchored on CNT as a superior anode material for lithium-ion batteries



Nanoscale, 2016, **8**,4121-4126
DOI: 10.1039/C5NR07996A, Paper
Chunrong Ma, Weimin Zhang, Yu-Shi He, Qiang Gong, Haiying Che, Zi-Feng Ma
High performance hierarchically structured carbon covering SnO_2 nanoparticles on CNTs were synthesized *via* a facile glucose mediated hydrothermal method and subsequent calcination as an anode for lithium-ion batteries.
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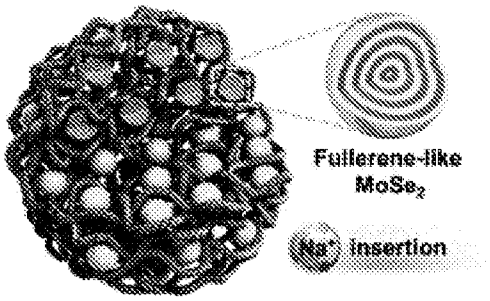
Two blinking mechanisms in highly confined AgInS2 and AgInS2/ZnS quantum dots evaluated by single particle spectroscopy



Nanoscale, 2016, **8**,4151-4159
DOI: 10.1039/C5NR07992F, Paper
B. Cichy, R. Rich, A. Olejniczak, Z. Gryczynski, W. Strek
Ternary $AgInS_2$ quantum dots (QDs) have been found as promising cadmium-free, red-shifted, and tunable luminescent bio-probes with efficient Stokes and anti-Stokes excitations and luminescence lifetimes (*ca.* 100 ns) convenient for time resolved techniques.
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Fullerene-like MoSe2 nanoparticles-embedded CNT balls with excellent structural stability for highly reversible sodium-ion storage

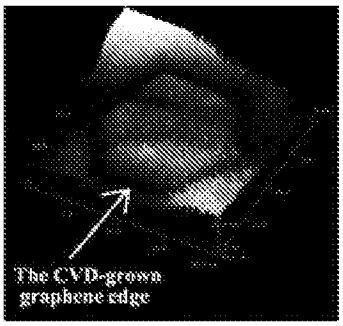
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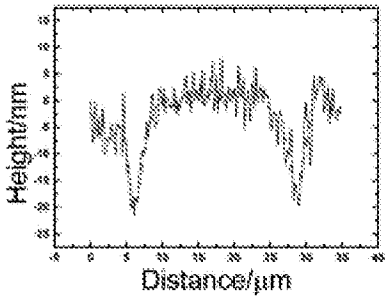


Fullerene-like $MoSe_2$ nanoparticles embedded CNT ball

Nanoscale, 2016, **8**,4209-4216
DOI: 10.1039/C5NR07733H, Paper
Seung Ho Choi, Yun Chan Kang
Three-dimensional (3D) porous-structured carbon nanotube (CNT) balls embedded with metal selenide nanocrystals were prepared by a simple two-step process. The fullerene-like $MoSe_2$/CNT composite balls, selected as the first target material, showed excellent sodium-ion storage properties.
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Edge morphology evolution of graphene domains during chemical vapor deposition cooling revealed through hydrogen etching

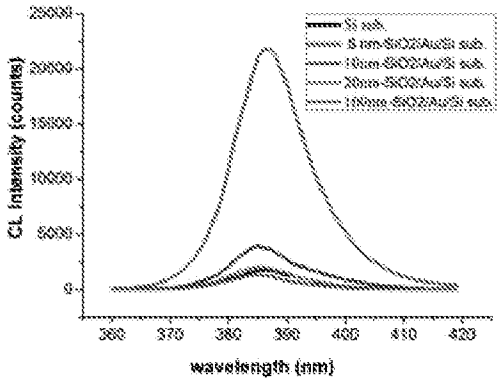




Nanoscale, 2016, **8**,4145-4150
DOI: 10.1039/C5NR06624G, Paper
Haoran Zhang, Yanhui Zhang, Yaqian Zhang, Zhiying Chen, Yanping Sui, Xiaoming Ge, Guanghui Yu, Zhi Jin, Xinyu Liu
The CVD cooling process induced graphene edge evolution, such as nanoparticle accumulation and graphene edge sinking. The results revealed the peculiar graphene-Cu movement during CVD cooling.
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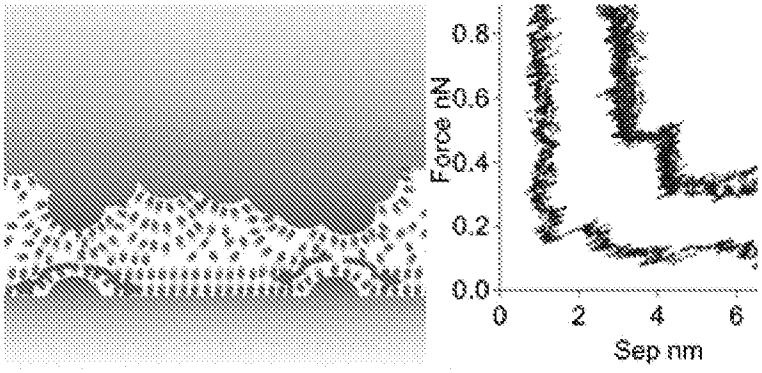
Strongly enhanced ultraviolet emission of an Au@SiO2/ZnO plasmonic hybrid nanostructure

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Nanoscale, 2016, **8**,4030-4036
DOI: 10.1039/C5NR06153A, Paper
Li Wang, Xiaodong Wang, Shengcheng Mao, Hua Wu, Xia Guo, Yuan Ji, Xiaodong Han
We present the surface plasmon polariton (SPP)-enhanced ultraviolet (UV) emission of an Au@SiO_2/ZnO hybrid nanostructure.
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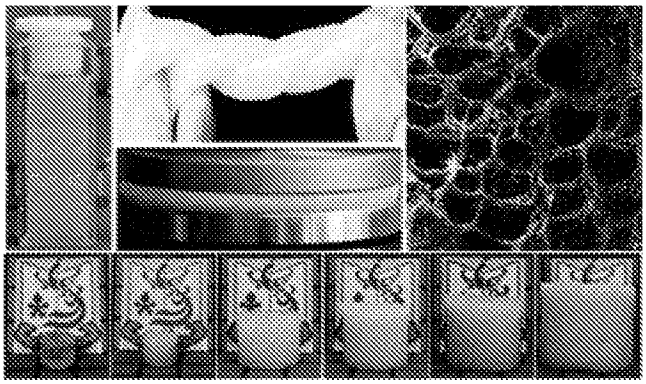
Layering of ionic liquids on rough surfaces



Nanoscale, 2016, **8**,4094-4106
DOI: 10.1039/C5NR07805A, Paper
Alexis Sheehan, L. Andres Jurado, Shivaprakash N. Ramakrishna, Andrea Arcifa, Antonella Rossi, Nicholas D. Spencer, Rosa M. Espinosa-Marzal
Structural forces reveal the ordered structure of one ionic liquid at rough interfaces of well-defined nanoscale roughness, also under nanoconfinement.
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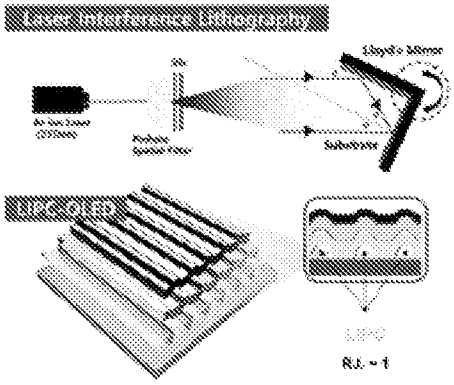
Aqueous compatible boron nitride nanosheets for high-performance hydrogels

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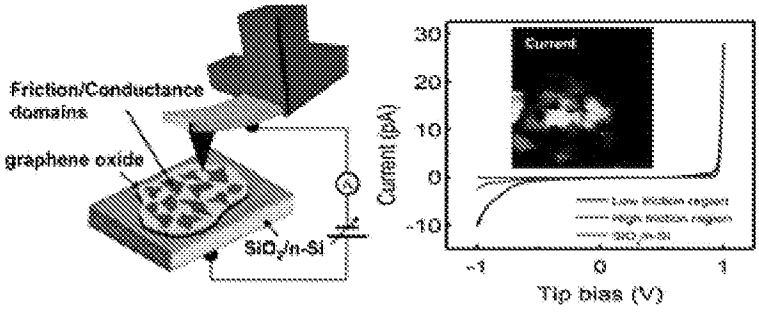
Nanoscale, 2016, **8**,4260-4266
DOI: 10.1039/C5NR07578E, Paper
Xiaozhen Hu, Jiahui Liu, Qiuju He, Yuan Meng, Liu Cao, Ya-Ping Sun, Jijie Chen, Fushen Lu
Aqueous dispersible boron nitride nanosheets were produced and used to fabricate nanocomposite hydrogels with high water retentivity and flexibility.
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An extremely low-index photonic crystal layer for enhanced light extraction from organic light-emitting diodes



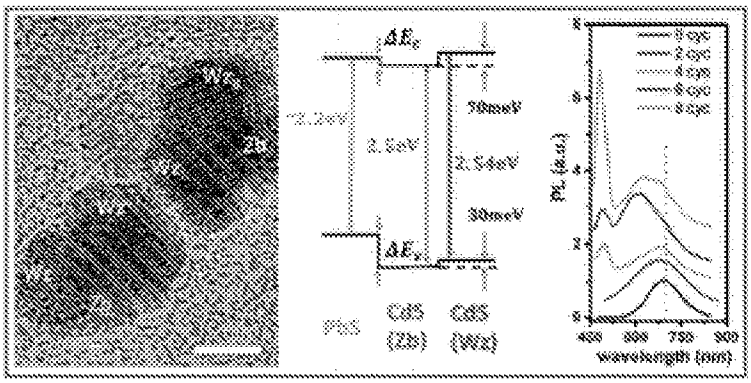
Nanoscale, 2016, **8**,4113-4120
DOI: 10.1039/C5NR07312J, Paper
Yong Sub Shim, Ju Hyun Hwang, Cheol Hwee Park, Sun-Gyu Jung, Young Wook Park, Byeong-Kwon Ju
This paper reports organic light-emitting diodes (OLEDs) with improved light extraction fabricated by embedding an extremely low-index photonic crystal (LIPC) layer.
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Friction and conductance imaging of sp2- and sp3-hybridized subdomains on single-layer graphene oxide



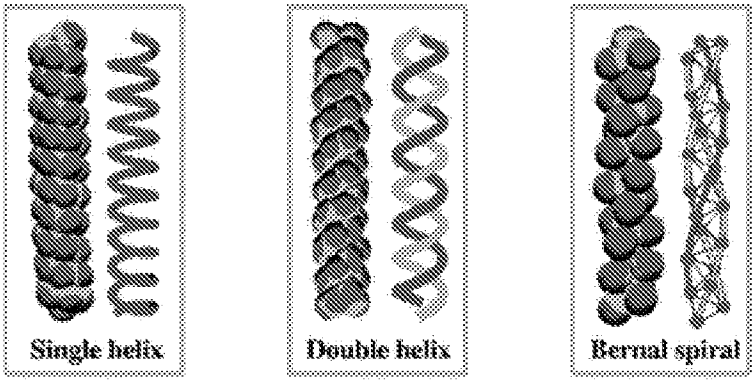
Nanoscale, 2016, **8**,4063-4069
DOI: 10.1039/C5NR06469D, Paper
Hyunsoo Lee, Narae Son, Hu Young Jeong, Tae Gun Kim, Gyeong Sook Bang, Jong Yun Kim, Gi Woong Shim, Kalyan C. Goddeti, Jong Hun Kim, Namdong Kim, Hyun-Joon Shin, Wondong Kim, Sehun Kim, Sung-Yool Choi, Jeong Young Park
We investigated the subdomain structures of graphene oxide with friction and conductance mappings.
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Dual emission in asymmetric "giant" PbS/CdS/CdS core/shell/shell quantum dots



Nanoscale, 2016, **8**,4217-4226
DOI: 10.1039/C5NR08881J, Paper
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Haiguang Zhao, Gianluca Sirigu, Andrea Parisini, Andrea Camellini, Giuseppe Nicotra, Federico Rosei, Vittorio Morandi, Margherita Zavelani-Rossi, Alberto Vomiero
Dual emission in asymmetric "giant" PbS/CdS/CdS core/shell/shell quantum dots enables color monitoring/modulation and control in the visible/NIR region for advanced applications.
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Supracolloidal helices from soft Janus particles by tuning the particle softness



Nanoscale, 2016, **8**,4070-4076
DOI: 10.1039/C5NR07011B, Paper
Qing-Zhi Zou, Zhan-Wei Li, Zhong-Yuan Lu, Zhao-Yan Sun
Supracolloidal helices including single helices, double helices, and Bernal spirals are observed through the self-

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assembly of soft Janus particles by properly tuning particle softness.
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Highly effective and uniform SERS substrates fabricated by etching multi-layered gold nanoparticle arrays

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C6NR00502K, Paper
Li Zhang, Changrong Guan, Ying Wang, Jianhui Liao
Gold nanoparticle multilayers printed on silicon substrates layer by layer were etched by gold etchant to form highly effective and uniform substrates for surface-enhanced Raman scattering (SERS). The performance of...
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Highly efficient plasmonic tip design for plasmon nanofocusing in near-field optical microscopy

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08548A, Paper
Takayuki Umakoshi, Yuika Saito, Prabhat Verma
Near-field scanning optical microscopy (NSOM) combined with plasmon nanofocusing is a powerful nano-analytical tool due to its attractive feature of efficient background suppression as well as light energy compression into...
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3D Flexible Water Channel: Stretchability of Nanoscale Water Bridge

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08072J, Paper
Jige Chen, Chunlei Wang, Ning Wei, Rongzheng Wan, Yi Gao
Artificial water channel contributes to a better understanding of natural water channel and aims to offer highly selective, advanced conductance system. Most studies use nanotubes, however it is difficult to...
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Silver Nanoparticles Confined in Carbon Nanotubes: On the Understanding of

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Confinement Effect and Promotional Catalysis for the Selective Hydrogenation of Dimethyl Oxalate

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08651E, Paper
Jianwei Zheng, Xinping Duan, Haiqiang Lin, Zhengqiang Gu, Huihuang Fang, Jianhui Li, Youzhu Yuan
Confined Ag nanomaterial in the channels of herringbone multi-wall carbon nanotubes (Ag-in/hCNT) was effectively prepared. The space restriction induces morphological changes of Ag nanoparticles into rough nanowires with an estimated...
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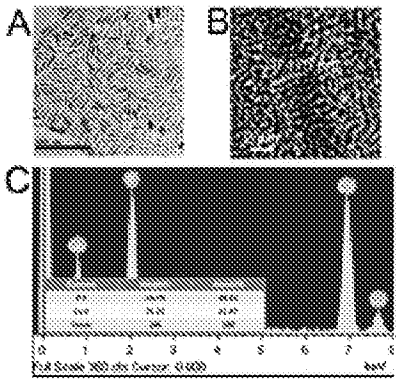
Large-area uniform and low-cost dual-mode plasmonic naked-eye colorimetry and SERS sensor with handheld Raman spectrometer

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08357E, Paper
Zhida Xu, Jing Jiang, Xinhao Wang, Kevin Han, Abid Ameen, Ibrahim Khan, Te-Wei Chang, Logan Liu
We demonstrated a highly-sensitive, wafer-scale, high-uniform plasmonic nano-mushroom substrate based on plastic for naked-eye plasmonic colorimetry and surface-enhanced Raman spectroscopy (SERS). We gave it the name FlexBrite. The dual-mode functionality...
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Elevated Gold Ellipse Nanoantenna Dimers as Sensitive and Tunable Surface Enhanced Raman Spectroscopy Substrates

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08920D, Paper
Aaron M Jubb, Yang Jiao, Gyula Eres, Scott Thomas Retterer, Baohua Gu
We demonstrate large area arrays of elevated gold ellipse dimers with precisely controlled gaps for use as sensitive and highly controllable surface enhanced Raman scattering (SERS) substrates. The significantly enhanced...
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A facile solution-phase synthesis of cobalt phosphide nanorods/hollow nanoparticles

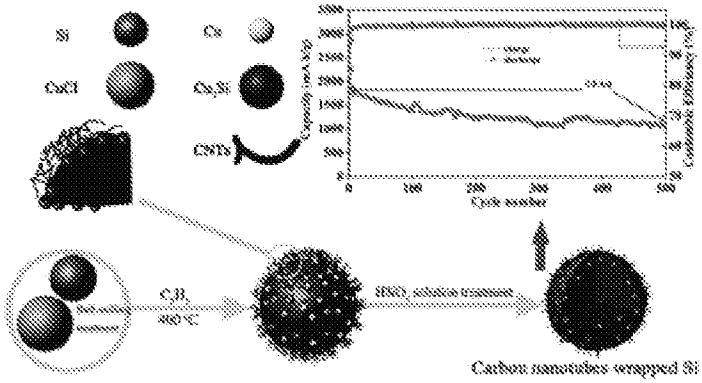


Nanoscale, 2016, Advance Article
DOI: 10.1039/C6NR00208K, Communication
Weiwei Yang, Yarong Huang, Jinlong Fan, Yongsheng Yu, Chunhui Yang, Haibo Li
A simple one-step solution-phase synthesis of cobalt phosphide nanorods (NRs) and hollow nanoparticles

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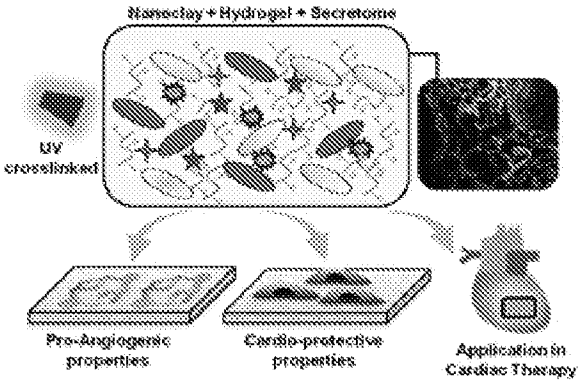
(NPs) has been reported in this paper.
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In situ growth of carbon nanotube wrapped Si composites as anodes for high performance lithium ion batteries



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08961A, Communication
Jianbin Zhou, Yang Lan, Kailong Zhang, Guoliang Xia, Jin Du, Yongchun Zhu, Yitai Qian
Carbon nanotube wrapped Si was synthesized *in situ* by using the CCVD method at 400 [degree]C and shows high electrochemical performance.
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Stem cell secretome-rich nanoclay hydrogel: a dual action therapy for cardiovascular regeneration

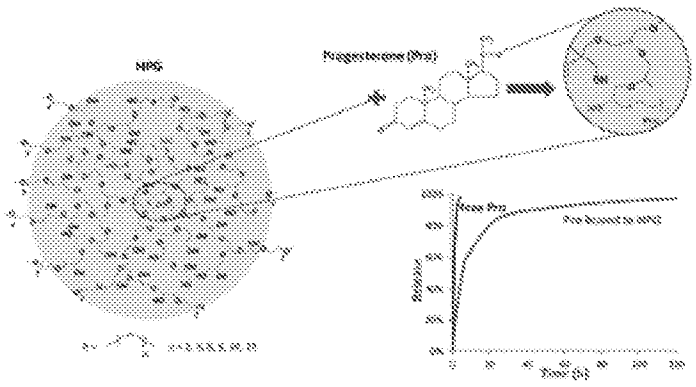


Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07806G, Communication
Renae Waters, Settimio Pacelli, Ryan Maloney, Indrani Medhi, Rafeeq P. H. Ahmed, Arghya Paul
We report development of a nanocomposite hydrogel platform using nanoclay materials and stem cell derived secretome for cardiac tissue repair and therapy.
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Progesterone binding nano-carriers based on hydrophobically modified

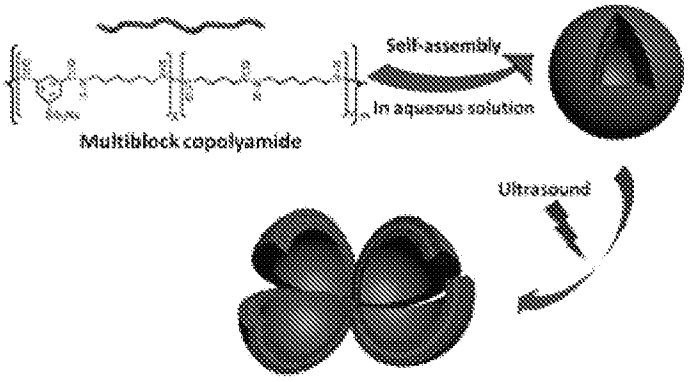
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hyperbranched polyglycerols



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08175K, Paper
M. Alizadeh Noghani, D. E. Brooks
A family of hydrophobically derivatized HPGs is assessed as a potential carrier for progesterone, an important steroid. Molecular determinants of binding and the release kinetics are investigated and the surprising role of non-freezing water on release kinetics described.
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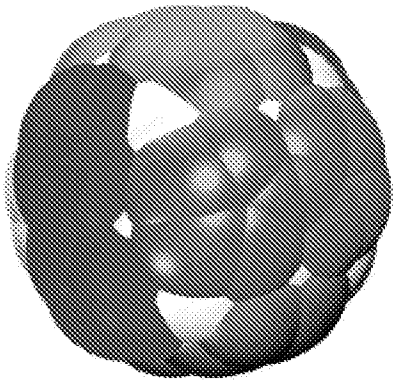
Ultrasound-responsive ultrathin multiblock copolyamide vesicles



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08596A, Communication
Lei Huang, Chunyang Yu, Tong Huang, Shuting Xu, Yongping Bai, Yongfeng Zhou
Novel ultrasound-responsive polymer vesicles with ultrathin walls and a special packing model were generated from an amphiphilic multiblock copolyamide.
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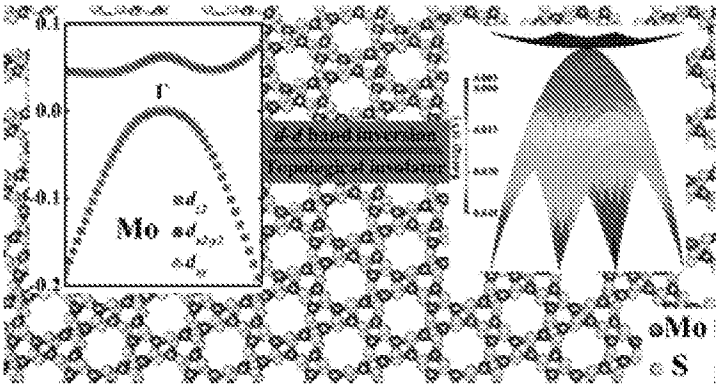
Sc20C60: a volleyballene

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Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07784B, Paper
Jing Wang, Hong-Man Ma, Ying Liu
A stable volleyball-like molecular cluster, *Volleyballene* $Sc_{20}C_{60}$, was identified. It possesses relatively high symmetry and a hollow space that can be used to accommodate other atoms or molecules for the purpose of studying fundamental chemistry.
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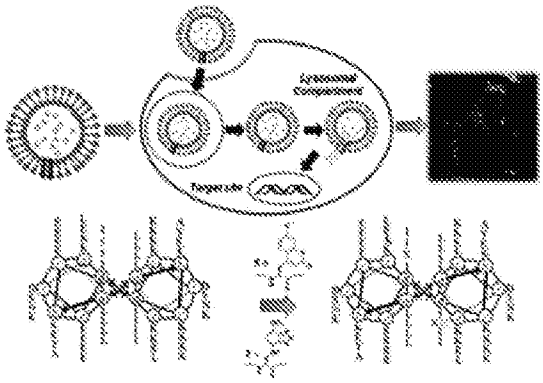
New quantum spin Hall insulator in two-dimensional MoS2 with periodically distributed pores



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08842A, Communication
Peng-Fei Liu, Liujiang Zhou, Thomas Frauenheim, Li-Ming Wu
A new two-dimensional topological insulator in two-dimensional MoS_2 with periodically distributed pores is predicted. Pure d-d band inversion is responsible for the quantum spin Hall effect. Theoretical analysis shows the largest nontrivial gap among MoS_2 isomers.
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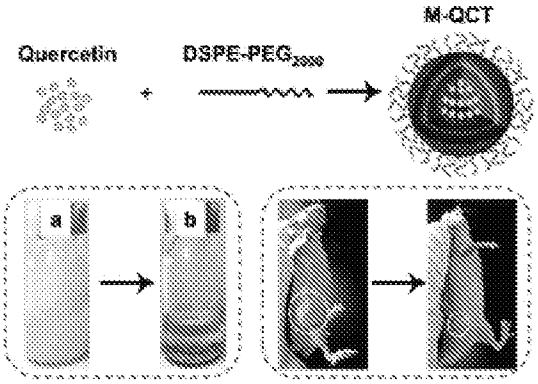
pH sensitive coiled coils: a strategy for enhanced liposomal drug delivery

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Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07734F, Paper
Rahi M. Reja, Mohsina Khan, Sumeet K. Singh, Rajkumar Misra, Anjali Shiras, Hosahudya N. Gopi
Design of pH sensitive coiled coils and their incorporation into the liposome vesicles as triggers for the controlled release of encapsulated drugs are reported.
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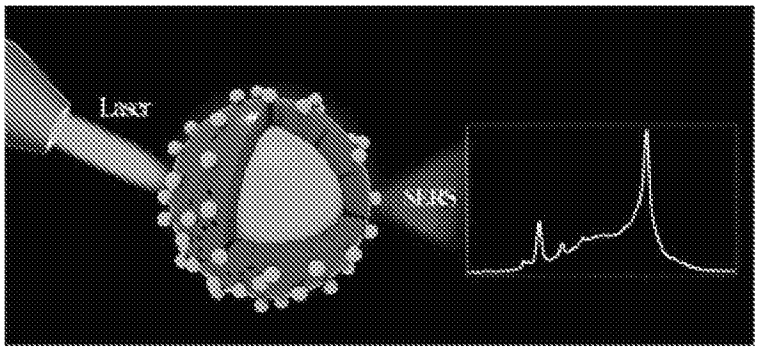
Quercetin-loaded nanomicelles to circumvent human castration-resistant prostate cancer in vitro and in vivo



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08966B, Paper
Jing Zhao, Juan Liu, Tuo Wei, Xiaowei Ma, Qiang Cheng, Shuaidong Huo, Chunqiu Zhang, Yanan Zhang, Xianglin Duan, Xing-Jie Liang
We develop a nanomicelle-based quercetin delivery system, which exhibits superior anticancer activity in the castration-resistant prostate cancer model.
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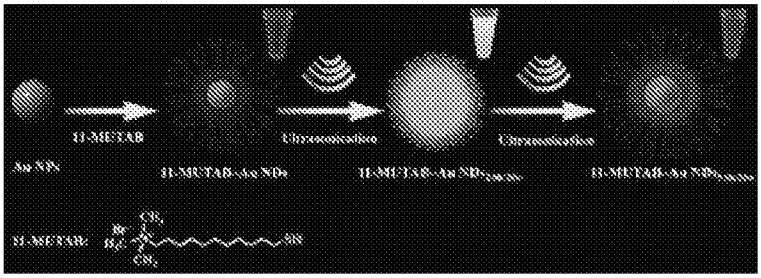
Hydrothermal synthesis of Ag@MSiO2@Ag three core-shell nanoparticles and their sensitive and stable SERS properties

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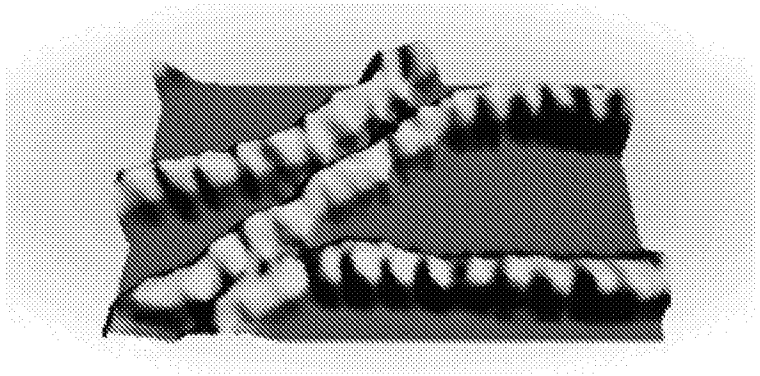
Nanoscale, 2016, Advance Article
DOI: 10.1039/C6NR00006A, Communication
Tao Jiang, Xiaolong Wang, Jun Zhou, Dong Chen, Ziqi Zhao
We report a unique Ag@$MSiO_2$@Ag three core-shell nanostructure as a SERS substrate with both sensitivity and stability.
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Ultrasound-mediated modulation of the emission of gold nanodots



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08387G, Paper
Yu-Ting Tseng, Rochelle Cherng, Zhiqin Yuan, Chien-Wei Wu, Huan-Tsung Chang, Chih-Ching Huang
Ultrasonication treatment of (11-mercaptoundecyl)-*N*,*N*,*N*-trimethylammonium bromide-capped gold nanodots (11-MUTAB-Au NDs) boosts a >1000-fold enhancement in its photoluminescence due to the smaller size and the higher 11-MUTAB ligand density on the surfaces.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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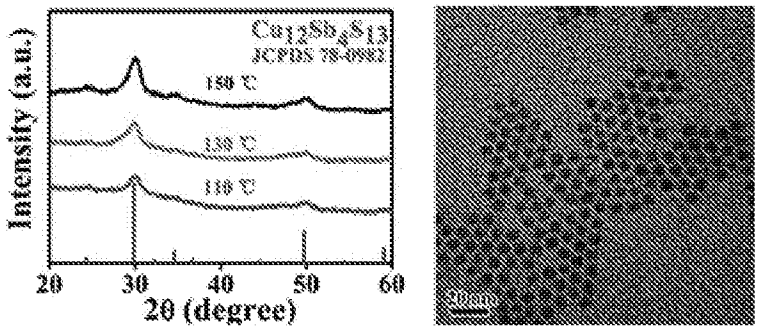
High resolution atomic force microscopy of double-stranded RNA



PATENT
REEL: 037821 FRAME: 0566

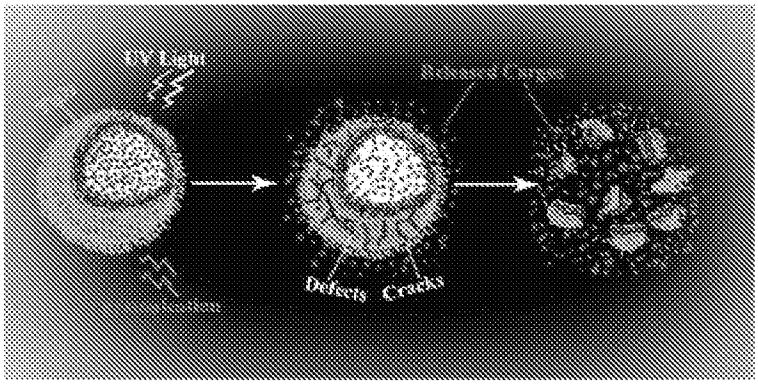
Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07445B, Paper
Pablo Ares, Maria Eugenia Fuentes-Perez, Elias Herrero-Galan, Jose M. Valpuesta, Adriana Gil, Julio Gomez-Herrero, Fernando Moreno-Herrero
Imaging double-stranded RNA at sub-helical pitch resolution with atomic force microscopy in liquid.
To cite this article before page numbers are assigned, use the DOI form of citation above.
The content of this RSS Feed (c) The Royal Society of Chemistry

A green synthesis route for the phase and size tunability of copper antimony sulfide nanocrystals with high yield



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR09097K, Paper
Keqiang Chen, Jing Zhou, Wen Chen, Qiao Chen, Peng Zhou, Yueli Liu
Typical XRD patterns of $Cu_{12}Sb_4S_{13}$ NCs with various sizes and a TEM image of 5.76 nm $Cu_{12}Sb_4S_{13}$ NCs.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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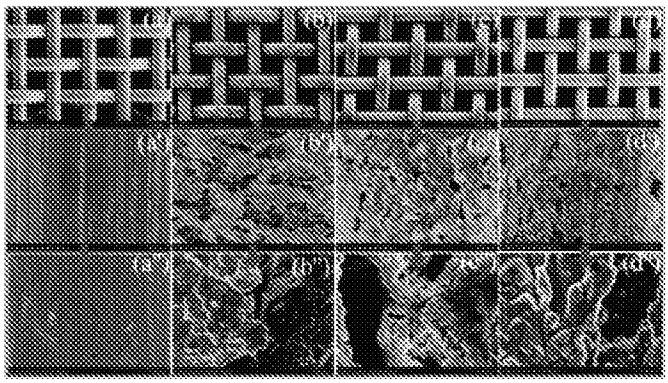
Bifunctional ultraviolet/ultrasound responsive composite TiO2/polyelectrolyte microcapsules



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR06666B, Paper
Hui Gao, Dongsheng Wen, Nadezda V. Tarakina, Jierong Liang, Andy J. Bushby, Gleb B. Sukhorukov
Functional composite TiO_2/polyelectrolyte microcapsules encapsulated with payloads are controllably opened by either ultraviolet or ultrasound treatment.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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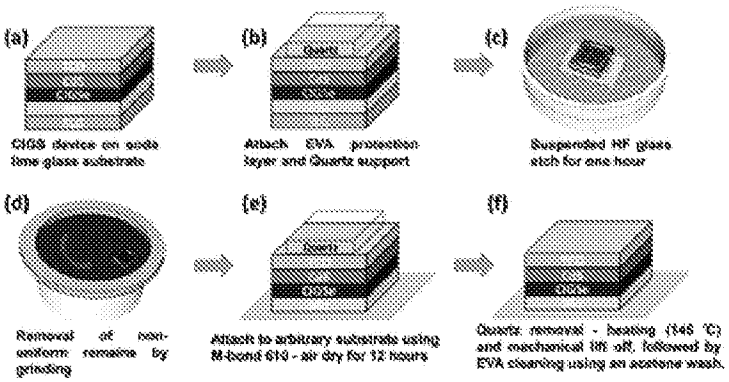
PATENT
REEL: 037821 FRAME: 0567

A multifunctional polymeric nanofilm with robust chemical performances for special wettability



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07601C, Paper
Yabin Wang, Feng Lin, Yaping Dong, Zhong Liu, Wu Li, Yudong Huang
A multifunctional polymeric nanofilm of a triazinedithiolsilane compound, which can protect metallic substrates and activate the corresponding surface simultaneously, is introduced onto a copper mesh surface *via* facile solution-immersion approaches.
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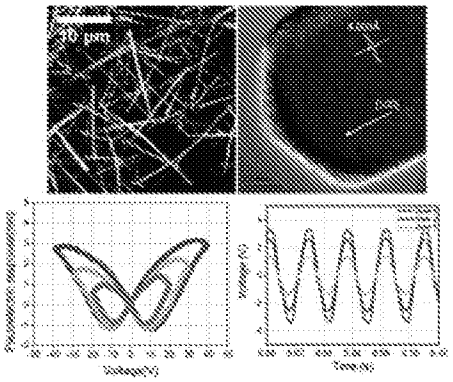
A facile chemical-mechanical polishing lift-off transfer process toward large scale Cu(In,Ga)Se2 thin-film solar cells on arbitrary substrates



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07008B, Paper
Kuan-Chun Tseng, Yu-Ting Yen, Stuart R. Thomas, Hung-Wei Tsai, Cheng-Hung Hsu, Wen-Chi Tsai, Chang-Hong Shen, Jia-Min Shieh, Zhiming M. Wang, Yu-Lun Chueh
The fabrication of Cu(In,Ga)Se_2 (CIGS) solar cells on flexible substrates is a non-trivial task due to thermal and ion diffusion related issues.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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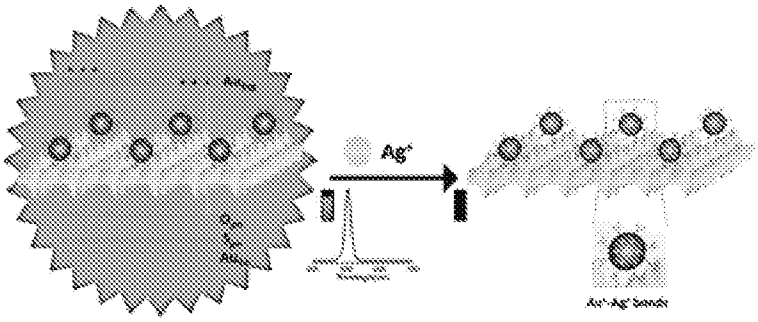
Lead-free 0.5Ba(Zr0.2Ti0.8)O3-0.5(Ba0.7Ca0.3)TiO3 nanowires for energy harvesting

PATENT
REEL: 037821 FRAME: 0568



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR09029F, Paper
Zhi Zhou, Christopher C. Bowland, Mohammad H. Malakooti, Haixiong Tang, Henry A. Sodano
$0.5Ba(Zr_{0.2}Ti_{0.8})O_3$-$0.5(Ba_{0.7}Ca_{0.3})TiO_3$ (BZT-BCT) nanowires with high piezoelectric coupling coefficient (90 +/- 5 pm V^{-1}) are utilized to fabricate a flexible, energy harvesting nanocomposite producing an open circuit voltage of 6.25 V and a power density of 2.25 [small mu]W cm^{-3}.
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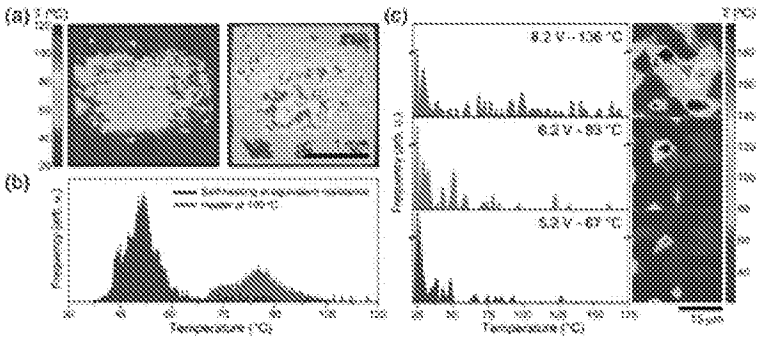
Green emission and Ag+ sensing of hydroxy double salt supported gold nanoclusters



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07029E, Paper
Jinyang Lu, Chunxiang Xu, Zhengshan Tian, Junfeng Lu, Yi Lin, Zengliang Shi
This work demonstrates a green-emitting complex of Zn-containing hydroxy double salt supported gold nanoclusters and its application for sensing Ag^+.
To cite this article before page numbers are assigned, use the DOI form of citation above.
The content of this RSS Feed (c) The Royal Society of Chemistry

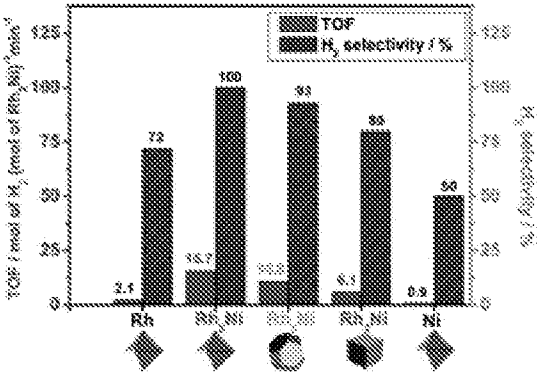
Localized self-heating in large arrays of 1D nanostructures

PATENT
REEL: 037821 FRAME: 0569



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07158E, Paper
O. Monereo, S. Illera, A. Varea, M. Schmidt, T. Sauerwald, A. Schutze, A. Cirera, J. D. Prades
Thermographic image of a CNFs film heated up by means of self-heating (left image) and external heater (right image). Raman mapping of the temperature distribution in a CNFs self-heated region at three different nominal temperatures with each corresponding temperature histogram.
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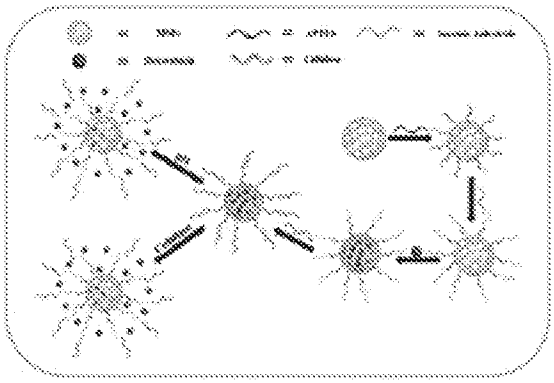
Synthesis of octahedral, truncated octahedral, and cubic Rh2Ni nanocrystals and their structure-activity relationship for the decomposition of hydrazine in aqueous solution to hydrogen



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR09227B, Paper
Chun Li, Tao Wang, Wei Chu, Ping Wu, Dong Ge Tong
Rh_2Ni nanocrystals with a higher percentage of {111} facets exhibited higher activity and H_2 selectivity during hydrazine dehydrogenation in aqueous solution.
To cite this article before page numbers are assigned, use the DOI form of citation above.
The content of this RSS Feed (c) The Royal Society of Chemistry

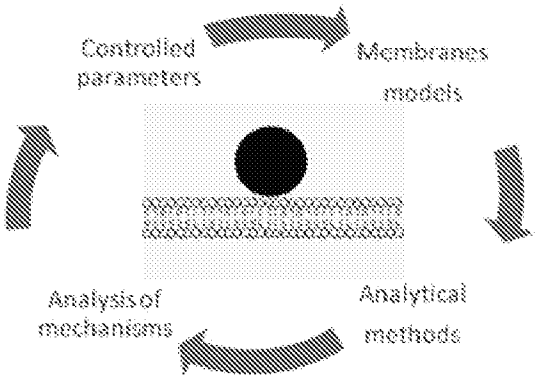
Cellulose conjugated FITC-labelled mesoporous silica nanoparticles: intracellular accumulation and stimuli responsive doxorubicin release

PATENT
REEL: 037821 FRAME: 0570



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08753H, Paper
Abdul Hakeem, Fouzia Zahid, Ruixue Duan, Muhammad Asif, Tianchi Zhang, Zhenyu Zhang, Yong Cheng, Xiaoding Lou, Fan Xia
Novel cellulose conjugated mesoporous silica nanoparticles (CLS-MSPs) for stimuli responsive intracellular doxorubicin (DOX) delivery were designed.
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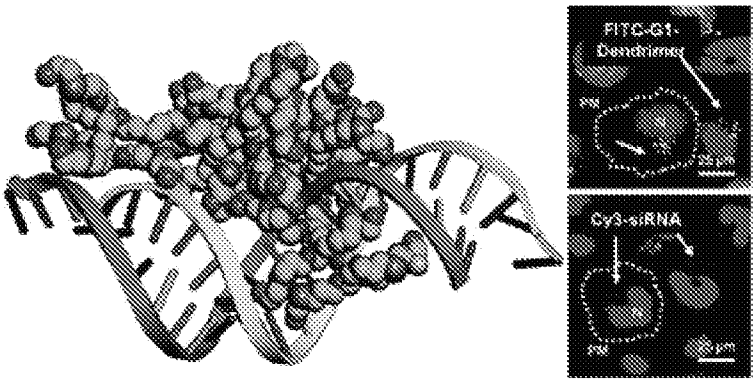
The relevance of membrane models to understand nanoparticles-cell membrane interactions



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07954C, Review Article
Estelle Rascol, Jean-Marie Devoisselle, Joel Chopineau
Membrane models are pertinent tools to explore and analyze nanoparticles-membrane interactions occurring at the cellular level.
To cite this article before page numbers are assigned, use the DOI form of citation above.
The content of this RSS Feed (c) The Royal Society of Chemistry

Low generation polyamine dendrimers bearing flexible tetraethylene glycol as nanocarriers for plasmids and siRNA

PATENT
REEL: 037821 FRAME: 0571



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR06757J, Paper
Rishi Sharma, Issan Zhang, Tze Chieh Shiao, Giovanni M. Pavan, Dusica Maysinger, Rene Roy
Polycationic tetraethyleneglycol dendrimers of low generation successfully deliver siRNA in human cells, with transfection efficiency comparable to that of Lipofectamine.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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DNA Origami Based Au-Ag-Core-Shell Nanoparticle Dimers with Single-Molecule SERS Sensitivity

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08674D, Paper
Julia Prinz, Christian Heck, Lisa Ellerik, virginia merk, Ilko Bald
DNA origami nanostructures are a versatile tool to arrange metal nanostructures and other chemical entities with nanometer precision. In this way gold nanoparticle dimers with defined distance can be constructed,...
The content of this RSS Feed (c) The Royal Society of Chemistry

Surface energy and wettability of van der Waals structures

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR06705G, Paper
Meenakshi Annamalai, Kalon Gopinadhan, Sang A Han, Surajit Saha, Hye-Jeong Park, Eun Bi Cho, Brijesh Kumar, Abhijeet Patra, Sang-Woo Kim, Thirumalai Venkatesan
Wetting behaviour of surfaces is believed to be affected by van der Waals (vdW) forces; however, there is no clear demonstration of this. With the isolation of two-dimensional vdW layered...
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Quantitative characterization of conformational-specific protein-DNA binding using a dual-spectral interferometric imaging biosensor

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR06785E, Paper
Xirui Zhang, George Daaboul, Philipp Sphuler, Peter Droege, Selim Unlu
DNA-binding proteins play crucial roles in the maintenance and functions of the genome and yet, their specific binding mechanisms are not fully understood. Recently, it was discovered that DNA-binding proteins...
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Sequential protein unfolding through a carbon nanotube pore

PATENT
REEL: 037821 FRAME: 0572

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C6NR00410E, Paper
Zhonghe Xu, Shuang Zhang, Jeffrey K Weber, Binquan Luan, Ruhong Zhou, Jingyuan Li
An assortment of biological processes, like protein degradation and the transport of proteins across membranes, depend on protein unfolding events mediated by nanopore interfaces. In this work, we exploit fully...
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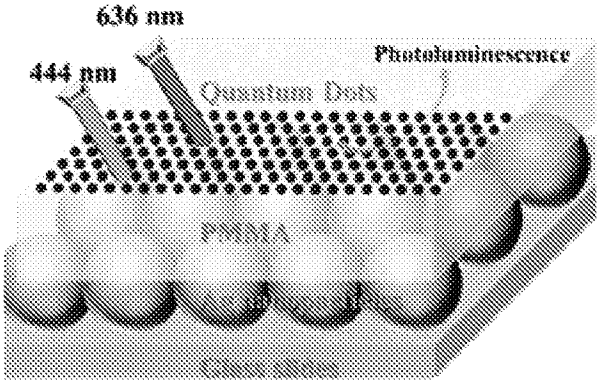
Charge Effects and Nanoparticle Pattern Formation in Electrohydrodynamic NanoDrip Printing of Colloids

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08783J, Paper
Patrizia Richner, Stephan J. P. Kress, David Norris, Dimos Poulikakos
Advancing open atmosphere printing technologies to produce features in the nanoscale range has important and broad applications ranging from electronics, to photonics, plasmonics and biology. Recently an electrohydrodynamic printing regime...
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Correction: CoPt/CeO2 catalysts for the growth of narrow diameter semiconducting single-walled carbon nanotubes

Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR90226F, Correction
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Lei Tang, Taotao Li, Chaowei Li, Lin Ling, Kai Zhang, Yagang Yao
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Silver nanoparticle film induced photoluminescence enhancement of near-infrared emitting PbS and PbS/CdS core/shell quantum dots: observation of different enhancement mechanisms

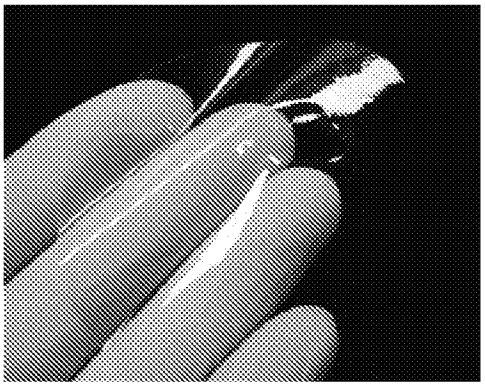


Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR05906B, Communication
H. Y. Liang, H. G. Zhao, Z. P. Li, C. Harnagea, D. L. Ma
A plasmon/fluorophore system consisting of Ag nanoparticles and near-infrared quantum dots (QDs) is investigated for photoluminescence (PL) enhancement.

PATENT
REEL: 037821 FRAME: 0573

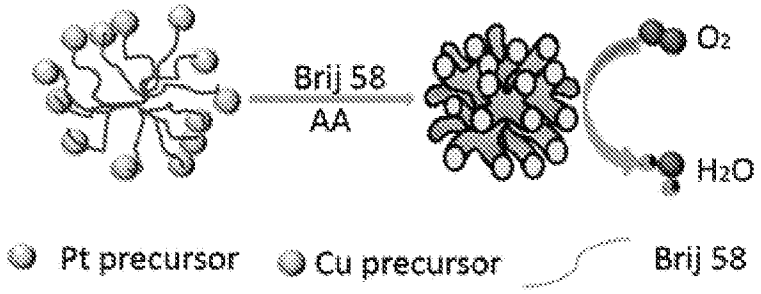
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Combinatorial release of dexamethasone and amiodarone from a nano-structured parylene-C film to reduce perioperative inflammation and atrial fibrillation



Nanoscale, 2016, **8**,4267-4275
DOI: 10.1039/C5NR07456H, Paper
Erik Robinson, Sunjay Kaushal, Justice Alaboson, Sudhish Sharma, Amogh Belagodu, Claire Watkins, Brandon Walker, Gregory Webster, Patrick McCarthy, Dean Ho
Suppressing perioperative inflammation and post-operative atrial fibrillation requires effective drug delivery platforms (DDP).
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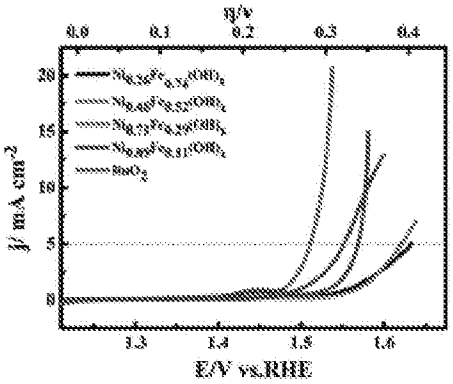
Highly branched PtCu bimetallic alloy nanodendrites with superior electrocatalytic activities for oxygen reduction reactions



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07682J, Paper
Shaofang Fu, Chengzhou Zhu, Qiurong Shi, Haibing Xia, Dan Du, Yuehe Lin
The highly branched PtCu bimetallic alloy nanodendrites were synthesized by a facile chemical reduction method using Brij 58 as the soft template. The as-prepared alloys presented superior electrocatalytic activities for oxygen reduction reactions.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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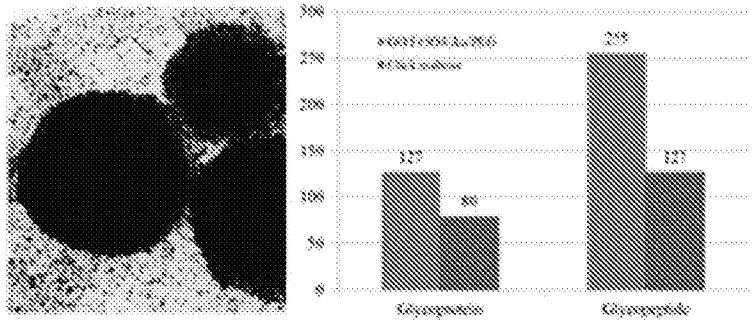
Amorphous mixed-metal hydroxide nanostructures for advanced water oxidation catalysts

PATENT
REEL: 037821 FRAME: 0574



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08989A, Paper
Y. Q. Gao, X. Y. Liu, G. W. Yang
We have synthesized amorphous mixed-metal (Ni-Fe) hydroxide nanostructures with a homogeneous distribution of Ni/Fe as well as a tunable Ni/Fe ratio by a simple, facile, green and low-cost electrochemical technique, and we have also demonstrated that the synthesized amorphous nanomaterials possess ultrahigh activity and super long-term cycle stability in the OER process.
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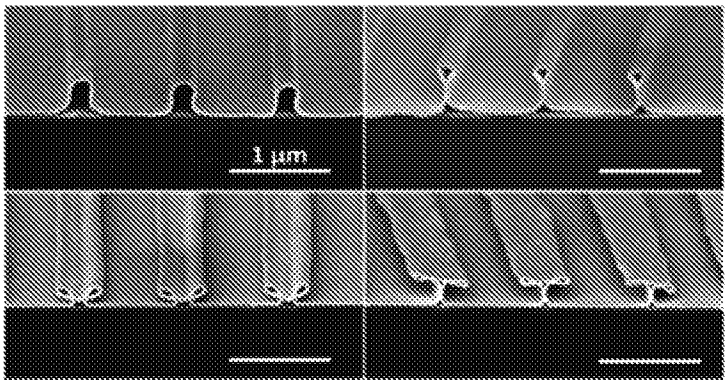
Hydrophilic GO/Fe3O4/Au/PEG nanocomposites for highly selective enrichment of glycopeptides



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08126B, Communication
Bo Jiang, Qi Wu, Nan Deng, Yuanbo Chen, Lihua Zhang, Zhen Liang, Yukui Zhang
GO/Fe_3O_4/Au/PEG nanocomposites were synthesized, and exhibited high selectivity to capture glycopeptides.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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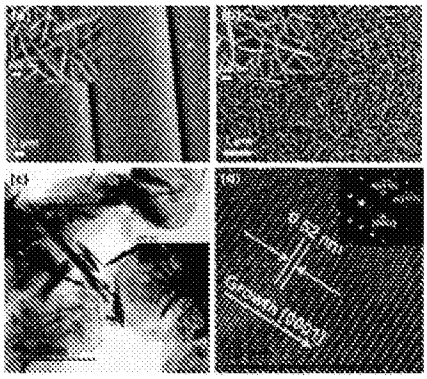
Fabrication and design of metal nano-accordion structures using atomic layer deposition and interference lithography

PATENT
REEL: 037821 FRAME: 0575



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08566G, Paper
J.-H. Min, A. Bagal, J. Z. Mundy, C. J. Oldham, B.-I. Wu, G. N. Parsons, C.-H. Chang
Fabricated free-standing platinum nano-accordion structures with a wide variety of cross-sectional profiles using a combination of ALD and IL.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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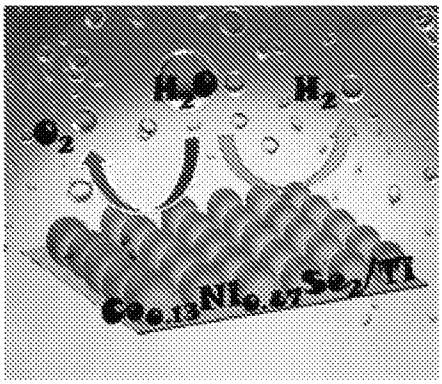
Flexible, transparent and exceptionally high power output nanogenerators based on ultrathin ZnO nanoflakes



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08324A, Paper
Huynh Van Ngoc, Dae Joon Kang
Novel nanogenerator structures composed of ZnO nanoflakes of less than 10 nm thickness were fabricated using a novel method involving a facile synthetic route and a rational design.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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Electrodeposited Co-doped NiSe2 nanoparticles film: a good electrocatalyst for efficient water splitting

PATENT
REEL: 037821 FRAME: 0576

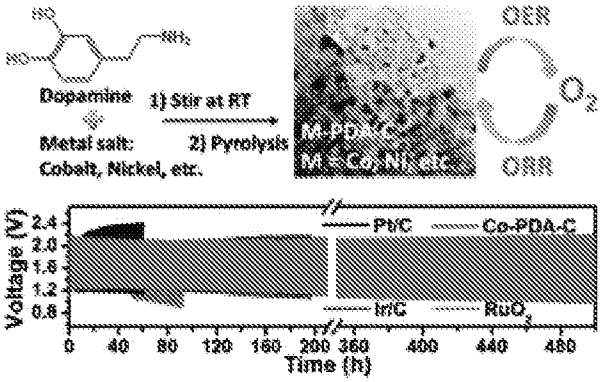


Nanoscale, 2016, **8**,3911-3915
DOI: 10.1039/C5NR07170D, Communication
Tingting Liu, Abdullah M. Asiri, Xuping Sun
Co-doped $NiSe_2$ nanoparticles film electrodeposited on Ti plate ($Co_{0.13}Ni_{0.87}Se_2$/Ti) acts as a robust water-splitting electrocatalyst in 1.0 M KOH, driving 10 mA cm^{-2} at HER overpotential of 64 mV and 100 mA cm^{-2} at OER overpotential of 320 mV.
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Correction: Polyol synthesis, functionalisation, and biocompatibility studies of superparamagnetic iron oxide nanoparticles as potential MRI contrast agents

Nanoscale, 2016, **8**,4395-4395
DOI: 10.1039/C5NR90206A, Correction
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Roxanne Hachani, Mark Lowdell, Martin Birchall, Aziliz Hervault, Damien Mertz, Sylvie Begin-Colin, Nguyen Thị Kim Thanh
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Mussel-inspired one-pot synthesis of transition metal and nitrogen co-doped carbon (M/N-C) as efficient oxygen catalysts for Zn-air batteries

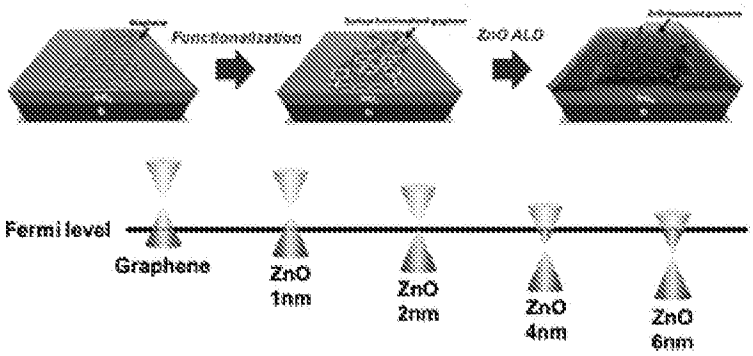


Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR06538K, Paper
Bing Li, Ye Chen, Xiaoming Ge, Jianwei Chai, Xiao Zhang, T. S. Andy Hor, Guojun Du, Zhaolin Liu, Hua Zhang, Yun Zong
Transition metal and nitrogen co-doped nanostructured carbons, synthesized *via* a simple and scalable room

PATENT
REEL: 037821 FRAME: 0577

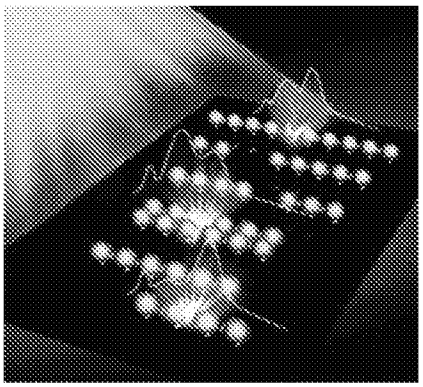
temperature approach inspired by mussels, have enabled robust cycling of Zn-air batteries.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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A non-destructive n-doping method for graphene with precise control of electronic properties via atomic layer deposition



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08016A, Paper
Kyu Seok Han, Pranav Y. Kalode, Yong-Eun Koo Lee, Hongbum Kim, Lynn Lee, Myung Mo Sung
A precise n-doping technique for graphene *via* atomic layer deposition (ALD) of ZnO thin films is presented.
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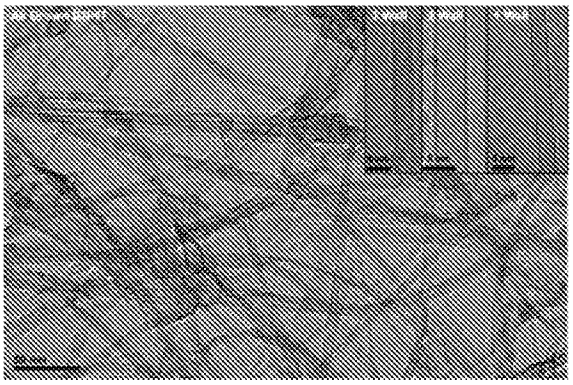
Strong plasmon coupling in self-assembled superparamagnetic nanoshell chains



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR09101B, Paper
Min Xiong, Xiulong Jin, Jian Ye
Construction of plasmonic superparamagnetic nanoshell chains by using a magnetic field is described. Strong plasmon coupling effects in the chains result in large electric field enhancements. Taking advantage of low-cost and large-area fabrication methods, these nanoshell chains are promising for biosensing, metamaterials, electromagnetic energy transport, and optical waveguide.
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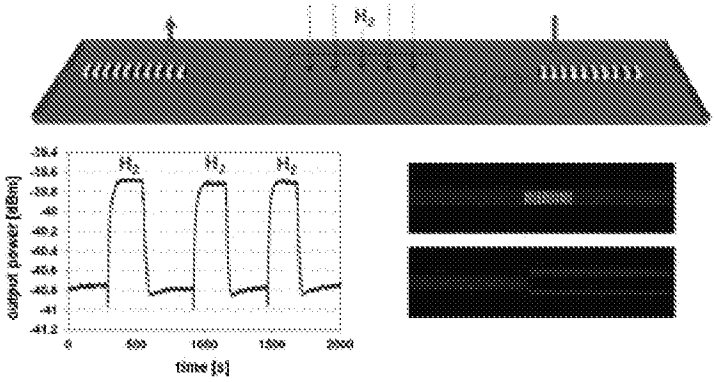
Thermodynamic approach to boron nitride nanotube solubility and dispersion

PATENT
REEL: 037821 FRAME: 0578



Nanoscale, 2016, **8**,4348-4359
DOI: 10.1039/C5NR08259E, Paper
A. L. Tiano, L. Gibbons, M. Tsui, S. I. Applin, R. Silva, C. Park, C. C. Fay
Inadequate dispersion of nanomaterials is a critical issue that significantly limits the potential properties of nanocomposites and when overcome, will enable further enhancement of material properties.
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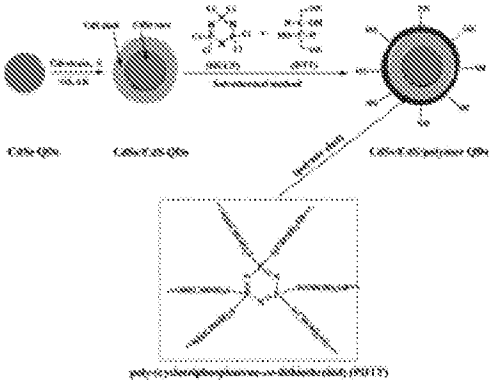
Hydrogen sensing with Pd-coated long-range surface plasmon membrane waveguides



Nanoscale, 2016, **8**,4284-4290
DOI: 10.1039/C5NR08001K, Paper
Norman R. Fong, Pierre Berini, R. N. Tait
A low power optical hydrogen sensor using a Pd film on a flexible LRSPP membrane waveguide with grating couplers.
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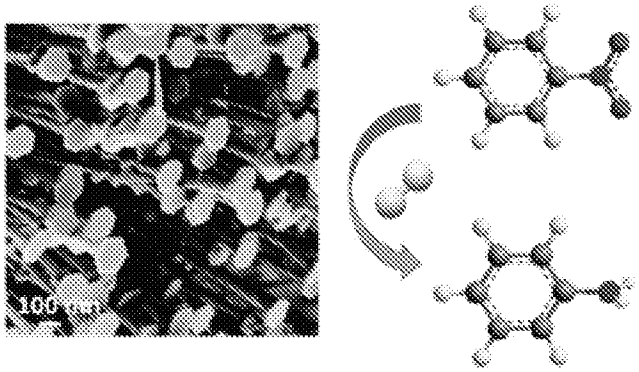
Suppressed blinking behavior of CdSe/CdS QDs by polymer coating

PATENT
REEL: 037821 FRAME: 0579



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08504G, Paper
Aidi Zhang, Yannan Bian, Jinjie Wang, Kuiyong Chen, Chaoqing Dong, Jicun Ren
Semiconductor quantum dots (QDs) are very important fluorescent nanocrystals with excellent optical properties.
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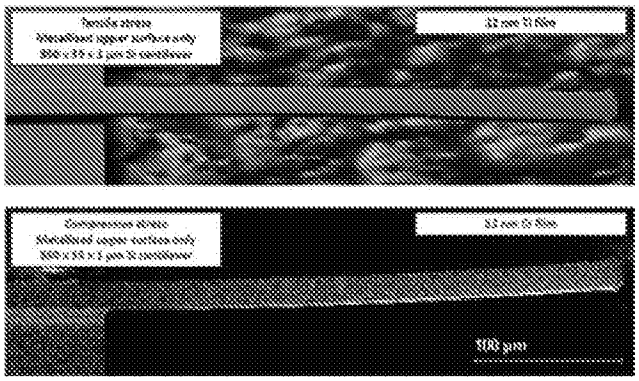
Designing axial growth of Co-Ni bimetallic nanowires with hexagon-like caps and their catalytic hydrogenation for nitrobenzene



Nanoscale, 2016, **8**,3949-3953
DOI: 10.1039/C5NR09131D, Communication
Jiawen Wang, Jingwei Liu, Nating Yang, Shuangshuang Huang, Yuhan Sun, Yan Zhu
Co-Ni bimetal nanowires with hexagonal caps are more effective than corresponding nanoparticles for the nitrobenzene hydrogenation to produce aniline.
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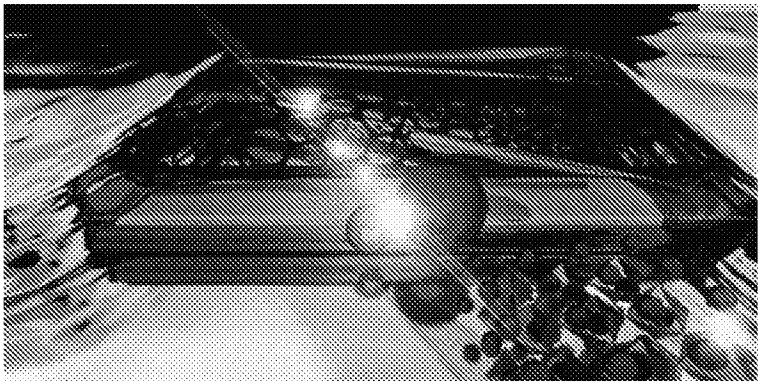
On the origin and magnitude of surface stresses due to metal nanofilms

PATENT
REEL: 037821 FRAME: 0580



Nanoscale, 2016, **8**,4245-4251
DOI: 10.1039/C5NR08789A, Paper
James Bowen, David Cheneler
Metallisation is a vital process for micro- and nanofabrication. We investigate the metallisation of silicon cantilevers with nano-films of chromium and titanium. Surface stresses acting in opposite directions were measured for these two metals.
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Ultrasensitive 1D field-effect phototransistors: CH3NH3PbI3 nanowire sensitized individual carbon nanotubes

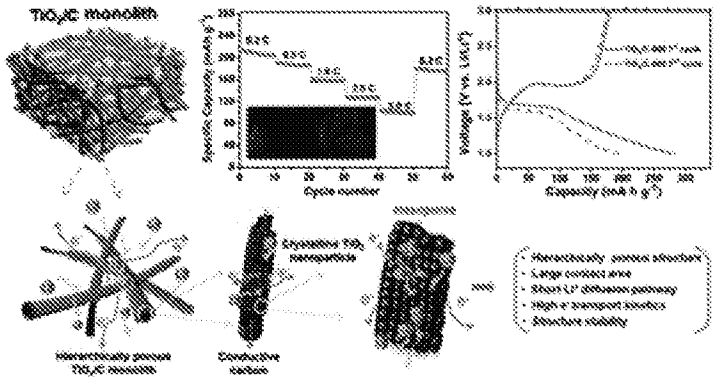


Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR06727H, Communication
M. Spina, B. Nafradi, H. M. Tohati, K. Kamaras, E. Bonvin, R. Gaal, L. Forro, E. Horvath
Field-effect phototransistors were fabricated based on individual carbon nanotubes (CNTs) sensitized by $CH_3NH_3PbI_3$ nanowires ($MAPbI_3NWs$).

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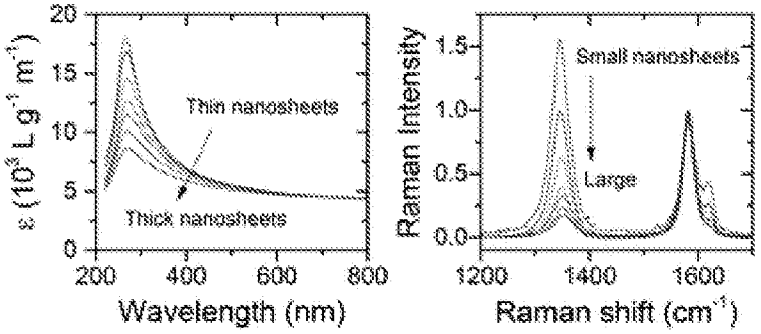
Hierarchical TiO2/C nanocomposite monoliths with a robust scaffolding architecture, mesopore-macropore network and TiO2-C heterostructure for high-performance lithium ion batteries

PATENT
REEL: 037821 FRAME: 0581



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR09149G, Paper
Hai-Bo Huang, Yue Yang, Li-Hua Chen, Yun Wang, Shao-Zhuan Huang, Jia-Wei Tao, Xiao-Ting Ma, Tawfique Hasan, Yu Li, Yan Xu, Bao-Lian Su
A general approach for the design of TiO_2/C nanocomposites with structural stability, and tunable and interconnected hierarchical porosity that leads to a new high electrochemical performance electrode.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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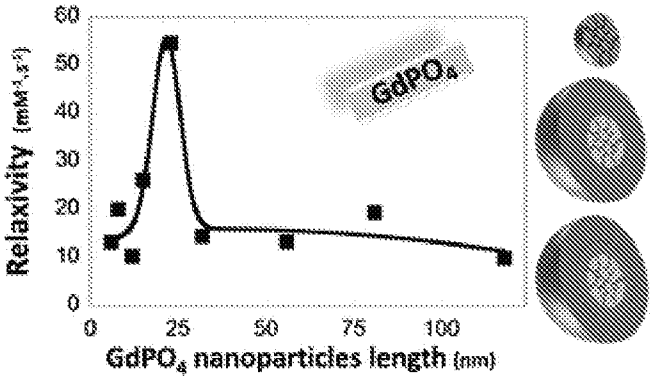
Spectroscopic metrics allow in situ measurement of mean size and thickness of liquid-exfoliated few-layer graphene nanosheets



Nanoscale, 2016, **8**,4311-4323
DOI: 10.1039/C5NR08047A, Paper
Claudia Backes, Keith R. Paton, Damien Hanlon, Shengjun Yuan, Mikhail I. Katsnelson, James Houston, Ronan J. Smith, David McCloskey, John F. Donegan, Jonathan N. Coleman
Quantitative spectroscopic metrics based on absorbance and Raman spectroscopy are presented for size-selected liquid-exfoliated graphene.
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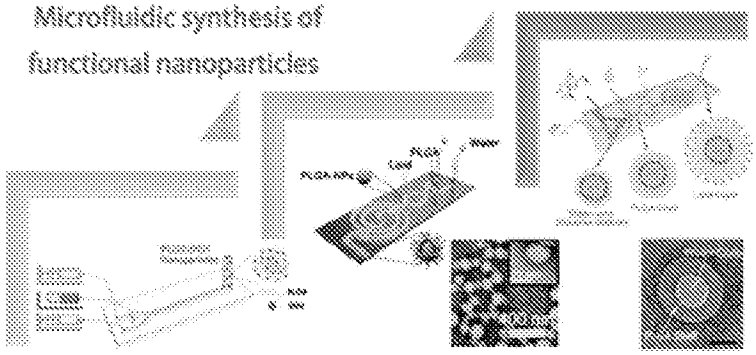
Hyperbranched polymer mediated size-controlled synthesis of gadolinium phosphate nanoparticles: colloidal properties and particle size-dependence on MRI relaxivity

PATENT
REEL: 037821 FRAME: 0582



Nanoscale, 2016, **8**,4252-4259
DOI: 10.1039/C5NR05064B, Paper
Camille Frangville, Maylis Gallois, Yichen Li, Hong Hanh Nguyen, Nancy Lauth-de Viguerie, Daniel R. Talham, Christophe Mingotaud, Jean-Daniel Marty
Core-shell(s) hyperbranched polymers were used to synthesize size-controlled gadolinium phosphate nanowires. An optimum particle size with high relaxivity values was evidenced.
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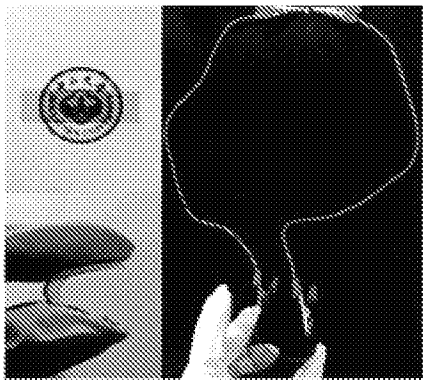
Microfluidics-mediated assembly of functional nanoparticles for cancer-related pharmaceutical applications



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07964K, Review Article
Qiang Feng, Jiashu Sun, Xingyu Jiang
This review focuses on microfluidic synthesis of functional nanoparticles with tunable structures and properties for cancer treatment and diagnosis.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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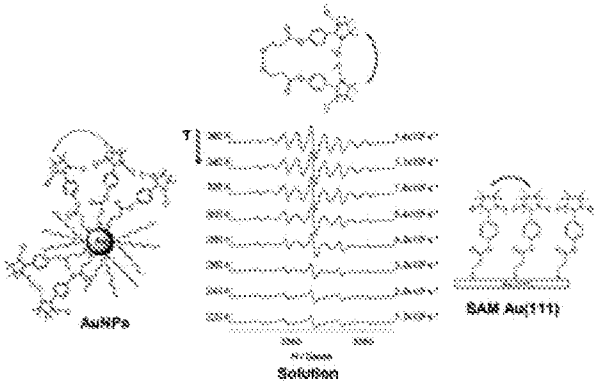
A flexible, transparent and super-long-life supercapacitor based on ultrafine Co3O4 nanocrystal electrodes

PATENT
REEL: 037821 FRAME: 0583



Nanoscale, 2016, **8**,4227-4235
DOI: 10.1039/C5NR09145D, Paper
X. Y. Liu, Y. Q. Gao, G. W. Yang
A flexible, transparent and super-long-life supercapacitor has been fabricated based on ultrafine Co_3O_4 nanocrystal electrodes.
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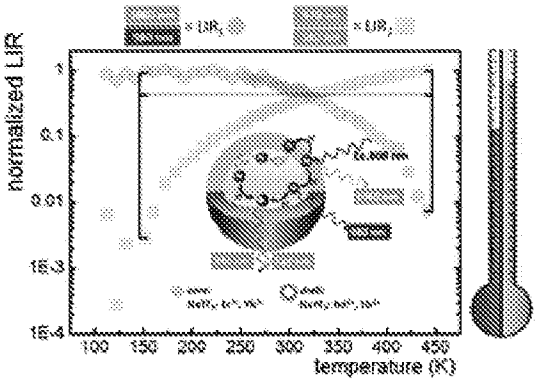
Dynamics of intramolecular spin exchange interaction of a nitronyl nitroxide diradical in solution and on surfaces



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08824K, Paper
V. Lloveras, E. Badetti, J. Veciana, J. Vidal-Gancedo
It is possible to preserve the same dynamic behaviour observed for a diradical in solution in AuNP surface-anchored radicals.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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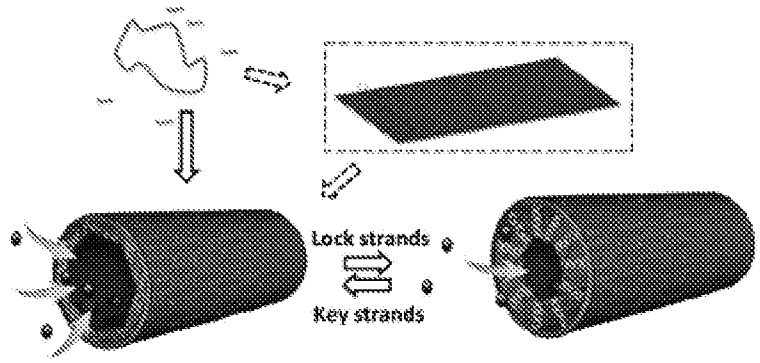
A broadening temperature sensitivity range with a core-shell YbEr@YbNd double ratiometric optical nanothermometer

PATENT
REEL: 037821 FRAME: 0584



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08223D, Paper
L. Marciniak, K. Prorok, L. Frances-Soriano, J. Perez-Prieto, A. Bednarkiewicz
The chemical architecture of lanthanide doped core-shell up-converting nanoparticles can be engineered to purposely design the properties of luminescent nanomaterials, which are typically inaccessible to their homogeneous counterparts.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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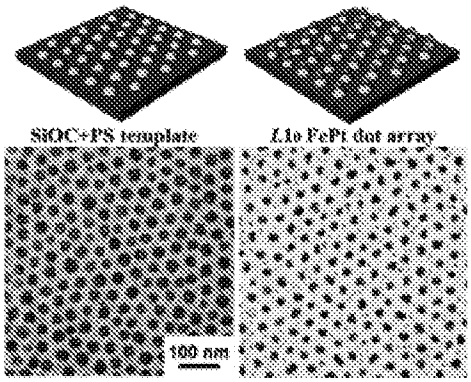
A switchable DNA origami nanochannel for regulating molecular transport at the nanometer scale



Nanoscale, 2016, **8**,3944-3948
DOI: 10.1039/C5NR08206D, Communication
Dianming Wang, Yiyang Zhang, Miao Wang, Yuanchen Dong, Chao Zhou, Mark Antonin Isbell, Zhongqiang Yang, Huajie Liu, Dongsheng Liu
A nanochannel with a shutter at one end was built by DNA nanotechnology.
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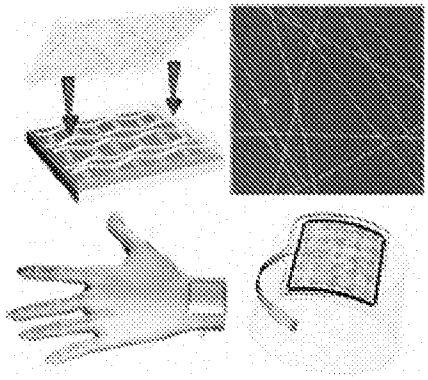
Thermal dewetting with a chemically heterogeneous nano-template for self-assembled L10 FePt nanoparticle arrays

PATENT
REEL: 037821 FRAME: 0585



Nanoscale, 2016, **8**,3926-3935
DOI: 10.1039/C5NR08339G, Communication
Liang-Wei Wang, Chung-Fu Cheng, Jung-Wei Liao, Chiu-Yen Wang, Ding-Shuo Wang, Kuo-Feng Huang, Tzu-Ying Lin, Rong-Ming Ho, Lih-Juann Chen, Chih-Huang Lai
The self-assembled $L1_0$ FePt nanoparticles are fabricated by thermal dewetting with a chemically heterogeneous nano-template.
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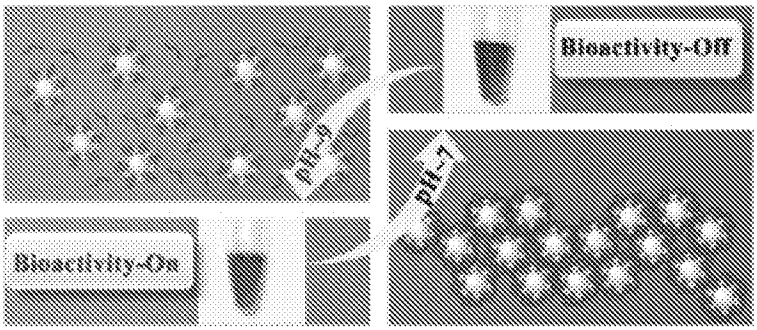
A high-performance, flexible and robust metal nanotrough-embedded transparent conducting film for wearable touch screen panels



Nanoscale, 2016, **8**,3916-3922
DOI: 10.1039/C5NR07657A, Communication
Hyeon-Gyun Im, Byeong Wan An, Jungho Jin, Junho Jang, Young-Geun Park, Jang-Ung Park, Byeong-Soo Bae
A junction resistance-free continuous metal nanotrough-embedded transparent conducting electrode (TCE) composite film (metal nanotrough-GFRHybrimer film) is reported.
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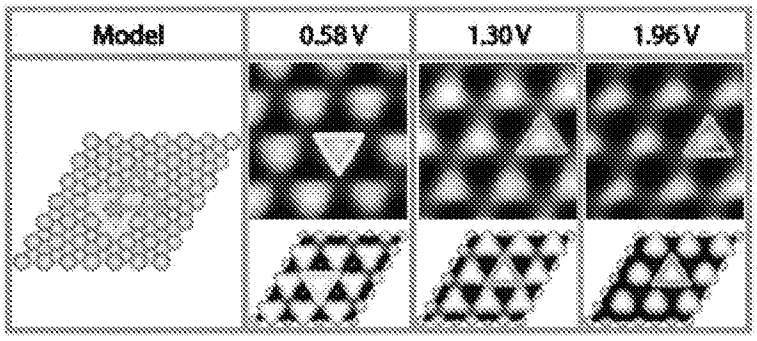
Multifunctional nanoparticle-protein conjugates with controllable bioactivity and pH responsiveness

PATENT
REEL: 037821 FRAME: 0586



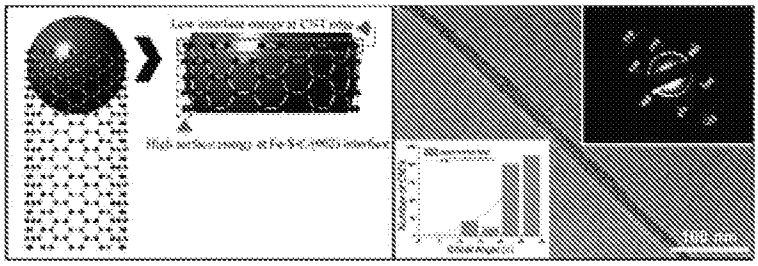
Nanoscale, 2016, **8**,4387-4394
DOI: 10.1039/C5NR07436C, Paper
Feng Liu, Lulu Xue, Yuqi Yuan, Jingjing Pan, Chenjie Zhang, Hongwei Wang, John L. Brash, Lin Yuan, Hong Chen
With the interaction of polymers, the nanoparticle-protein conjugates show controllable bioactivity and pH responsiveness.
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Tuning the surface electronic structure of a Pt3Ti(111) electro catalyst



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08420B, Paper
M. Pa[German sz ligature}ens, V. Caciuc, N. Atodiresei, M. Moors, S. Blugel, R. Waser, S. Karthauser
Combining voltage dependent STM imaging with *ab initio* DFT calculations to identify the exact termination of an electro catalyst.
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Inherent predominance of high chiral angle metallic carbon nanotubes in continuous fibers grown from a molten catalyst

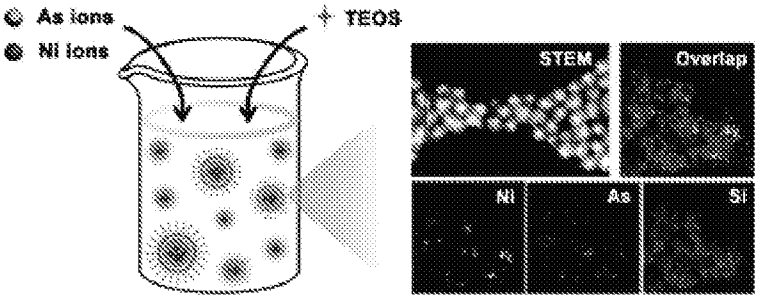


Nanoscale, 2016, **8**,4236-4244
DOI: 10.1039/C5NR07455J, Paper

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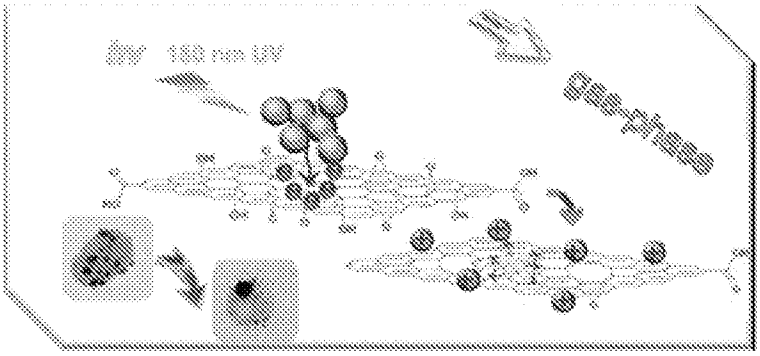
B. Aleman, M. Mar Bernal, B. Mas, Emilio M. Perez, V. Reguero, G. Xu, Y. Cui, Juan J. Vilatela
The armchair-biased chiral angle distribution in continuous fibres of CNTs is controlled by the molten state of the Fe-S-C alloy catalyst.
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A facile route to core-shell nanoparticulate formation of arsenic trioxide for effective solid tumor treatment



Nanoscale, 2016, **8**,4373-4380
DOI: 10.1039/C5NR07860A, Paper
Zongjun Zhang, Hanyu Liu, Hualu Zhou, Xianglong Zhu, Zhenghuan Zhao, Xiaoqin Chi, Hong Shan, Jinhao Gao
The facile synthesis of pH-sensitive arsenic-based nanodrugs by a "one-pot" reverse microemulsion method was reported.
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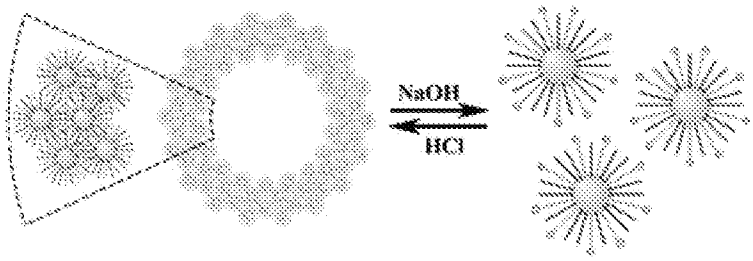
Gas-phase rapid reduction of graphene oxide through photoionization of gold nanoparticles



Nanoscale, 2016, **8**,3906-3910
DOI: 10.1039/C5NR08509H, Communication
Jeong Hoon Byeon
This work introduces for the first time a rapid reduction of graphene oxide *via* the photoionization of gold nanoparticles in a continuous gas-phase process.
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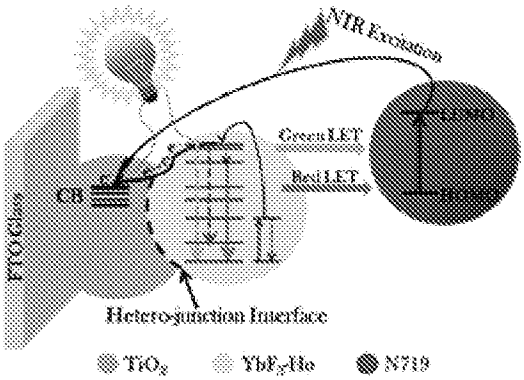
pH-Responsive reversible self-assembly of gold nanoparticles into nanovesicles

PATENT
REEL: 037821 FRAME: 0588



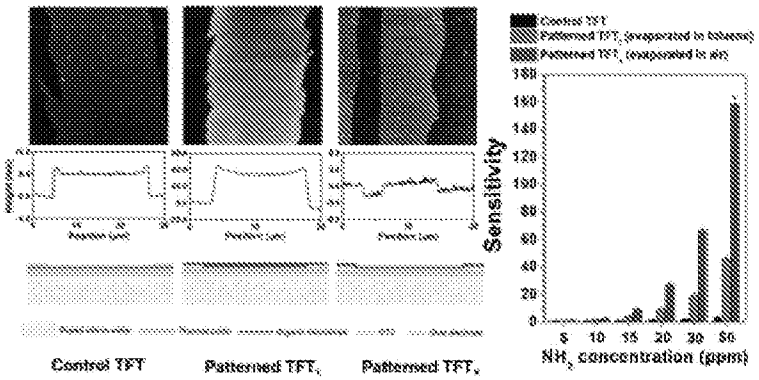
Nanoscale, 2016, **8**,3923-3925
DOI: 10.1039/C6NR00044D, Communication
Chunfang Fan, Tong Bian, Lu Shang, Run Shi, Li-Zhu Wu, Chen-Ho Tung, Tierui Zhang
pH-Responsive Au nanovesicles with reversible self-assembly and disassembly performance were developed by adjusting protonation and deprotonation of surface ligands.
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Enhanced photovoltaic performance of dye-sensitized solar cells using a new photoelectrode material: upconversion YbF3-Ho/TiO2 nanoheterostructures



Nanoscale, 2016, **8**,4173-4180
DOI: 10.1039/C5NR08319B, Paper
Jia Yu, Yulin Yang, Ruiqing Fan, Ping Wang, Yuwei Dong
UC/TiO_2 nanoheterostructures induce electron-injection from YbF_3-Ho to TiO_2 by utilizing near-infrared light, and further improve the existing merits of TiO_2.
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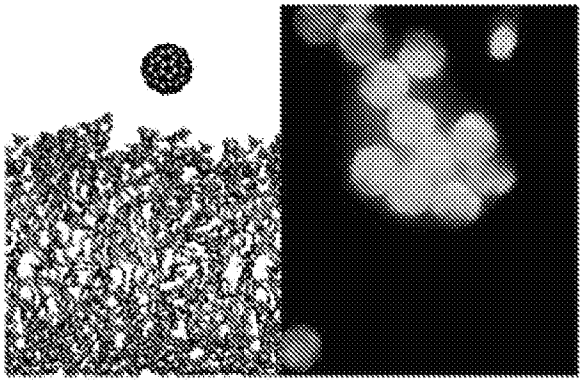
Fast patterning of oriented organic microstripes for field-effect ammonia gas sensors



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REEL: 037821 FRAME: 0589

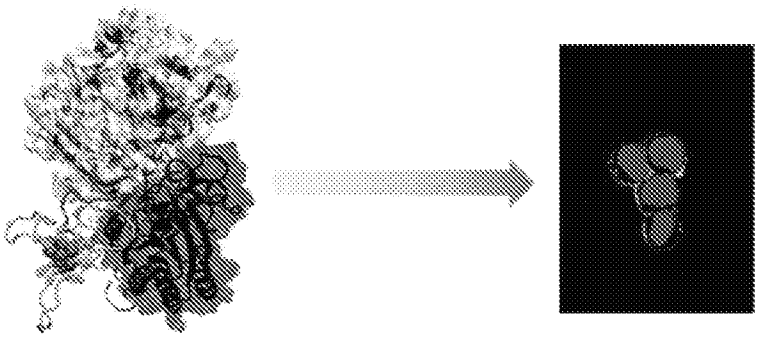
Nanoscale, 2016, **8**,3954-3961
DOI: 10.1039/C5NR09001F, Communication
Binghao Wang, Jinqiang Ding, Tao Zhu, Wei Huang, Zequn Cui, Jianmei Chen, Lizhen Huang, Lifeng Chi
A series of organic field-effect transistors (OFETs) with patterned ultra-thin films for NH_3 detection are achieved *via* fast dip-coating.
The content of this RSS Feed (c) The Royal Society of Chemistry

C60 fullerene localization and membrane interactions in RAW 264.7 immortalized mouse macrophages



Nanoscale, 2016, **8**,4134-4144
DOI: 10.1039/C5NR07003A, Paper
K. A. Russ, P. Elvati, T. L. Parsonage, A. Dews, J. A. Jarvis, M. Ray, B. Schneider, P. J. S. Smith, P. T. F. Williamson, A. Violi, M. A. Philbert
There continues to be a significant increase in the number and complexity of hydrophobic nanomaterials that are engineered for a variety of commercial purposes making human exposure a significant health concern.
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Computational design of peptide-Au cluster probe for sensitive detection of [small alpha]IIb[small beta]3 integrin

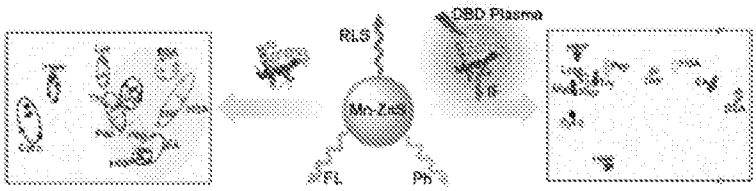


Nanoscale, 2016, **8**,4203-4208
DOI: 10.1039/C5NR09175F, Paper
Lina Zhao, Jiao Zhai, Xuejie Zhang, Xueyun Gao, Xiaohong Fang, Jingyuan Li
We have designed a novel peptide-Au cluster probe to specifically bind to [small alpha]$_{IIb}$[small beta]$_3$ integrin.
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Plasma-assisted quadruple-channel optosensing of proteins and cells with Mn-

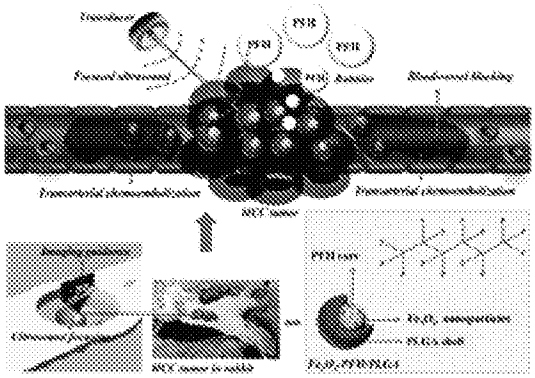
PATENT
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doped ZnS quantum dots



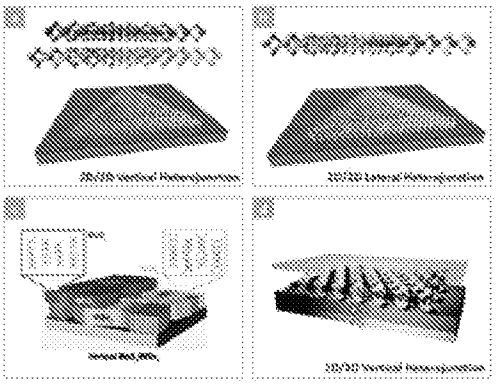
Nanoscale, 2016, **8**,4291-4298
DOI: 10.1039/C5NR09130F, Paper
Chenghui Li, Peng Wu, Xiandeng Hou
The addition of the intrinsic fluorescence of proteins to the existing triple-channel optical properties of Mn-ZnS QDs yields new quadruple-channel optosensing devices with substantially increased discrimination capacity for proteins. A low-temperature plasma for protein treatment further enforces the discrimination.
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Nanoparticle-enhanced synergistic HIFU ablation and transarterial chemoembolization for efficient cancer therapy



Nanoscale, 2016, **8**,4324-4339
DOI: 10.1039/C5NR08292G, Paper
Yufeng You, Zhigang Wang, Haitao Ran, Yuanyi Zheng, Dong Wang, Jinshun Xu, Zhibiao Wang, Yu Chen, Pan Li
We have developed a nanoparticle-based HIFU synergistic cancer surgery enhanced by transarterial chemoembolization for high-efficient HCC treatment based on Fe_3O_4-PFH/PLGA nanocapsules.
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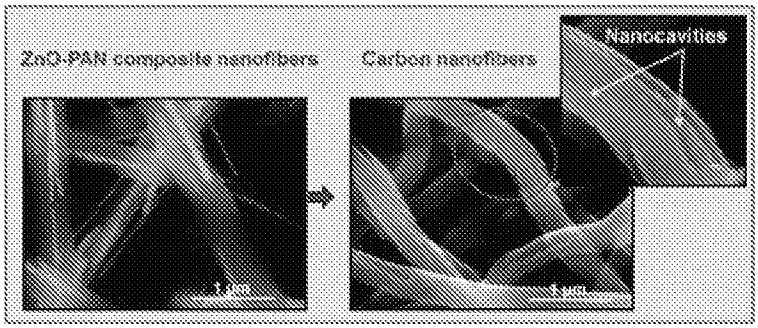
Fundamentals of lateral and vertical heterojunctions of atomically thin materials



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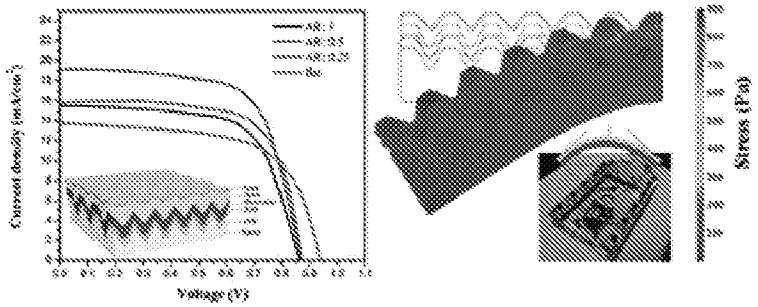
Nanoscale, 2016, **8**,3870-3887
DOI: 10.1039/C5NR08982D, Minireview
Anupum Pant, Zafer Mutlu, Darshana Wickramaratne, Hui Cai, Roger K. Lake, Cengiz Ozkan, Sefaattin Tongay
At the turn of this century, Herbert Kroemer, the 2000 Nobel Prize winner in Physics, famously commented that "the interface is the device".
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Zinc oxide nanorod assisted rapid single-step process for the conversion of electrospun poly(acrylonitrile) nanofibers to carbon nanofibers with a high graphitic content



Nanoscale, 2016, **8**,4360-4372
DOI: 10.1039/C5NR06809F, Paper
Ratyakshi Nain, Dhirendra Singh, Manjeet Jassal, Ashwini K. Agrawal
The effect of incorporation of rigid zinc oxide (ZnO) nanostructures on carbonization behavior of electrospun special acrylic fiber grade poly(acrylonitrile) (PAN-SAF) nanofibers was investigated.
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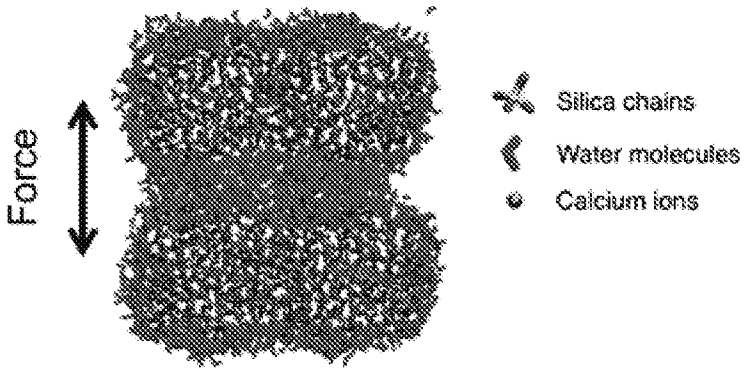
Efficient, flexible and mechanically robust perovskite solar cells on inverted nanocone plastic substrates



Nanoscale, 2016, **8**,4276-4283
DOI: 10.1039/C5NR08836D, Paper
Mohammad Mahdi Tavakoli, Qingfeng Lin, Siu-Fung Leung, Ga Ching Lui, Hao Lu, Liang Li, Bin Xiang, Zhiyong Fan
Utilization of nanostructures on photovoltaic devices can significantly improve the device energy conversion efficiency by enhancing the device light harvesting capability as well as carrier collection efficiency.
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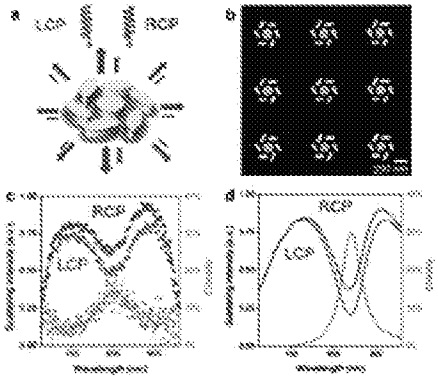
Interaction grand potential between calcium-silicate-hydrate nanoparticles at the molecular level

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Nanoscale, 2016, **8**,4160-4172
DOI: 10.1039/C5NR08142D, Paper
Patrick A. Bonnaud, Christophe Labbez, Ryuji Miura, Ai Suzuki, Naoto Miyamoto, Nozomu Hatakeyama, Akira Miyamoto, Krystyn J. Van Vliet
Mean forces and interaction grand potentials between calcium-silicate-hydrate particles.
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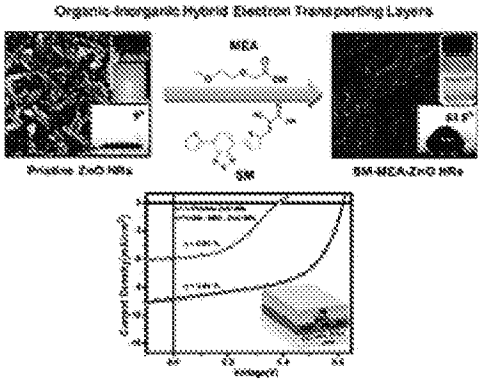
Planar plasmonic chiral nanostructures



Nanoscale, 2016, **8**,3900-3905
DOI: 10.1039/C5NR09302C, Communication
Shuai Zu, Yanjun Bao, Zheyu Fang
A strong chiral optical response induced at a plasmonic Fano resonance in a planar Au heptamer nanostructure was experimentally and theoretically demonstrated.
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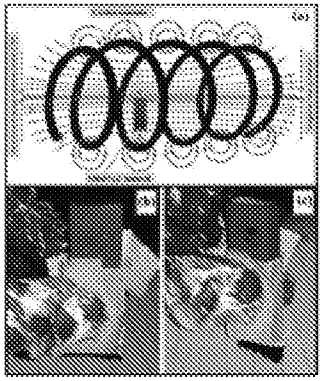
Co-functionalized organic/inorganic hybrid ZnO nanorods as electron transporting layers for inverted organic solar cells

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Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08849F, Paper
Swapnil B. Ambade, Rohan B. Ambade, Seung Hun Eom, Myung-Jin Baek, Sushil S. Bagde, Rajaram S. Mane, Soo-Hyoung Lee
The first hybrid co-functionalization of solution processed planar ZnO nanorod ETLs in iOSCs with organic small molecule based on a D-A-D configuration with meticulous control of aggregation.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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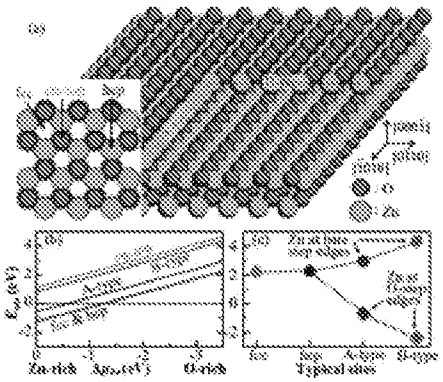
Fe3C-filled carbon nanotubes: permanent cylindrical nanomagnets possessing exotic magnetic properties



Nanoscale, 2016, **8**,4299-4310
DOI: 10.1039/C5NR09188H, Paper
Reetu Kumari, Lucky Krishnia, Vinay Kumar, Sandeep Singh, H. K. Singh, R. K. Kotnala, R. R. Juluri, U. M. Bhatta, P. V. Satyam, Brajesh S. Yadav, Zainab Naqvi, Pawan K. Tyagi
We study how confinement affects the magnetism of Fe_3C filled CNTs and stress induced structural phase transition. A model describing the growth mechanism as well as *in situ* pole formation in nanorod is discussed.
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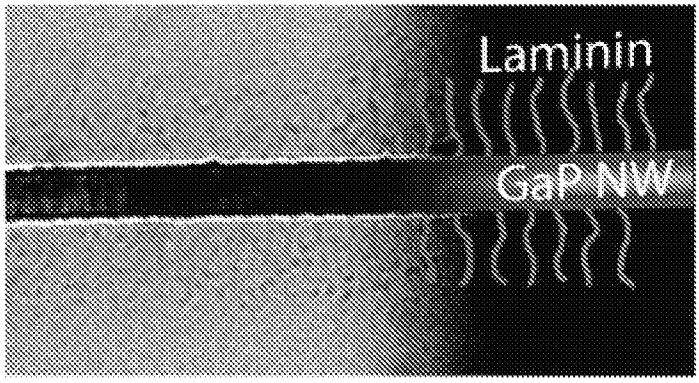
Effects of nitrogen dopants on the atomic step kinetics and electronic structures of O-polar ZnO

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Nanoscale, 2016, **8**,4381-4386
DOI: 10.1039/C5NR09060A, Paper
Hao Wang, Huahan Zhan, Yinghui Zhou, Yaping Wu, Xiaohang Chen, Huiqiong Wang, Junyong Kang
Oxygen-polar ZnO films are grown in step flow mode by molecular beam epitaxy.
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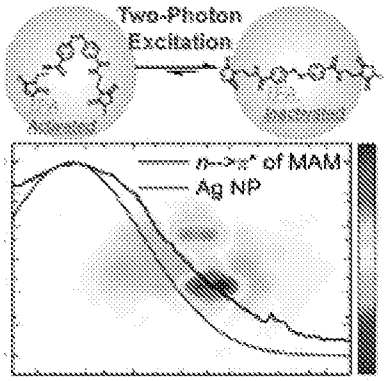
Electron microscopy imaging of proteins on gallium phosphide semiconductor nanowires



Nanoscale, 2016, **8**,3936-3943
DOI: 10.1039/C5NR08888G, Communication
Martin Hjort, Mikael Bauer, Stefan Gunnarsson, Erik Marsell, Alexei A. Zakharov, Gunnel Karlsson, Elodie Sanfins, Christelle N. Prinz, Reine Wallenberg, Tommy Cedervall, Anders Mikkelsen
We have imaged GaP nanowires (NWs) incubated with human laminin, serum albumin (HSA), and blood plasma using both cryo-transmission electron microscopy and synchrotron based X-ray photoemission electron microscopy.
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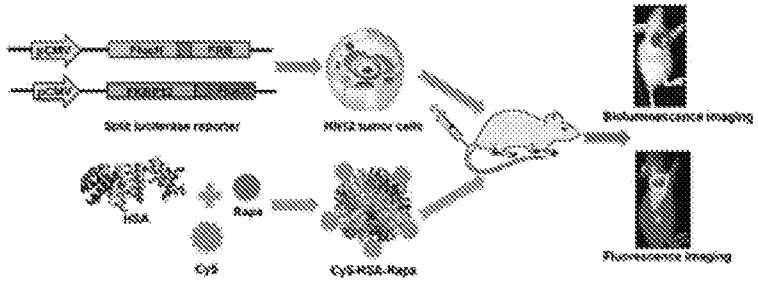
Plasmon-enhanced two-photon-induced isomerization for highly-localized light-based actuation of inorganic/organic interfaces

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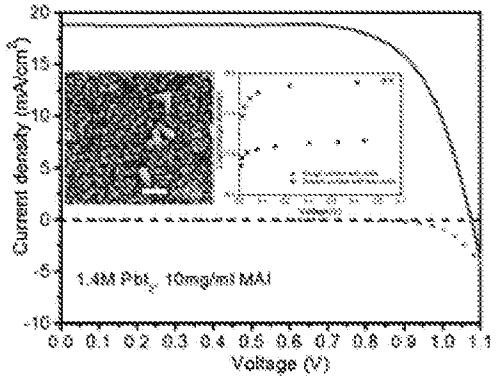
Nanoscale, 2016, **8**,4194-4202
DOI: 10.1039/C5NR07973J, Paper
Chang-Keun Lim, Xin Li, Yue Li, Kurt L. M. Drew, J. Pablo Palafox-Hernandez, Zhenghua Tang, Alexander Baev, Andrey N. Kuzmin, Marc R. Knecht, Tiffany R. Walsh, Mark T. Swihart, Hans Agren, Paras N. Prasad
Plasmon-enhanced two-photon isomerization of non-donor/acceptor modified azobenzene on Ag NPs.
The content of this RSS Feed (c) The Royal Society of Chemistry

Combined image guided monitoring the pharmacokinetics of rapamycin loaded human serum albumin nanoparticles with a split luciferase reporter



Nanoscale, 2016, **8**,3991-4000
DOI: 10.1039/C5NR07308A, Paper
Fu Wang, Kai Yang, Zhe Wang, Ying Ma, J. Silvio Gutkind, Naoki Hida, Gang Niu, Jie Tian
This integrated imaging platform could provide more reliable respective PK profiles of a loaded drug and its carrier.
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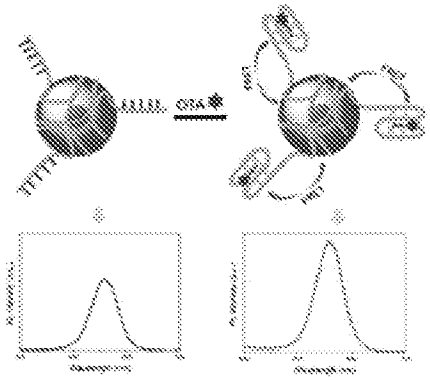
Influence of void-free perovskite capping layer on the charge recombination process in high performance CH3NH3PbI3 perovskite solar cells



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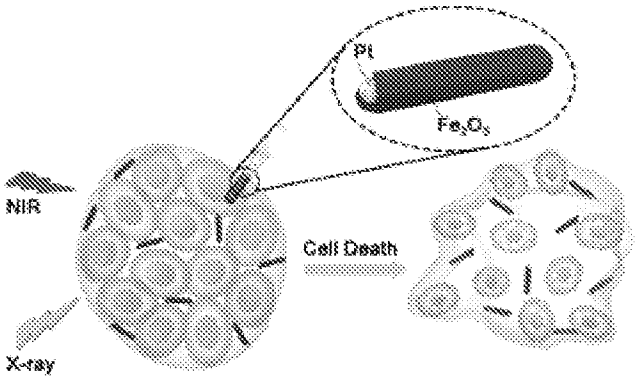
Nanoscale, 2016, **8**,4181-4193
DOI: 10.1039/C5NR06362K, Paper
Kunwu Fu, Christopher T. Nelson, Mary Cooper Scott, Andrew Minor, Nripan Mathews, Lydia Helena Wong
Uniform surface coverage of perovskite capping layer formed with less void formation reduces charge recombination and enhances device performance.
The content of this RSS Feed (c) The Royal Society of Chemistry

A self-assembly aptasensor based on thick-shell quantum dots for sensing of ochratoxin A



Nanoscale, 2016, **8**,4127-4133
DOI: 10.1039/C5NR08284F, Paper
Xianfeng Chu, Xiaowen Dou, Ruizheng Liang, Menghua Li, Weijun Kong, Xihui Yang, Jiaoyang Luo, Meihua Yang, Ming Zhao
A tunable-valency self-assembling aptasensor based on a thick-shell quantum dot was fabricated for ochratoxin A (OTA).
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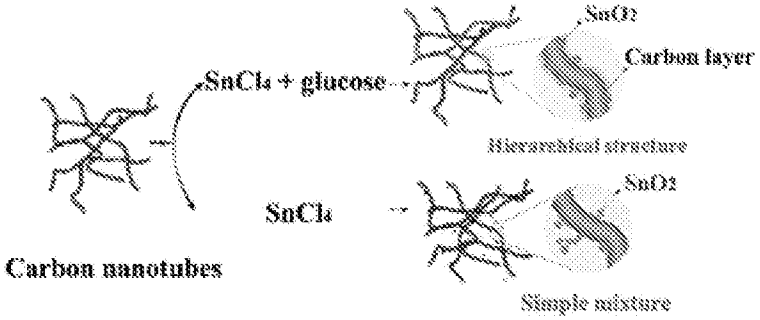
Facile preparation of hybrid core-shell nanorods for photothermal and radiation combined therapy



Nanoscale, 2016, **8**,3895-3899
DOI: 10.1039/C5NR09102K, Communication
Yaoyao Deng, Erdong Li, Xiaju Cheng, Jing Zhu, Shuanglong Lu, Cuicui Ge, Hongwei Gu, Yue Pan
Water-soluble platinum@iron oxide core-shell nanorods were synthesized and explored for NIR photothermal and X-ray radiation combined therapy.
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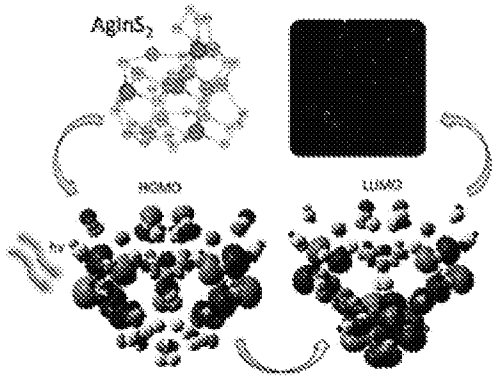
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Carbon coated SnO2 nanoparticles anchored on CNT as a superior anode material for lithium-ion batteries



Nanoscale, 2016, **8**,4121-4126
DOI: 10.1039/C5NR07996A, Paper
Chunrong Ma, Weimin Zhang, Yu-Shi He, Qiang Gong, Haiying Che, Zi-Feng Ma
High performance hierarchically structured carbon covering SnO_2 nanoparticles on CNTs were synthesized *via* a facile glucose mediated hydrothermal method and subsequent calcination as an anode for lithium-ion batteries.
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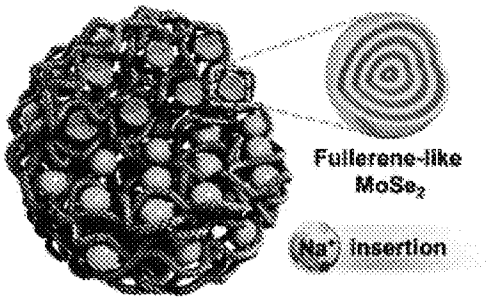
Two blinking mechanisms in highly confined AgInS2 and AgInS2/ZnS quantum dots evaluated by single particle spectroscopy



Nanoscale, 2016, **8**,4151-4159
DOI: 10.1039/C5NR07992F, Paper
B. Cichy, R. Rich, A. Olejniczak, Z. Gryczynski, W. Strek
Ternary $AgInS_2$ quantum dots (QDs) have been found as promising cadmium-free, red-shifted, and tunable luminescent bio-probes with efficient Stokes and anti-Stokes excitations and luminescence lifetimes (*ca.* 100 ns) convenient for time resolved techniques.
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Fullerene-like MoSe2 nanoparticles-embedded CNT balls with excellent structural stability for highly reversible sodium-ion storage

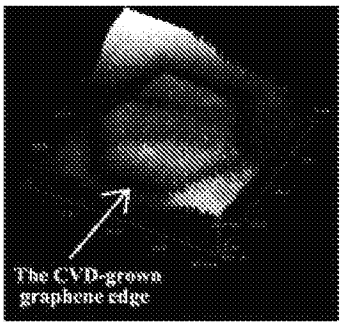
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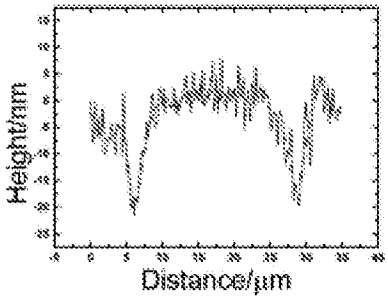


Fullerene-like $MoSe_2$ nanoparticles embedded CNT ball

Nanoscale, 2016, **8**,4209-4216
DOI: 10.1039/C5NR07733H, Paper
Seung Ho Choi, Yun Chan Kang
Three-dimensional (3D) porous-structured carbon nanotube (CNT) balls embedded with metal selenide nanocrystals were prepared by a simple two-step process. The fullerene-like $MoSe_2$/CNT composite balls, selected as the first target material, showed excellent sodium-ion storage properties.
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Edge morphology evolution of graphene domains during chemical vapor deposition cooling revealed through hydrogen etching

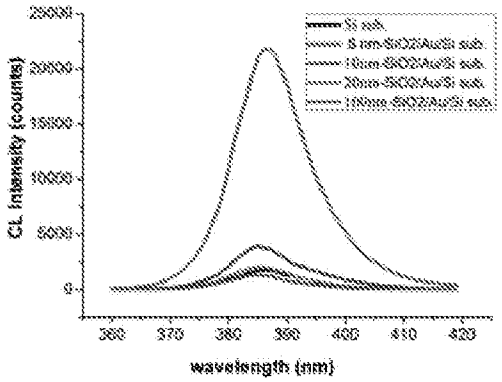




Nanoscale, 2016, **8**,4145-4150
DOI: 10.1039/C5NR06624G, Paper
Haoran Zhang, Yanhui Zhang, Yaqian Zhang, Zhiying Chen, Yanping Sui, Xiaoming Ge, Guanghui Yu, Zhi Jin, Xinyu Liu
The CVD cooling process induced graphene edge evolution, such as nanoparticle accumulation and graphene edge sinking. The results revealed the peculiar graphene-Cu movement during CVD cooling.
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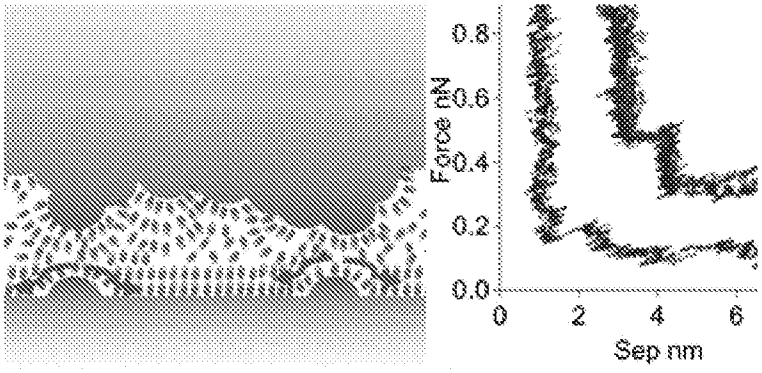
Strongly enhanced ultraviolet emission of an Au@SiO2/ZnO plasmonic hybrid nanostructure

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Nanoscale, 2016, **8**,4030-4036
DOI: 10.1039/C5NR06153A, Paper
Li Wang, Xiaodong Wang, Shengcheng Mao, Hua Wu, Xia Guo, Yuan Ji, Xiaodong Han
We present the surface plasmon polariton (SPP)-enhanced ultraviolet (UV) emission of an Au@SiO_2/ZnO hybrid nanostructure.
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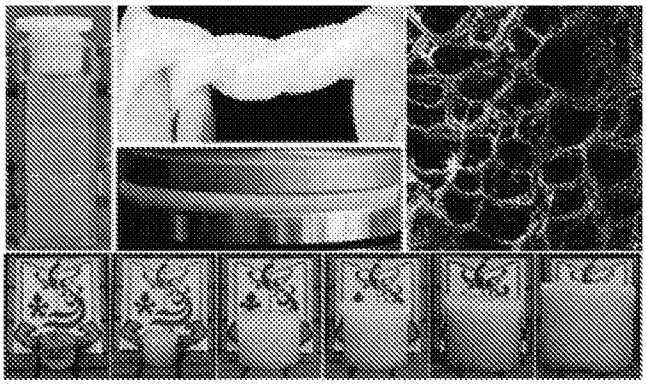
Layering of ionic liquids on rough surfaces



Nanoscale, 2016, **8**,4094-4106
DOI: 10.1039/C5NR07805A, Paper
Alexis Sheehan, L. Andres Jurado, Shivaprakash N. Ramakrishna, Andrea Arcifa, Antonella Rossi, Nicholas D. Spencer, Rosa M. Espinosa-Marzal
Structural forces reveal the ordered structure of one ionic liquid at rough interfaces of well-defined nanoscale roughness, also under nanoconfinement.
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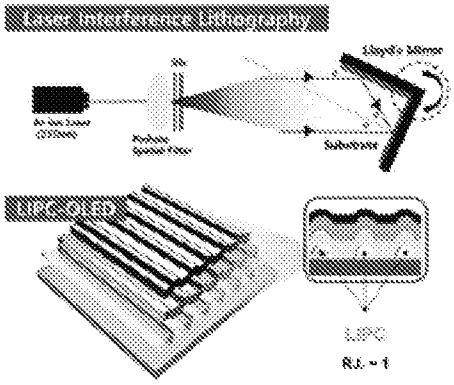
Aqueous compatible boron nitride nanosheets for high-performance hydrogels

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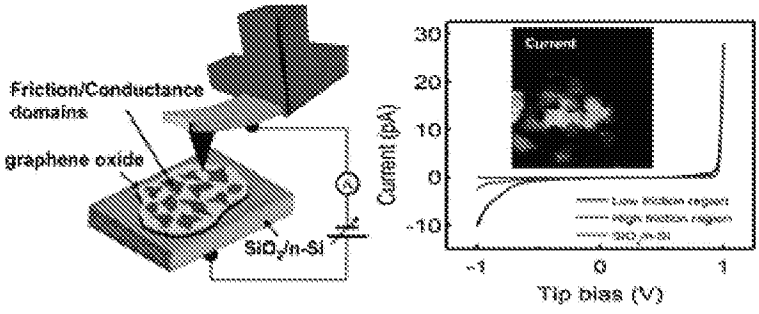
Nanoscale, 2016, **8**,4260-4266
DOI: 10.1039/C5NR07578E, Paper
Xiaozhen Hu, Jiahui Liu, Qiuju He, Yuan Meng, Liu Cao, Ya-Ping Sun, Jijie Chen, Fushen Lu
Aqueous dispersible boron nitride nanosheets were produced and used to fabricate nanocomposite hydrogels with high water retentivity and flexibility.
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An extremely low-index photonic crystal layer for enhanced light extraction from organic light-emitting diodes



Nanoscale, 2016, **8**,4113-4120
DOI: 10.1039/C5NR07312J, Paper
Yong Sub Shim, Ju Hyun Hwang, Cheol Hwee Park, Sun-Gyu Jung, Young Wook Park, Byeong-Kwon Ju
This paper reports organic light-emitting diodes (OLEDs) with improved light extraction fabricated by embedding an extremely low-index photonic crystal (LIPC) layer.
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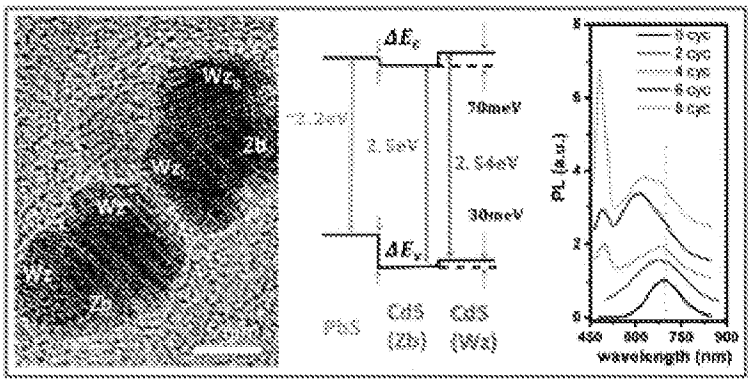
Friction and conductance imaging of sp2- and sp3-hybridized subdomains on single-layer graphene oxide



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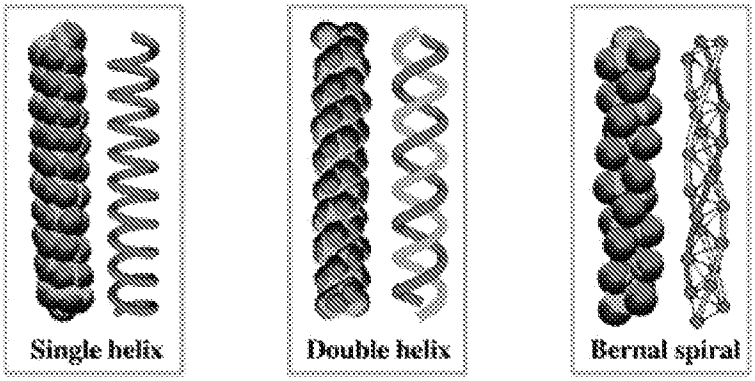
Nanoscale, 2016, **8**,4063-4069
DOI: 10.1039/C5NR06469D, Paper
Hyunsoo Lee, Narae Son, Hu Young Jeong, Tae Gun Kim, Gyeong Sook Bang, Jong Yun Kim, Gi Woong Shim, Kalyan C. Goddeti, Jong Hun Kim, Namdong Kim, Hyun-Joon Shin, Wondong Kim, Sehun Kim, Sung-Yool Choi, Jeong Young Park
We investigated the subdomain structures of graphene oxide with friction and conductance mappings.
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Dual emission in asymmetric "giant" PbS/CdS/CdS core/shell/shell quantum dots



Nanoscale, 2016, **8**,4217-4226
DOI: 10.1039/C5NR08881J, Paper
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Haiguang Zhao, Gianluca Sirigu, Andrea Parisini, Andrea Camellini, Giuseppe Nicotra, Federico Rosei, Vittorio Morandi, Margherita Zavelani-Rossi, Alberto Vomiero
Dual emission in asymmetric "giant" PbS/CdS/CdS core/shell/shell quantum dots enables color monitoring/modulation and control in the visible/NIR region for advanced applications.
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Supracolloidal helices from soft Janus particles by tuning the particle softness



Nanoscale, 2016, **8**,4070-4076
DOI: 10.1039/C5NR07011B, Paper
Qing-Zhi Zou, Zhan-Wei Li, Zhong-Yuan Lu, Zhao-Yan Sun
Supracolloidal helices including single helices, double helices, and Bernal spirals are observed through the self-

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assembly of soft Janus particles by properly tuning particle softness.
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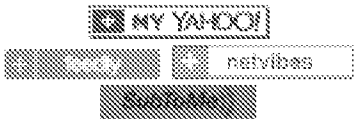
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Highly effective and uniform SERS substrates fabricated by etching multi-layered gold nanoparticle arrays

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C6NR00502K, Paper
Li Zhang, Changrong Guan, Ying Wang, Jianhui Liao
Gold nanoparticle multilayers printed on silicon substrates layer by layer were etched by gold etchant to form highly effective and uniform substrates for surface-enhanced Raman scattering (SERS). The performance of...
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Highly efficient plasmonic tip design for plasmon nanofocusing in near-field optical microscopy

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08548A, Paper
Takayuki Umakoshi, Yuika Saito, Prabhat Verma
Near-field scanning optical microscopy (NSOM) combined with plasmon nanofocusing is a powerful nano-analytical tool due to its attractive feature of efficient background suppression as well as light energy compression into...
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3D Flexible Water Channel: Stretchability of Nanoscale Water Bridge

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08072J, Paper
Jige Chen, Chunlei Wang, Ning Wei, Rongzheng Wan, Yi Gao
Artificial water channel contributes to a better understanding of natural water channel and aims to offer highly selective, advanced conductance system. Most studies use nanotubes, however it is difficult to...
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Silver Nanoparticles Confined in Carbon Nanotubes: On the Understanding of

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Confinement Effect and Promotional Catalysis for the Selective Hydrogenation of Dimethyl Oxalate

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08651E, Paper
Jianwei Zheng, Xinping Duan, Haiqiang Lin, Zhengqiang Gu, Huihuang Fang, Jianhui Li, Youzhu Yuan
Confined Ag nanomaterial in the channels of herringbone multi-wall carbon nanotubes (Ag-in/hCNT) was effectively prepared. The space restriction induces morphological changes of Ag nanoparticles into rough nanowires with an estimated...
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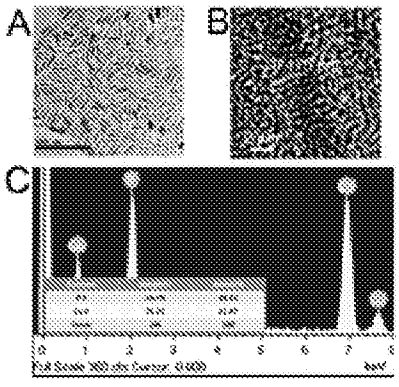
Large-area uniform and low-cost dual-mode plasmonic naked-eye colorimetry and SERS sensor with handheld Raman spectrometer

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08357E, Paper
Zhida Xu, Jing Jiang, Xinhao Wang, Kevin Han, Abid Ameen, Ibrahim Khan, Te-Wei Chang, Logan Liu
We demonstrated a highly-sensitive, wafer-scale, high-uniform plasmonic nano-mushroom substrate based on plastic for naked-eye plasmonic colorimetry and surface-enhanced Raman spectroscopy (SERS). We gave it the name FlexBrite. The dual-mode functionality...
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Elevated Gold Ellipse Nanoantenna Dimers as Sensitive and Tunable Surface Enhanced Raman Spectroscopy Substrates

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08920D, Paper
Aaron M Jubb, Yang Jiao, Gyula Eres, Scott Thomas Retterer, Baohua Gu
We demonstrate large area arrays of elevated gold ellipse dimers with precisely controlled gaps for use as sensitive and highly controllable surface enhanced Raman scattering (SERS) substrates. The significantly enhanced...
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A facile solution-phase synthesis of cobalt phosphide nanorods/hollow nanoparticles

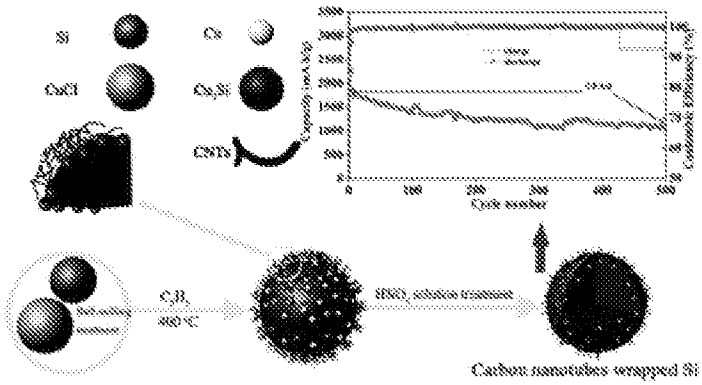


Nanoscale, 2016, Advance Article
DOI: 10.1039/C6NR00208K, Communication
Weiwei Yang, Yarong Huang, Jinlong Fan, Yongsheng Yu, Chunhui Yang, Haibo Li
A simple one-step solution-phase synthesis of cobalt phosphide nanorods (NRs) and hollow nanoparticles

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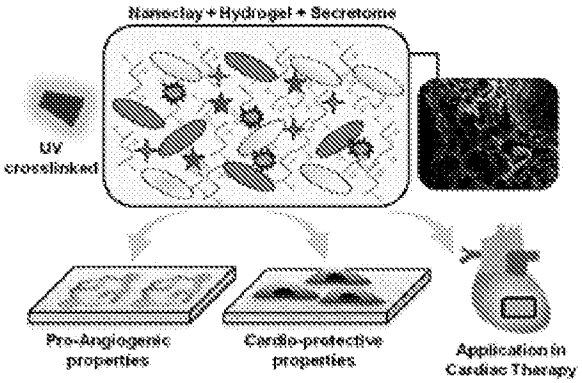
(NPs) has been reported in this paper.
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In situ growth of carbon nanotube wrapped Si composites as anodes for high performance lithium ion batteries



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08961A, Communication
Jianbin Zhou, Yang Lan, Kailong Zhang, Guoliang Xia, Jin Du, Yongchun Zhu, Yitai Qian
Carbon nanotube wrapped Si was synthesized *in situ* by using the CCVD method at 400 [degree]C and shows high electrochemical performance.
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Stem cell secretome-rich nanoclay hydrogel: a dual action therapy for cardiovascular regeneration

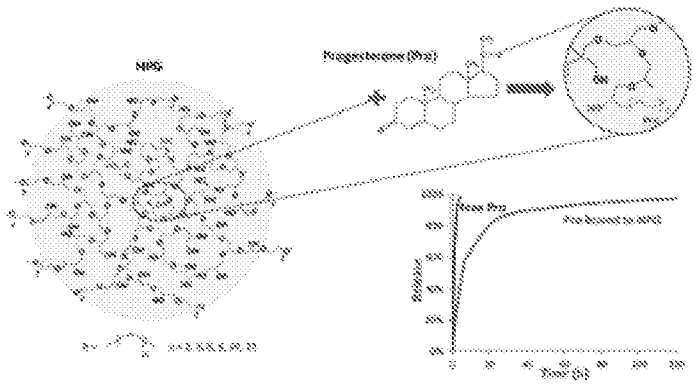


Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07806G, Communication
Renae Waters, Settimio Pacelli, Ryan Maloney, Indrani Medhi, Rafeeq P. H. Ahmed, Arghya Paul
We report development of a nanocomposite hydrogel platform using nanoclay materials and stem cell derived secretome for cardiac tissue repair and therapy.
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Progesterone binding nano-carriers based on hydrophobically modified

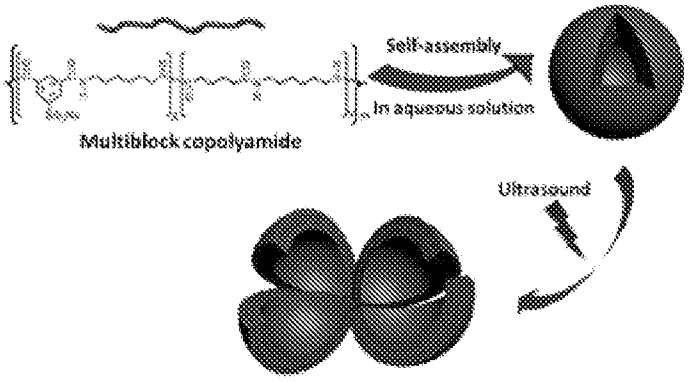
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REEL: 037821 FRAME: 0606

hyperbranched polyglycerols



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08175K, Paper
M. Alizadeh Noghani, D. E. Brooks
A family of hydrophobically derivatized HPGs is assessed as a potential carrier for progesterone, an important steroid. Molecular determinants of binding and the release kinetics are investigated and the surprising role of non-freezing water on release kinetics described.
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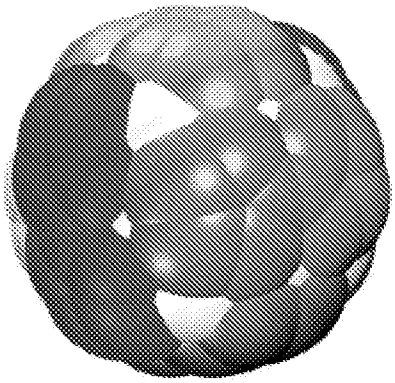
Ultrasound-responsive ultrathin multiblock copolyamide vesicles



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08596A, Communication
Lei Huang, Chunyang Yu, Tong Huang, Shuting Xu, Yongping Bai, Yongfeng Zhou
Novel ultrasound-responsive polymer vesicles with ultrathin walls and a special packing model were generated from an amphiphilic multiblock copolyamide.
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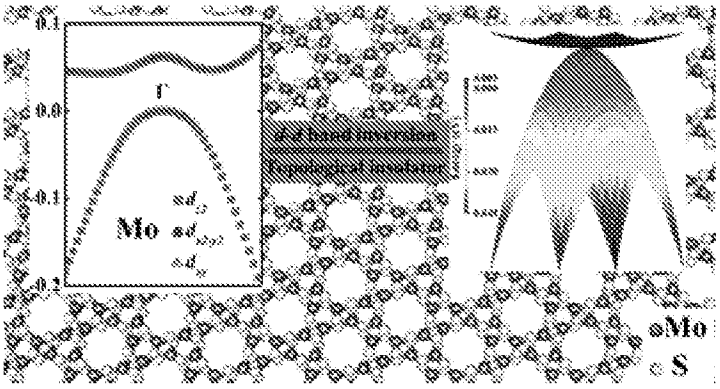
Sc20C60: a volleyballene

PATENT
REEL: 037821 FRAME: 0607



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07784B, Paper
Jing Wang, Hong-Man Ma, Ying Liu
A stable volleyball-like molecular cluster, *Volleyballene* $Sc_{20}C_{60}$, was identified. It possesses relatively high symmetry and a hollow space that can be used to accommodate other atoms or molecules for the purpose of studying fundamental chemistry.
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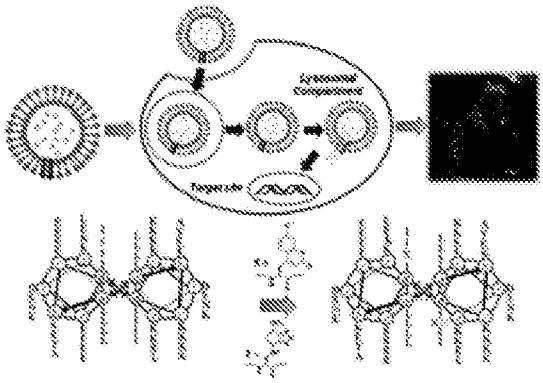
New quantum spin Hall insulator in two-dimensional MoS2 with periodically distributed pores



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08842A, Communication
Peng-Fei Liu, Liujiang Zhou, Thomas Frauenheim, Li-Ming Wu
A new two-dimensional topological insulator in two-dimensional MoS_2 with periodically distributed pores is predicted. Pure d-d band inversion is responsible for the quantum spin Hall effect. Theoretical analysis shows the largest nontrivial gap among MoS_2 isomers.
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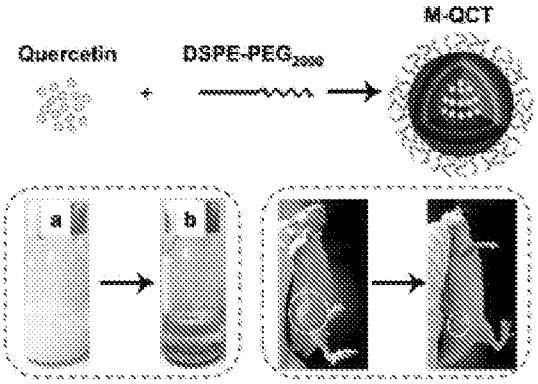
pH sensitive coiled coils: a strategy for enhanced liposomal drug delivery

PATENT
REEL: 037821 FRAME: 0608



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07734F, Paper
Rahi M. Reja, Mohsina Khan, Sumeet K. Singh, Rajkumar Misra, Anjali Shiras, Hosahudya N. Gopi
Design of pH sensitive coiled coils and their incorporation into the liposome vesicles as triggers for the controlled release of encapsulated drugs are reported.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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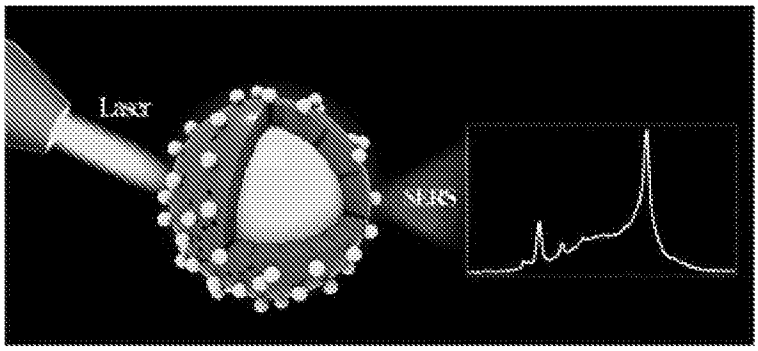
Quercetin-loaded nanomicelles to circumvent human castration-resistant prostate cancer in vitro and in vivo



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08966B, Paper
Jing Zhao, Juan Liu, Tuo Wei, Xiaowei Ma, Qiang Cheng, Shuaidong Huo, Chunqiu Zhang, Yanan Zhang, Xianglin Duan, Xing-Jie Liang
We develop a nanomicelle-based quercetin delivery system, which exhibits superior anticancer activity in the castration-resistant prostate cancer model.
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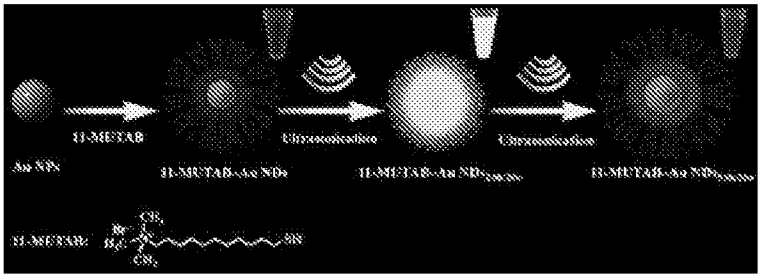
Hydrothermal synthesis of Ag@MSiO2@Ag three core-shell nanoparticles and their sensitive and stable SERS properties

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REEL: 037821 FRAME: 0609



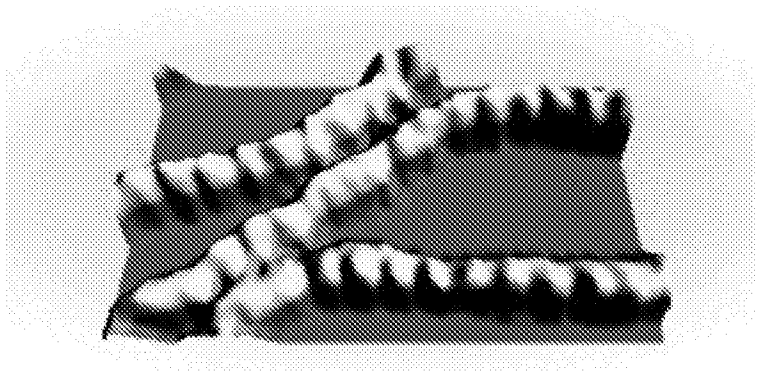
Nanoscale, 2016, Advance Article
DOI: 10.1039/C6NR00006A, Communication
Tao Jiang, Xiaolong Wang, Jun Zhou, Dong Chen, Ziqi Zhao
We report a unique Ag@$MSiO_2$@Ag three core-shell nanostructure as a SERS substrate with both sensitivity and stability.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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Ultrasound-mediated modulation of the emission of gold nanodots



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08387G, Paper
Yu-Ting Tseng, Rochelle Cherng, Zhiqin Yuan, Chien-Wei Wu, Huan-Tsung Chang, Chih-Ching Huang
Ultrasonication treatment of (11-mercaptoundecyl)-*N*,*N*,*N*-trimethylammonium bromide-capped gold nanodots (11-MUTAB-Au NDs) boosts a >1000-fold enhancement in its photoluminescence due to the smaller size and the higher 11-MUTAB ligand density on the surfaces.
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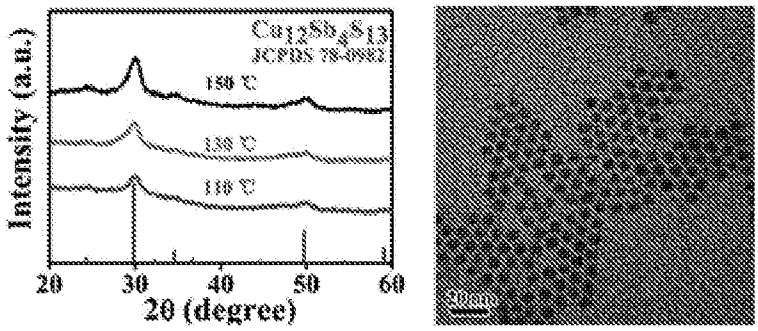
High resolution atomic force microscopy of double-stranded RNA



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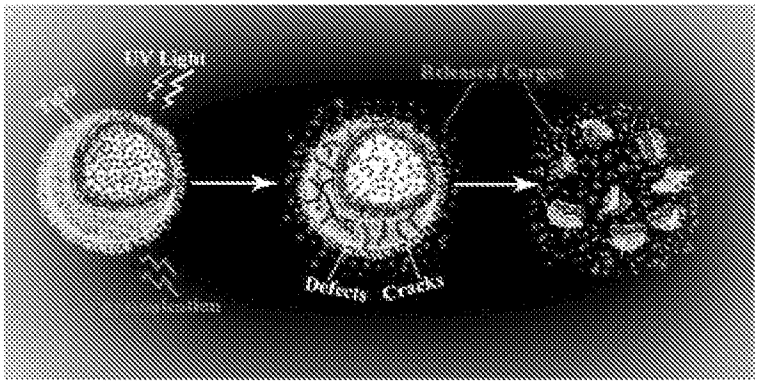
Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07445B, Paper
Pablo Ares, Maria Eugenia Fuentes-Perez, Elias Herrero-Galan, Jose M. Valpuesta, Adriana Gil, Julio Gomez-Herrero, Fernando Moreno-Herrero
Imaging double-stranded RNA at sub-helical pitch resolution with atomic force microscopy in liquid.
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A green synthesis route for the phase and size tunability of copper antimony sulfide nanocrystals with high yield



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR09097K, Paper
Keqiang Chen, Jing Zhou, Wen Chen, Qiao Chen, Peng Zhou, Yueli Liu
Typical XRD patterns of $Cu_{12}Sb_4S_{13}$ NCs with various sizes and a TEM image of 5.76 nm $Cu_{12}Sb_4S_{13}$ NCs.
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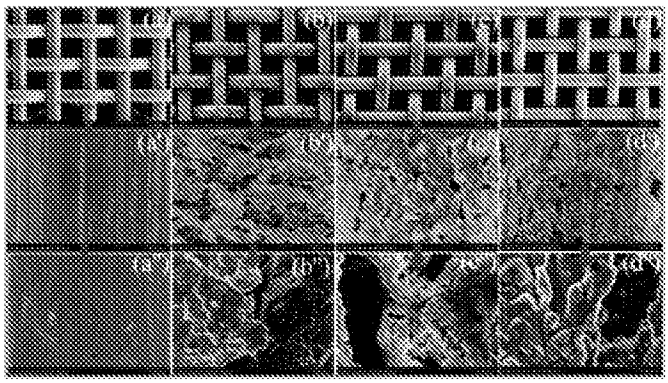
Bifunctional ultraviolet/ultrasound responsive composite TiO2/polyelectrolyte microcapsules



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR06666B, Paper
Hui Gao, Dongsheng Wen, Nadezda V. Tarakina, Jierong Liang, Andy J. Bushby, Gleb B. Sukhorukov
Functional composite TiO_2/polyelectrolyte microcapsules encapsulated with payloads are controllably opened by either ultraviolet or ultrasound treatment.
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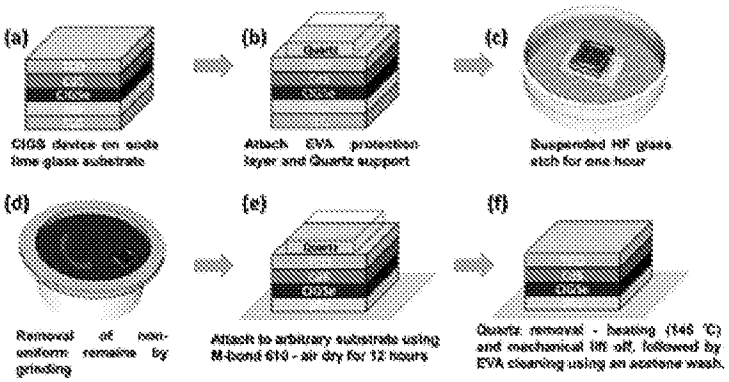
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REEL: 037821 FRAME: 0611

A multifunctional polymeric nanofilm with robust chemical performances for special wettability



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07601C, Paper
Yabin Wang, Feng Lin, Yaping Dong, Zhong Liu, Wu Li, Yudong Huang
A multifunctional polymeric nanofilm of a triazinedithiolsilane compound, which can protect metallic substrates and activate the corresponding surface simultaneously, is introduced onto a copper mesh surface *via* facile solution-immersion approaches.
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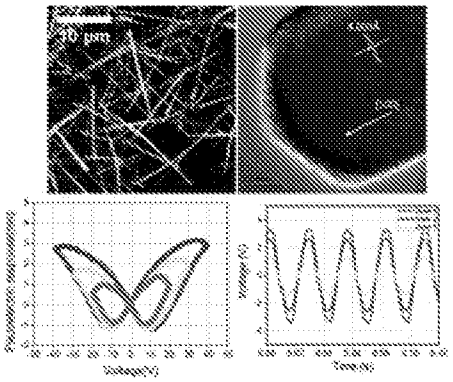
A facile chemical-mechanical polishing lift-off transfer process toward large scale Cu(In,Ga)Se2 thin-film solar cells on arbitrary substrates



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07008B, Paper
Kuan-Chun Tseng, Yu-Ting Yen, Stuart R. Thomas, Hung-Wei Tsai, Cheng-Hung Hsu, Wen-Chi Tsai, Chang-Hong Shen, Jia-Min Shieh, Zhiming M. Wang, Yu-Lun Chueh
The fabrication of Cu(In,Ga)Se_2 (CIGS) solar cells on flexible substrates is a non-trivial task due to thermal and ion diffusion related issues.
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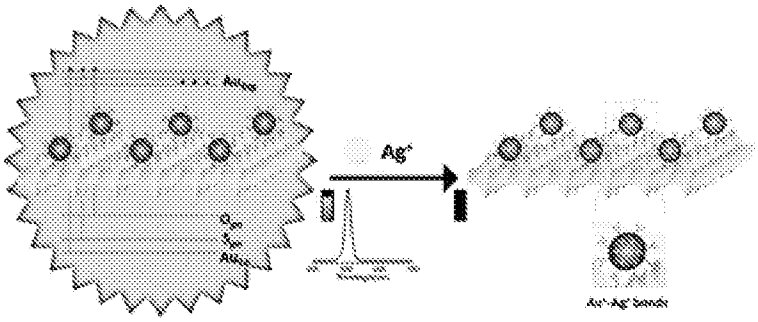
Lead-free 0.5Ba(Zr0.2Ti0.8)O3-0.5(Ba0.7Ca0.3)TiO3 nanowires for energy harvesting

PATENT
REEL: 037821 FRAME: 0612



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR09029F, Paper
Zhi Zhou, Christopher C. Bowland, Mohammad H. Malakooti, Haixiong Tang, Henry A. Sodano
$0.5Ba(Zr_{0.2}Ti_{0.8})O_3$-$0.5(Ba_{0.7}Ca_{0.3})TiO_3$ (BZT-BCT) nanowires with high piezoelectric coupling coefficient (90 +/- 5 pm V^{-1}) are utilized to fabricate a flexible, energy harvesting nanocomposite producing an open circuit voltage of 6.25 V and a power density of 2.25 [small mu]W cm^{-3}.
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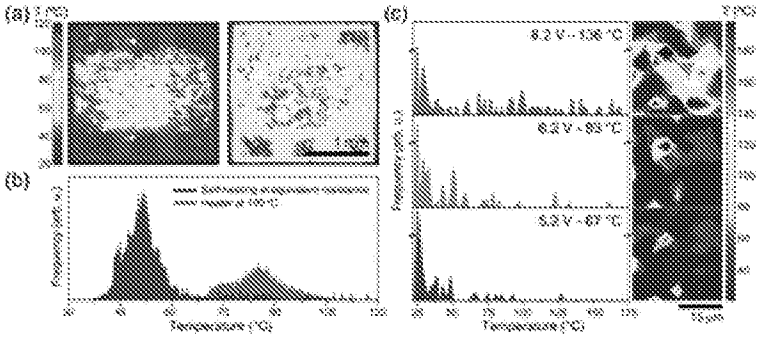
Green emission and Ag+ sensing of hydroxy double salt supported gold nanoclusters



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07029E, Paper
Jinyang Lu, Chunxiang Xu, Zhengshan Tian, Junfeng Lu, Yi Lin, Zengliang Shi
This work demonstrates a green-emitting complex of Zn-containing hydroxy double salt supported gold nanoclusters and its application for sensing Ag^+.
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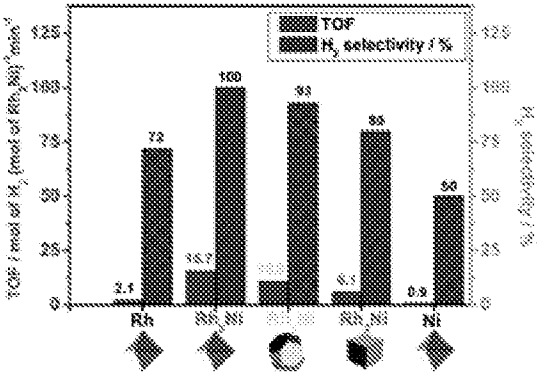
Localized self-heating in large arrays of 1D nanostructures

PATENT
REEL: 037821 FRAME: 0613



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07158E, Paper
O. Monereo, S. Illera, A. Varea, M. Schmidt, T. Sauerwald, A. Schutze, A. Cirera, J. D. Prades
Thermographic image of a CNFs film heated up by means of self-heating (left image) and external heater (right image). Raman mapping of the temperature distribution in a CNFs self-heated region at three different nominal temperatures with each corresponding temperature histogram.
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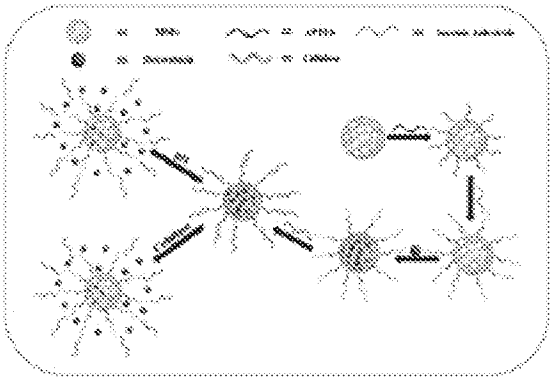
Synthesis of octahedral, truncated octahedral, and cubic Rh2Ni nanocrystals and their structure-activity relationship for the decomposition of hydrazine in aqueous solution to hydrogen



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR09227B, Paper
Chun Li, Tao Wang, Wei Chu, Ping Wu, Dong Ge Tong
Rh_2Ni nanocrystals with a higher percentage of {111} facets exhibited higher activity and H_2 selectivity during hydrazine dehydrogenation in aqueous solution.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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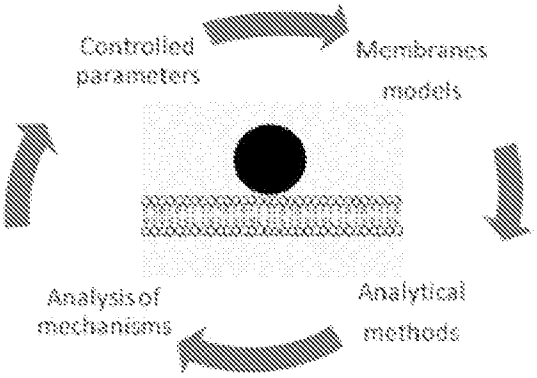
Cellulose conjugated FITC-labelled mesoporous silica nanoparticles: intracellular accumulation and stimuli responsive doxorubicin release

PATENT
REEL: 037821 FRAME: 0614



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08753H, Paper
Abdul Hakeem, Fouzia Zahid, Ruixue Duan, Muhammad Asif, Tianchi Zhang, Zhenyu Zhang, Yong Cheng, Xiaoding Lou, Fan Xia
Novel cellulose conjugated mesoporous silica nanoparticles (CLS-MSPs) for stimuli responsive intracellular doxorubicin (DOX) delivery were designed.
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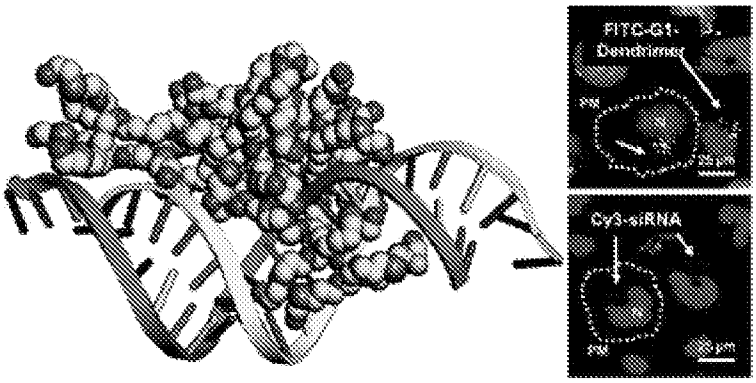
The relevance of membrane models to understand nanoparticles-cell membrane interactions



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07954C, Review Article
Estelle Rascol, Jean-Marie Devoisselle, Joel Chopineau
Membrane models are pertinent tools to explore and analyze nanoparticles-membrane interactions occurring at the cellular level.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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Low generation polyamine dendrimers bearing flexible tetraethylene glycol as nanocarriers for plasmids and siRNA

PATENT
REEL: 037821 FRAME: 0615



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR06757J, Paper
Rishi Sharma, Issan Zhang, Tze Chieh Shiao, Giovanni M. Pavan, Dusica Maysinger, Rene Roy
Polycationic tetraethyleneglycol dendrimers of low generation successfully deliver siRNA in human cells, with transfection efficiency comparable to that of Lipofectamine.
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DNA Origami Based Au-Ag-Core-Shell Nanoparticle Dimers with Single-Molecule SERS Sensitivity

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08674D, Paper
Julia Prinz, Christian Heck, Lisa Ellerik, virginia merk, Ilko Bald
DNA origami nanostructures are a versatile tool to arrange metal nanostructures and other chemical entities with nanometer precision. In this way gold nanoparticle dimers with defined distance can be constructed,...
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Surface energy and wettability of van der Waals structures

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR06705G, Paper
Meenakshi Annamalai, Kalon Gopinadhan, Sang A Han, Surajit Saha, Hye-Jeong Park, Eun Bi Cho, Brijesh Kumar, Abhijeet Patra, Sang-Woo Kim, Thirumalai Venkatesan
Wetting behaviour of surfaces is believed to be affected by van der Waals (vdW) forces; however, there is no clear demonstration of this. With the isolation of two-dimensional vdW layered...
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Quantitative characterization of conformational-specific protein-DNA binding using a dual-spectral interferometric imaging biosensor

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR06785E, Paper
Xirui Zhang, George Daaboul, Philipp Sphuler, Peter Droege, Selim Unlu
DNA-binding proteins play crucial roles in the maintenance and functions of the genome and yet, their specific binding mechanisms are not fully understood. Recently, it was discovered that DNA-binding proteins...
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Sequential protein unfolding through a carbon nanotube pore

PATENT
REEL: 037821 FRAME: 0616

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C6NR00410E, Paper
Zhonghe Xu, Shuang Zhang, Jeffrey K Weber, Binquan Luan, Ruhong Zhou, Jingyuan Li
An assortment of biological processes, like protein degradation and the transport of proteins across membranes, depend on protein unfolding events mediated by nanopore interfaces. In this work, we exploit fully...
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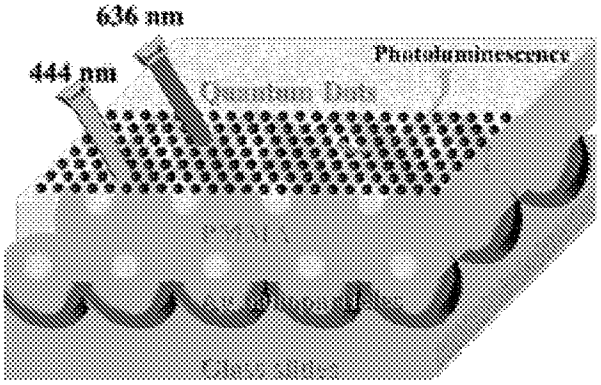
Charge Effects and Nanoparticle Pattern Formation in Electrohydrodynamic NanoDrip Printing of Colloids

Nanoscale, 2016, Accepted Manuscript
DOI: 10.1039/C5NR08783J, Paper
Patrizia Richner, Stephan J. P. Kress, David Norris, Dimos Poulikakos
Advancing open atmosphere printing technologies to produce features in the nanoscale range has important and broad applications ranging from electronics, to photonics, plasmonics and biology. Recently an electrohydrodynamic printing regime...
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Correction: CoPt/CeO2 catalysts for the growth of narrow diameter semiconducting single-walled carbon nanotubes

Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR90226F, Correction
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Lei Tang, Taotao Li, Chaowei Li, Lin Ling, Kai Zhang, Yagang Yao
To cite this article before page numbers are assigned, use the DOI form of citation above.
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Silver nanoparticle film induced photoluminescence enhancement of near-infrared emitting PbS and PbS/CdS core/shell quantum dots: observation of different enhancement mechanisms

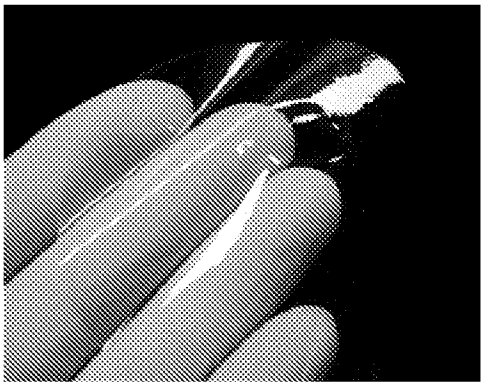


Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR05906B, Communication
H. Y. Liang, H. G. Zhao, Z. P. Li, C. Harnagea, D. L. Ma
A plasmon/fluorophore system consisting of Ag nanoparticles and near-infrared quantum dots (QDs) is investigated for photoluminescence (PL) enhancement.

PATENT
REEL: 037821 FRAME: 0617

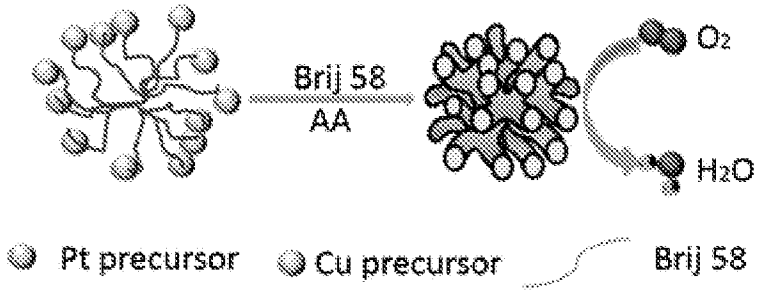
To cite this article before page numbers are assigned, use the DOI form of citation above.
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Combinatorial release of dexamethasone and amiodarone from a nano-structured parylene-C film to reduce perioperative inflammation and atrial fibrillation



Nanoscale, 2016, **8**,4267-4275
DOI: 10.1039/C5NR07456H, Paper
Erik Robinson, Sunjay Kaushal, Justice Alaboson, Sudhish Sharma, Amogh Belagodu, Claire Watkins, Brandon Walker, Gregory Webster, Patrick McCarthy, Dean Ho
Suppressing perioperative inflammation and post-operative atrial fibrillation requires effective drug delivery platforms (DDP).
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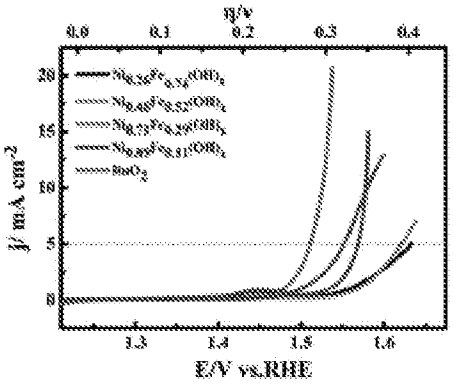
Highly branched PtCu bimetallic alloy nanodendrites with superior electrocatalytic activities for oxygen reduction reactions



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07682J, Paper
Shaofang Fu, Chengzhou Zhu, Qiurong Shi, Haibing Xia, Dan Du, Yuehe Lin
The highly branched PtCu bimetallic alloy nanodendrites were synthesized by a facile chemical reduction method using Brij 58 as the soft template. The as-prepared alloys presented superior electrocatalytic activities for oxygen reduction reactions.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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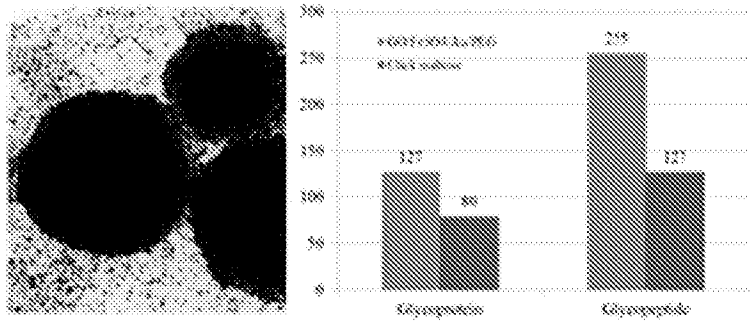
Amorphous mixed-metal hydroxide nanostructures for advanced water oxidation catalysts

PATENT
REEL: 037821 FRAME: 0618



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08989A, Paper
Y. Q. Gao, X. Y. Liu, G. W. Yang
We have synthesized amorphous mixed-metal (Ni-Fe) hydroxide nanostructures with a homogeneous distribution of Ni/Fe as well as a tunable Ni/Fe ratio by a simple, facile, green and low-cost electrochemical technique, and we have also demonstrated that the synthesized amorphous nanomaterials possess ultrahigh activity and super long-term cycle stability in the OER process.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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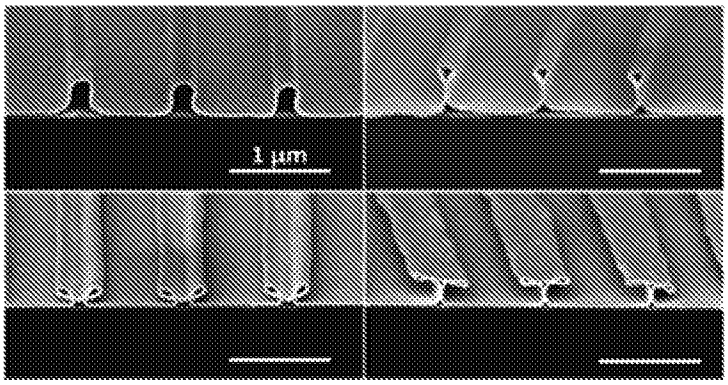
Hydrophilic GO/Fe3O4/Au/PEG nanocomposites for highly selective enrichment of glycopeptides



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08126B, Communication
Bo Jiang, Qi Wu, Nan Deng, Yuanbo Chen, Lihua Zhang, Zhen Liang, Yukui Zhang
GO/Fe_3O_4/Au/PEG nanocomposites were synthesized, and exhibited high selectivity to capture glycopeptides.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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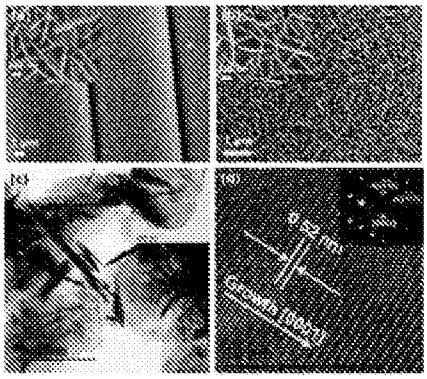
Fabrication and design of metal nano-accordion structures using atomic layer deposition and interference lithography

PATENT
REEL: 037821 FRAME: 0619



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08566G, Paper
J.-H. Min, A. Bagal, J. Z. Mundy, C. J. Oldham, B.-I. Wu, G. N. Parsons, C.-H. Chang
Fabricated free-standing platinum nano-accordion structures with a wide variety of cross-sectional profiles using a combination of ALD and IL.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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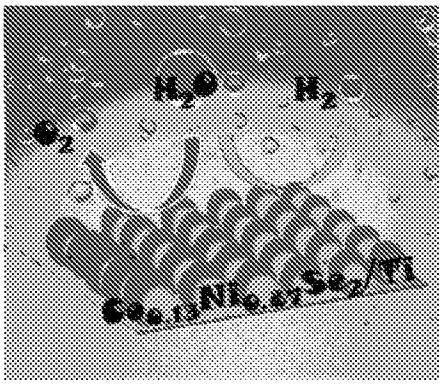
Flexible, transparent and exceptionally high power output nanogenerators based on ultrathin ZnO nanoflakes



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08324A, Paper
Huynh Van Ngoc, Dae Joon Kang
Novel nanogenerator structures composed of ZnO nanoflakes of less than 10 nm thickness were fabricated using a novel method involving a facile synthetic route and a rational design.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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Electrodeposited Co-doped NiSe2 nanoparticles film: a good electrocatalyst for efficient water splitting

PATENT
REEL: 037821 FRAME: 0620

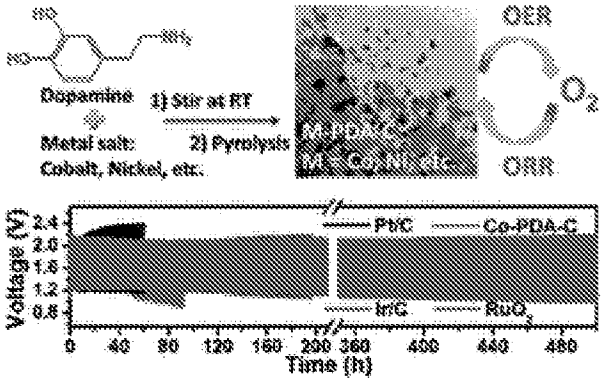


Nanoscale, 2016, **8**,3911-3915
DOI: 10.1039/C5NR07170D, Communication
Tingting Liu, Abdullah M. Asiri, Xuping Sun
Co-doped $NiSe_2$ nanoparticles film electrodeposited on Ti plate ($Co_{0.13}Ni_{0.87}Se_2$/Ti) acts as a robust water-splitting electrocatalyst in 1.0 M KOH, driving 10 mA cm^{-2} at HER overpotential of 64 mV and 100 mA cm^{-2} at OER overpotential of 320 mV.
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Correction: Polyol synthesis, functionalisation, and biocompatibility studies of superparamagnetic iron oxide nanoparticles as potential MRI contrast agents

Nanoscale, 2016, **8**,4395-4395
DOI: 10.1039/C5NR90206A, Correction
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Roxanne Hachani, Mark Lowdell, Martin Birchall, Aziliz Hervault, Damien Mertz, Sylvie Begin-Colin, Nguyen Thị Kim Thanh
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Mussel-inspired one-pot synthesis of transition metal and nitrogen co-doped carbon (M/N-C) as efficient oxygen catalysts for Zn-air batteries

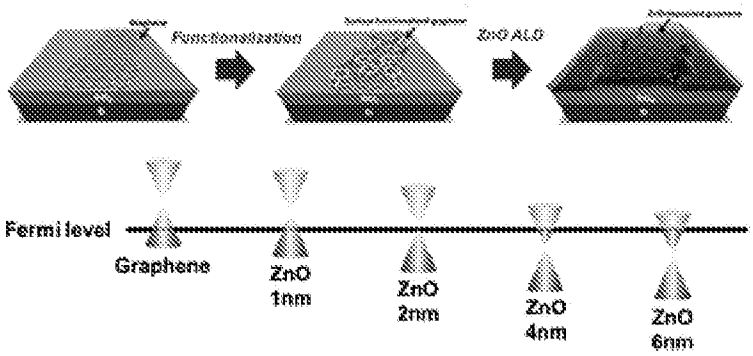


Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR06538K, Paper
Bing Li, Ye Chen, Xiaoming Ge, Jianwei Chai, Xiao Zhang, T. S. Andy Hor, Guojun Du, Zhaolin Liu, Hua Zhang, Yun Zong
Transition metal and nitrogen co-doped nanostructured carbons, synthesized *via* a simple and scalable room

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REEL: 037821 FRAME: 0621

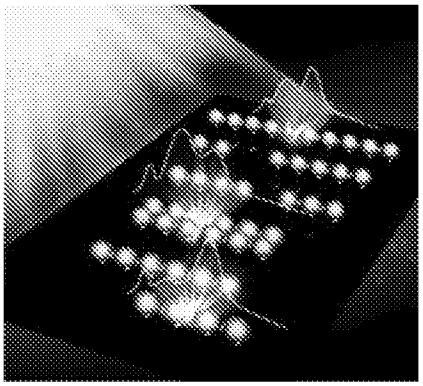
temperature approach inspired by mussels, have enabled robust cycling of Zn-air batteries.
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A non-destructive n-doping method for graphene with precise control of electronic properties via atomic layer deposition



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08016A, Paper
Kyu Seok Han, Pranav Y. Kalode, Yong-Eun Koo Lee, Hongbum Kim, Lynn Lee, Myung Mo Sung
A precise n-doping technique for graphene *via* atomic layer deposition (ALD) of ZnO thin films is presented.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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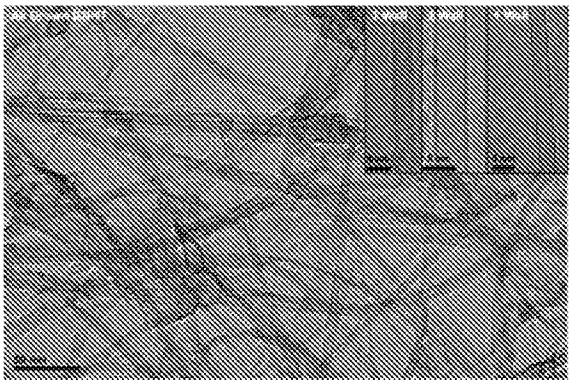
Strong plasmon coupling in self-assembled superparamagnetic nanoshell chains



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR09101B, Paper
Min Xiong, Xiulong Jin, Jian Ye
Construction of plasmonic superparamagnetic nanoshell chains by using a magnetic field is described. Strong plasmon coupling effects in the chains result in large electric field enhancements. Taking advantage of low-cost and large-area fabrication methods, these nanoshell chains are promising for biosensing, metamaterials, electromagnetic energy transport, and optical waveguide.
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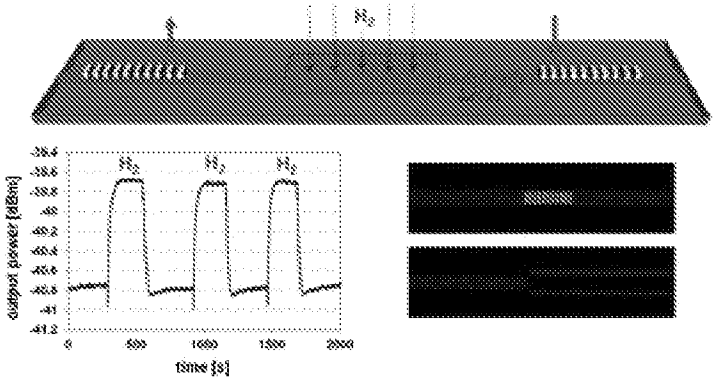
Thermodynamic approach to boron nitride nanotube solubility and dispersion

PATENT
REEL: 037821 FRAME: 0622



Nanoscale, 2016, **8**,4348-4359
DOI: 10.1039/C5NR08259E, Paper
A. L. Tiano, L. Gibbons, M. Tsui, S. I. Applin, R. Silva, C. Park, C. C. Fay
Inadequate dispersion of nanomaterials is a critical issue that significantly limits the potential properties of nanocomposites and when overcome, will enable further enhancement of material properties.
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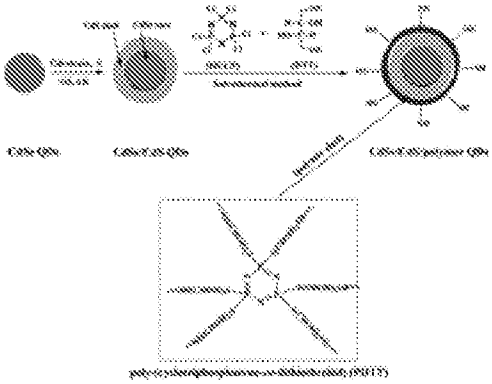
Hydrogen sensing with Pd-coated long-range surface plasmon membrane waveguides



Nanoscale, 2016, **8**,4284-4290
DOI: 10.1039/C5NR08001K, Paper
Norman R. Fong, Pierre Berini, R. N. Tait
A low power optical hydrogen sensor using a Pd film on a flexible LRSPP membrane waveguide with grating couplers.
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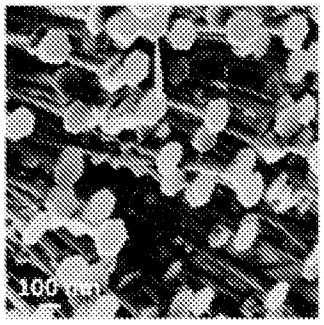
Suppressed blinking behavior of CdSe/CdS QDs by polymer coating

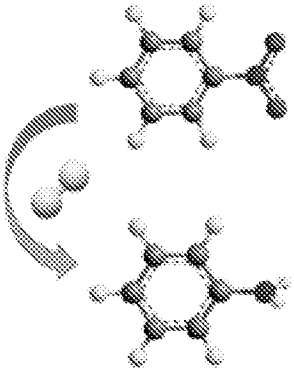
PATENT
REEL: 037821 FRAME: 0623



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08504G, Paper
Aidi Zhang, Yannan Bian, Jinjie Wang, Kuiyong Chen, Chaoqing Dong, Jicun Ren
Semiconductor quantum dots (QDs) are very important fluorescent nanocrystals with excellent optical properties.
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Designing axial growth of Co-Ni bimetallic nanowires with hexagon-like caps and their catalytic hydrogenation for nitrobenzene

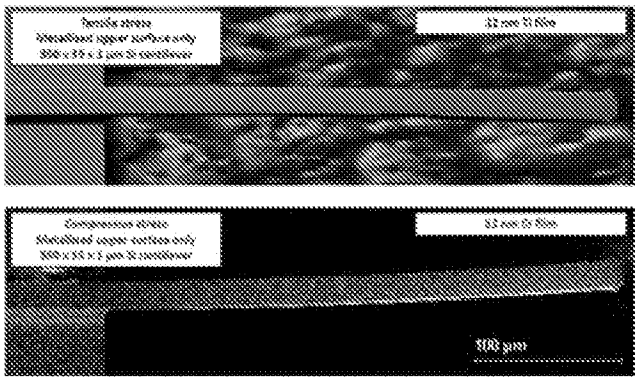




Nanoscale, 2016, **8**,3949-3953
DOI: 10.1039/C5NR09131D, Communication
Jiawen Wang, Jingwei Liu, Nating Yang, Shuangshuang Huang, Yuhan Sun, Yan Zhu
Co-Ni bimetal nanowires with hexagonal caps are more effective than corresponding nanoparticles for the nitrobenzene hydrogenation to produce aniline.
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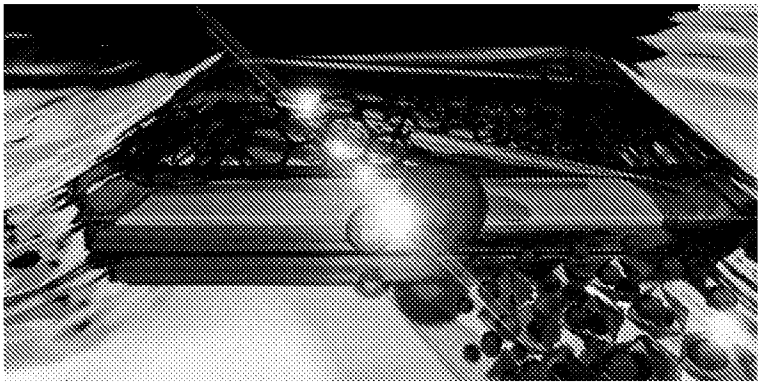
On the origin and magnitude of surface stresses due to metal nanofilms

PATENT
REEL: 037821 FRAME: 0624



Nanoscale, 2016, **8**,4245-4251
DOI: 10.1039/C5NR08789A, Paper
James Bowen, David Cheneler
Metallisation is a vital process for micro- and nanofabrication. We investigate the metallisation of silicon cantilevers with nano-films of chromium and titanium. Surface stresses acting in opposite directions were measured for these two metals.
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Ultrasensitive 1D field-effect phototransistors: CH3NH3PbI3 nanowire sensitized individual carbon nanotubes

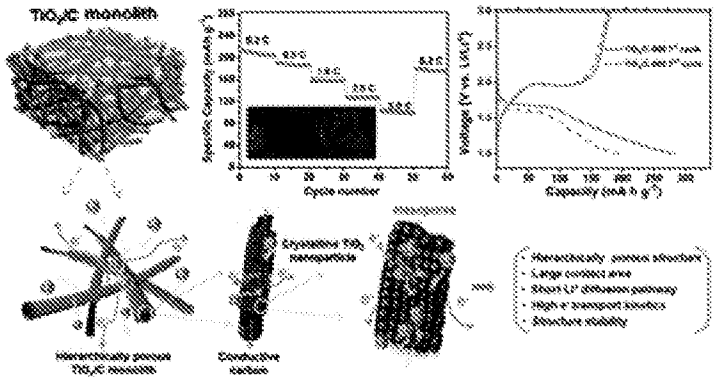


Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR06727H, Communication
M. Spina, B. Nafradi, H. M. Tohati, K. Kamaras, E. Bonvin, R. Gaal, L. Forro, E. Horvath
Field-effect phototransistors were fabricated based on individual carbon nanotubes (CNTs) sensitized by $CH_3NH_3PbI_3$ nanowires ($MAPbI_3NWs$).

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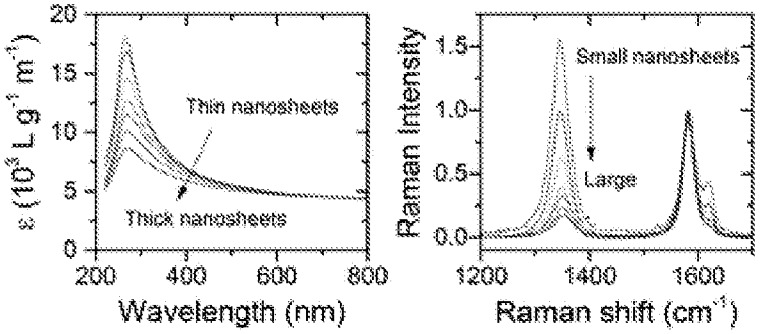
Hierarchical TiO2/C nanocomposite monoliths with a robust scaffolding architecture, mesopore-macropore network and TiO2-C heterostructure for high-performance lithium ion batteries

PATENT
REEL: 037821 FRAME: 0625



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR09149G, Paper
Hai-Bo Huang, Yue Yang, Li-Hua Chen, Yun Wang, Shao-Zhuan Huang, Jia-Wei Tao, Xiao-Ting Ma, Tawfique Hasan, Yu Li, Yan Xu, Bao-Lian Su
A general approach for the design of TiO_2/C nanocomposites with structural stability, and tunable and interconnected hierarchical porosity that leads to a new high electrochemical performance electrode.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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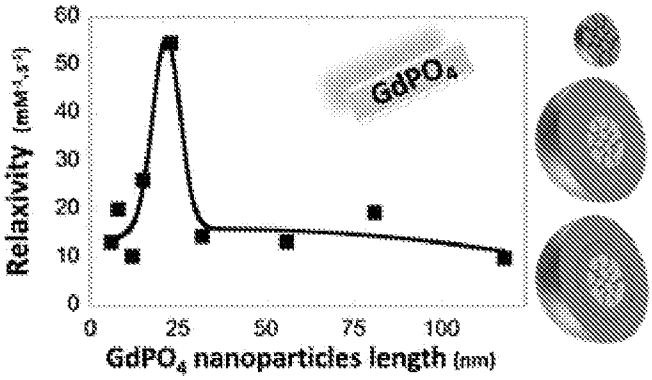
Spectroscopic metrics allow in situ measurement of mean size and thickness of liquid-exfoliated few-layer graphene nanosheets



Nanoscale, 2016, **8**,4311-4323
DOI: 10.1039/C5NR08047A, Paper
Claudia Backes, Keith R. Paton, Damien Hanlon, Shengjun Yuan, Mikhail I. Katsnelson, James Houston, Ronan J. Smith, David McCloskey, John F. Donegan, Jonathan N. Coleman
Quantitative spectroscopic metrics based on absorbance and Raman spectroscopy are presented for size-selected liquid-exfoliated graphene.
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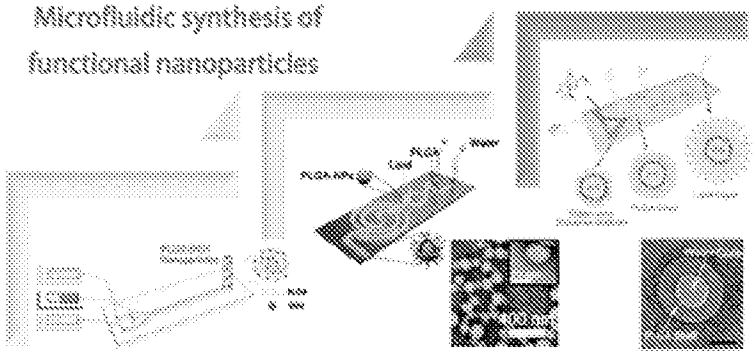
Hyperbranched polymer mediated size-controlled synthesis of gadolinium phosphate nanoparticles: colloidal properties and particle size-dependence on MRI relaxivity

PATENT
REEL: 037821 FRAME: 0626



Nanoscale, 2016, **8**,4252-4259
DOI: 10.1039/C5NR05064B, Paper
Camille Frangville, Maylis Gallois, Yichen Li, Hong Hanh Nguyen, Nancy Lauth-de Viguerie, Daniel R. Talham, Christophe Mingotaud, Jean-Daniel Marty
Core-shell(s) hyperbranched polymers were used to synthesize size-controlled gadolinium phosphate nanowires. An optimum particle size with high relaxivity values was evidenced.
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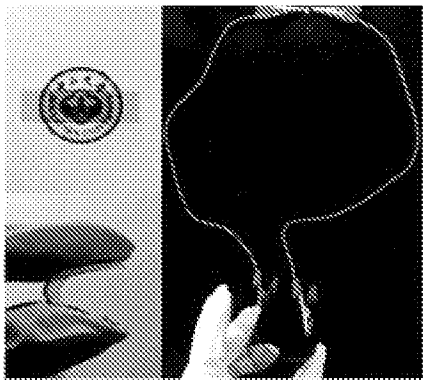
Microfluidics-mediated assembly of functional nanoparticles for cancer-related pharmaceutical applications



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR07964K, Review Article
Qiang Feng, Jiashu Sun, Xingyu Jiang
This review focuses on microfluidic synthesis of functional nanoparticles with tunable structures and properties for cancer treatment and diagnosis.
To cite this article before page numbers are assigned, use the DOI form of citation above.
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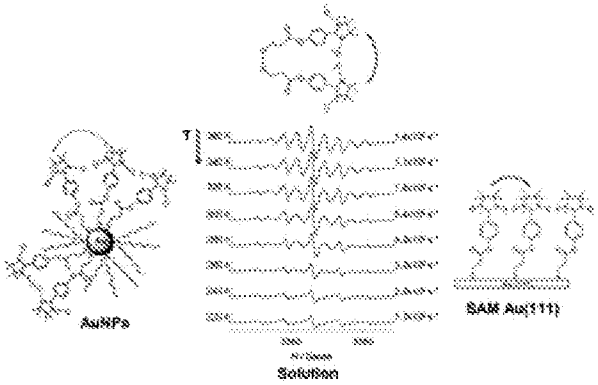
A flexible, transparent and super-long-life supercapacitor based on ultrafine Co3O4 nanocrystal electrodes

PATENT
REEL: 037821 FRAME: 0627



Nanoscale, 2016, **8**,4227-4235
DOI: 10.1039/C5NR09145D, Paper
X. Y. Liu, Y. Q. Gao, G. W. Yang
A flexible, transparent and super-long-life supercapacitor has been fabricated based on ultrafine Co_3O_4 nanocrystal electrodes.
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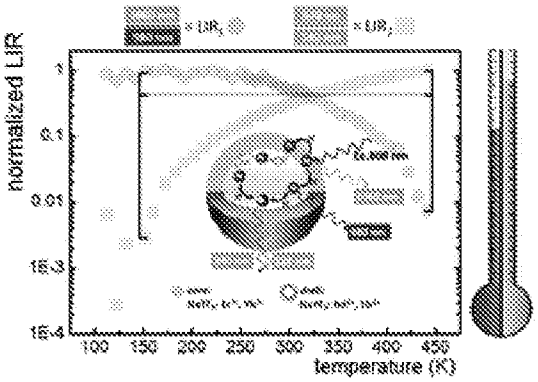
Dynamics of intramolecular spin exchange interaction of a nitronyl nitroxide diradical in solution and on surfaces



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08824K, Paper
V. Lloveras, E. Badetti, J. Veciana, J. Vidal-Gancedo
It is possible to preserve the same dynamic behaviour observed for a diradical in solution in AuNP surface-anchored radicals.
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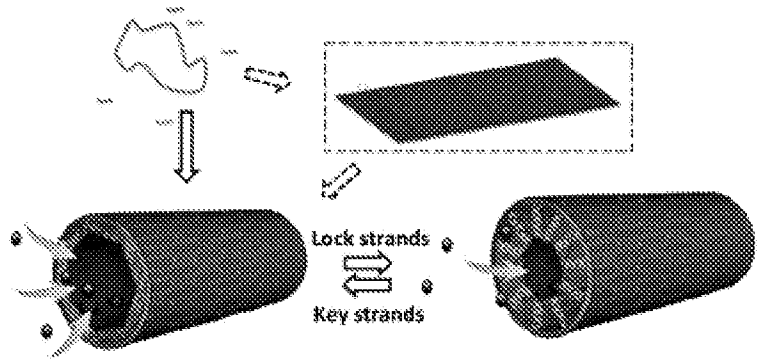
A broadening temperature sensitivity range with a core-shell YbEr@YbNd double ratiometric optical nanothermometer

PATENT
REEL: 037821 FRAME: 0628



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08223D, Paper
L. Marciniak, K. Prorok, L. Frances-Soriano, J. Perez-Prieto, A. Bednarkiewicz
The chemical architecture of lanthanide doped core-shell up-converting nanoparticles can be engineered to purposely design the properties of luminescent nanomaterials, which are typically inaccessible to their homogeneous counterparts.
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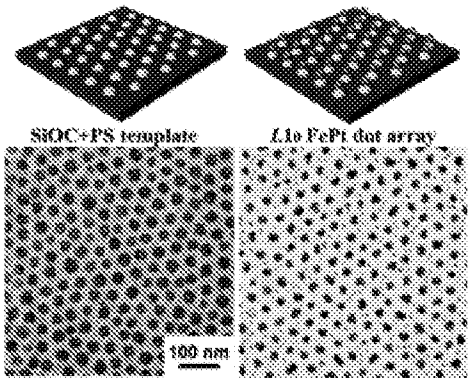
A switchable DNA origami nanochannel for regulating molecular transport at the nanometer scale



Nanoscale, 2016, **8**,3944-3948
DOI: 10.1039/C5NR08206D, Communication
Dianming Wang, Yiyang Zhang, Miao Wang, Yuanchen Dong, Chao Zhou, Mark Antonin Isbell, Zhongqiang Yang, Huajie Liu, Dongsheng Liu
A nanochannel with a shutter at one end was built by DNA nanotechnology.
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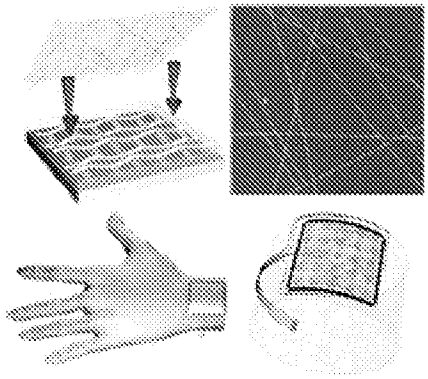
Thermal dewetting with a chemically heterogeneous nano-template for self-assembled L10 FePt nanoparticle arrays

PATENT
REEL: 037821 FRAME: 0629



Nanoscale, 2016, **8**,3926-3935
DOI: 10.1039/C5NR08339G, Communication
Liang-Wei Wang, Chung-Fu Cheng, Jung-Wei Liao, Chiu-Yen Wang, Ding-Shuo Wang, Kuo-Feng Huang, Tzu-Ying Lin, Rong-Ming Ho, Lih-Juann Chen, Chih-Huang Lai
The self-assembled $L1_0$ FePt nanoparticles are fabricated by thermal dewetting with a chemically heterogeneous nano-template.
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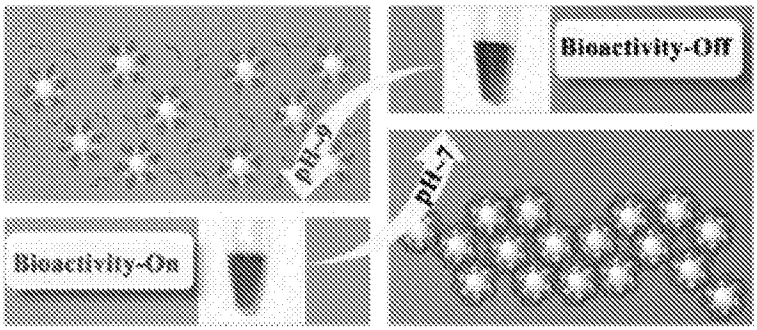
A high-performance, flexible and robust metal nanotrough-embedded transparent conducting film for wearable touch screen panels



Nanoscale, 2016, **8**,3916-3922
DOI: 10.1039/C5NR07657A, Communication
Hyeon-Gyun Im, Byeong Wan An, Jungho Jin, Junho Jang, Young-Geun Park, Jang-Ung Park, Byeong-Soo Bae
A junction resistance-free continuous metal nanotrough-embedded transparent conducting electrode (TCE) composite film (metal nanotrough-GFRHybrimer film) is reported.
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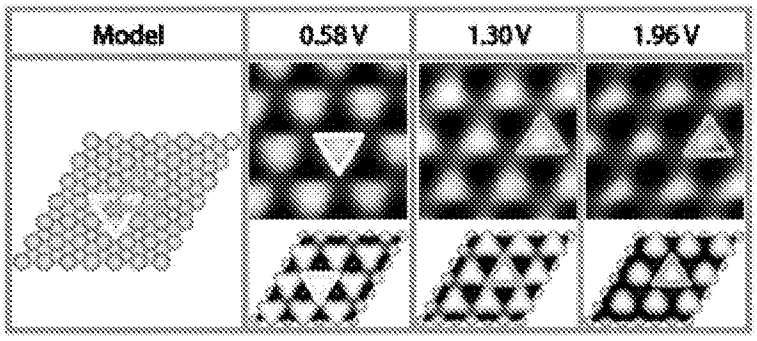
Multifunctional nanoparticle-protein conjugates with controllable bioactivity and pH responsiveness

PATENT
REEL: 037821 FRAME: 0630



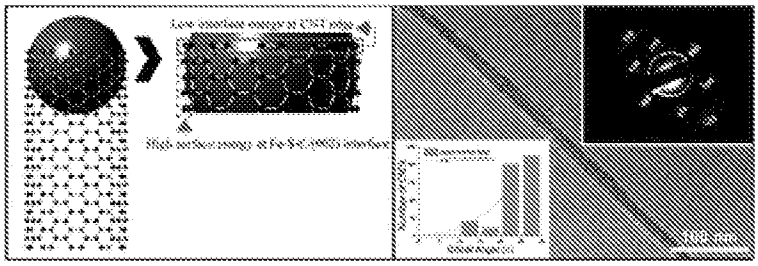
Nanoscale, 2016, **8**,4387-4394
DOI: 10.1039/C5NR07436C, Paper
Feng Liu, Lulu Xue, Yuqi Yuan, Jingjing Pan, Chenjie Zhang, Hongwei Wang, John L. Brash, Lin Yuan, Hong Chen
With the interaction of polymers, the nanoparticle-protein conjugates show controllable bioactivity and pH responsiveness.
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Tuning the surface electronic structure of a Pt3Ti(111) electro catalyst



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08420B, Paper
M. Pa[German sz ligature}ens, V. Caciuc, N. Atodiresei, M. Moors, S. Blugel, R. Waser, S. Karthauser
Combining voltage dependent STM imaging with *ab initio* DFT calculations to identify the exact termination of an electro catalyst.
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Inherent predominance of high chiral angle metallic carbon nanotubes in continuous fibers grown from a molten catalyst

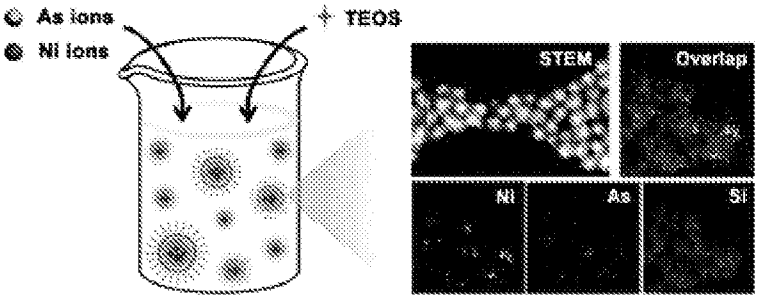


Nanoscale, 2016, **8**,4236-4244
DOI: 10.1039/C5NR07455J, Paper

PATENT
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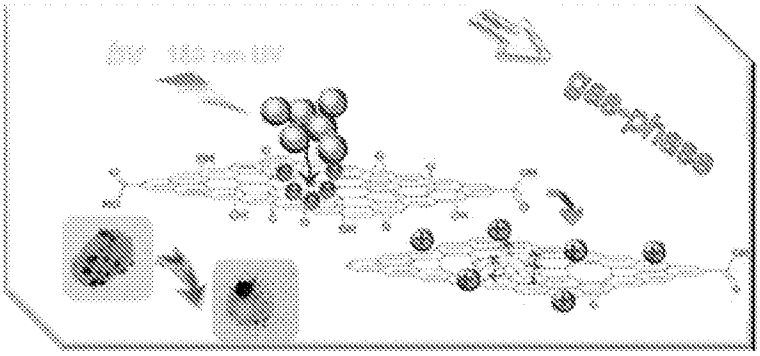
B. Aleman, M. Mar Bernal, B. Mas, Emilio M. Perez, V. Reguero, G. Xu, Y. Cui, Juan J. Vilatela
The armchair-biased chiral angle distribution in continuous fibres of CNTs is controlled by the molten state of the Fe-S-C alloy catalyst.
The content of this RSS Feed (c) The Royal Society of Chemistry

A facile route to core-shell nanoparticulate formation of arsenic trioxide for effective solid tumor treatment



Nanoscale, 2016, **8**,4373-4380
DOI: 10.1039/C5NR07860A, Paper
Zongjun Zhang, Hanyu Liu, Hualu Zhou, Xianglong Zhu, Zhenghuan Zhao, Xiaoqin Chi, Hong Shan, Jinhao Gao
The facile synthesis of pH-sensitive arsenic-based nanodrugs by a "one-pot" reverse microemulsion method was reported.
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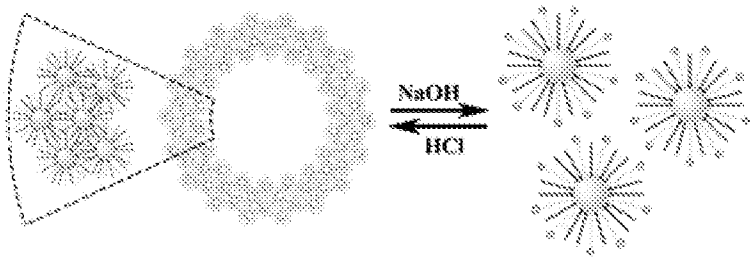
Gas-phase rapid reduction of graphene oxide through photoionization of gold nanoparticles



Nanoscale, 2016, **8**,3906-3910
DOI: 10.1039/C5NR08509H, Communication
Jeong Hoon Byeon
This work introduces for the first time a rapid reduction of graphene oxide *via* the photoionization of gold nanoparticles in a continuous gas-phase process.
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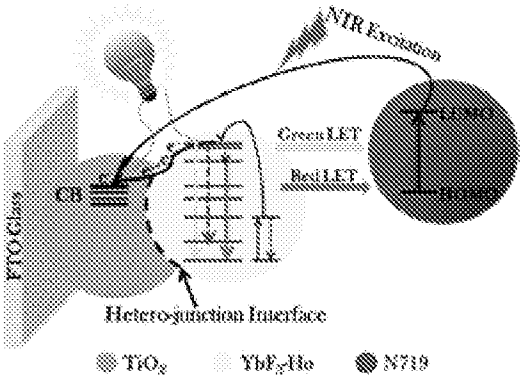
pH-Responsive reversible self-assembly of gold nanoparticles into nanovesicles

PATENT
REEL: 037821 FRAME: 0632



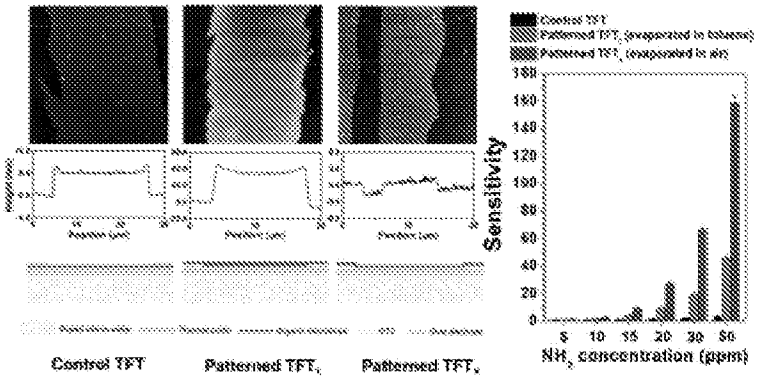
Nanoscale, 2016, **8**,3923-3925
DOI: 10.1039/C6NR00044D, Communication
Chunfang Fan, Tong Bian, Lu Shang, Run Shi, Li-Zhu Wu, Chen-Ho Tung, Tierui Zhang
pH-Responsive Au nanovesicles with reversible self-assembly and disassembly performance were developed by adjusting protonation and deprotonation of surface ligands.
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Enhanced photovoltaic performance of dye-sensitized solar cells using a new photoelectrode material: upconversion YbF3-Ho/TiO2 nanoheterostructures



Nanoscale, 2016, **8**,4173-4180
DOI: 10.1039/C5NR08319B, Paper
Jia Yu, Yulin Yang, Ruiqing Fan, Ping Wang, Yuwei Dong
UC/TiO_2 nanoheterostructures induce electron-injection from YbF_3-Ho to TiO_2 by utilizing near-infrared light, and further improve the existing merits of TiO_2.
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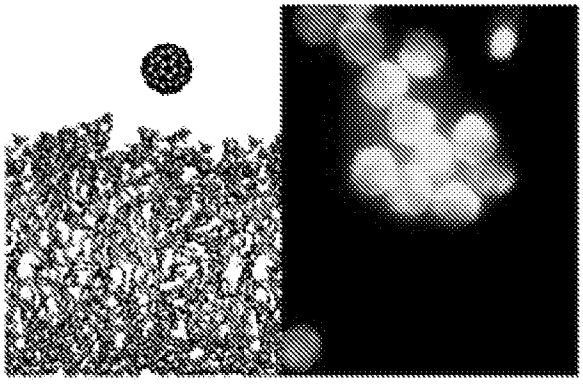
Fast patterning of oriented organic microstripes for field-effect ammonia gas sensors



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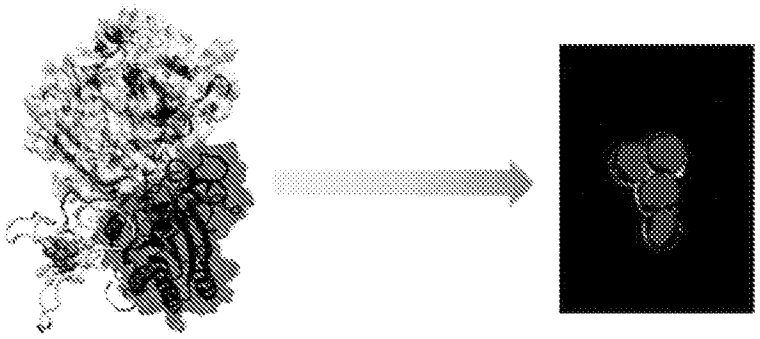
Nanoscale, 2016, **8**,3954-3961
DOI: 10.1039/C5NR09001F, Communication
Binghao Wang, Jinqiang Ding, Tao Zhu, Wei Huang, Zequn Cui, Jianmei Chen, Lizhen Huang, Lifeng Chi
A series of organic field-effect transistors (OFETs) with patterned ultra-thin films for NH_3 detection are achieved *via* fast dip-coating.
The content of this RSS Feed (c) The Royal Society of Chemistry

C60 fullerene localization and membrane interactions in RAW 264.7 immortalized mouse macrophages



Nanoscale, 2016, **8**,4134-4144
DOI: 10.1039/C5NR07003A, Paper
K. A. Russ, P. Elvati, T. L. Parsonage, A. Dews, J. A. Jarvis, M. Ray, B. Schneider, P. J. S. Smith, P. T. F. Williamson, A. Violi, M. A. Philbert
There continues to be a significant increase in the number and complexity of hydrophobic nanomaterials that are engineered for a variety of commercial purposes making human exposure a significant health concern.
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Computational design of peptide-Au cluster probe for sensitive detection of [small alpha]IIb[small beta]3 integrin

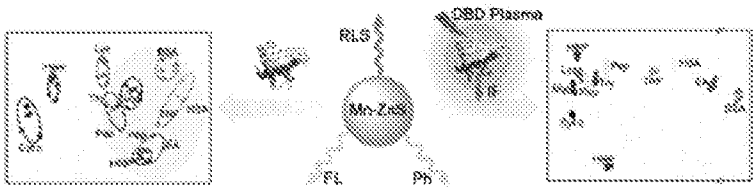


Nanoscale, 2016, **8**,4203-4208
DOI: 10.1039/C5NR09175F, Paper
Lina Zhao, Jiao Zhai, Xuejie Zhang, Xueyun Gao, Xiaohong Fang, Jingyuan Li
We have designed a novel peptide-Au cluster probe to specifically bind to [small alpha]$_{IIb}$[small beta]$_3$ integrin.
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Plasma-assisted quadruple-channel optosensing of proteins and cells with Mn-

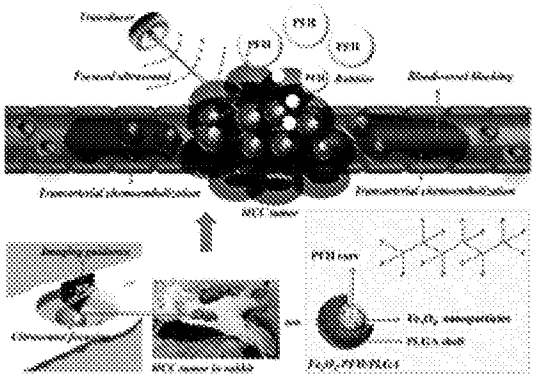
PATENT
REEL: 037821 FRAME: 0634

doped ZnS quantum dots



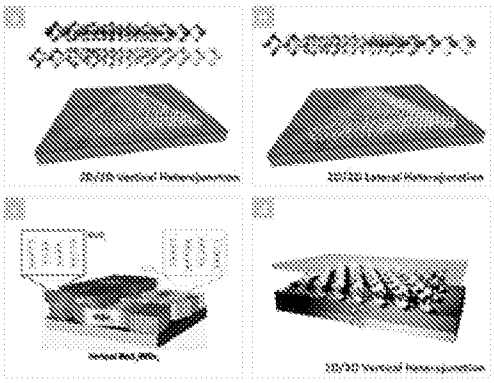
Nanoscale, 2016, **8**,4291-4298
DOI: 10.1039/C5NR09130F, Paper
Chenghui Li, Peng Wu, Xiandeng Hou
The addition of the intrinsic fluorescence of proteins to the existing triple-channel optical properties of Mn-ZnS QDs yields new quadruple-channel optosensing devices with substantially increased discrimination capacity for proteins. A low-temperature plasma for protein treatment further enforces the discrimination.
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Nanoparticle-enhanced synergistic HIFU ablation and transarterial chemoembolization for efficient cancer therapy



Nanoscale, 2016, **8**,4324-4339
DOI: 10.1039/C5NR08292G, Paper
Yufeng You, Zhigang Wang, Haitao Ran, Yuanyi Zheng, Dong Wang, Jinshun Xu, Zhibiao Wang, Yu Chen, Pan Li
We have developed a nanoparticle-based HIFU synergistic cancer surgery enhanced by transarterial chemoembolization for high-efficient HCC treatment based on Fe_3O_4-PFH/PLGA nanocapsules.
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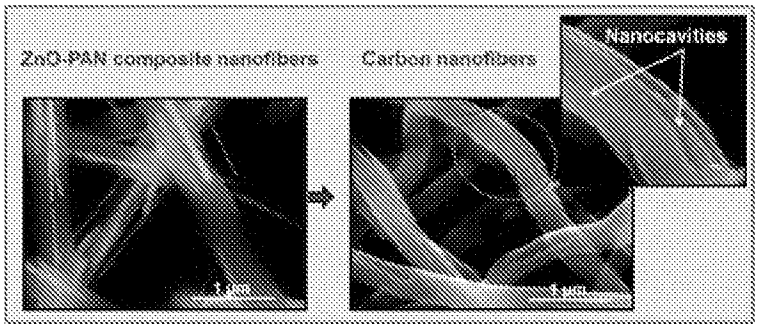
Fundamentals of lateral and vertical heterojunctions of atomically thin materials



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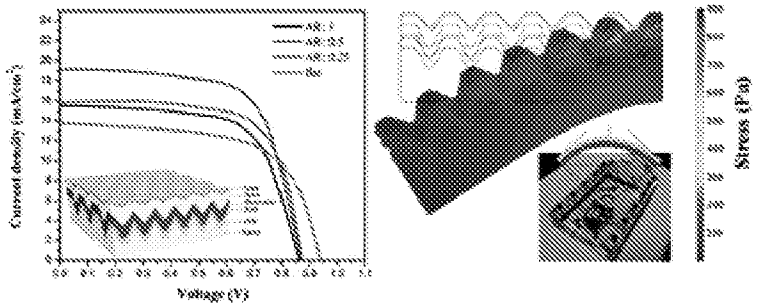
Nanoscale, 2016, **8**,3870-3887
DOI: 10.1039/C5NR08982D, Minireview
Anupum Pant, Zafer Mutlu, Darshana Wickramaratne, Hui Cai, Roger K. Lake, Cengiz Ozkan, Sefaattin Tongay
At the turn of this century, Herbert Kroemer, the 2000 Nobel Prize winner in Physics, famously commented that "the interface is the device".
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Zinc oxide nanorod assisted rapid single-step process for the conversion of electrospun poly(acrylonitrile) nanofibers to carbon nanofibers with a high graphitic content



Nanoscale, 2016, **8**,4360-4372
DOI: 10.1039/C5NR06809F, Paper
Ratyakshi Nain, Dhirendra Singh, Manjeet Jassal, Ashwini K. Agrawal
The effect of incorporation of rigid zinc oxide (ZnO) nanostructures on carbonization behavior of electrospun special acrylic fiber grade poly(acrylonitrile) (PAN-SAF) nanofibers was investigated.
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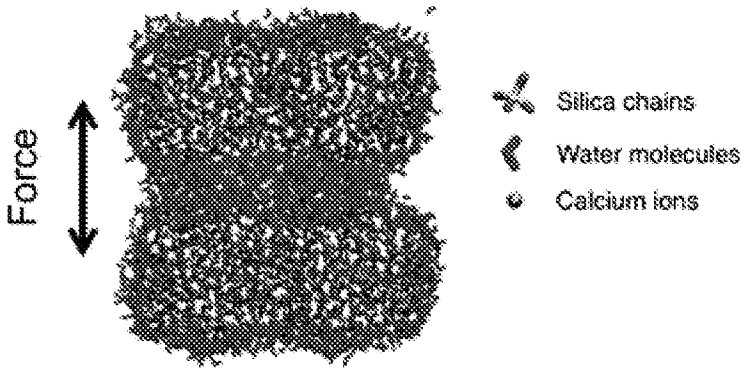
Efficient, flexible and mechanically robust perovskite solar cells on inverted nanocone plastic substrates



Nanoscale, 2016, **8**,4276-4283
DOI: 10.1039/C5NR08836D, Paper
Mohammad Mahdi Tavakoli, Qingfeng Lin, Siu-Fung Leung, Ga Ching Lui, Hao Lu, Liang Li, Bin Xiang, Zhiyong Fan
Utilization of nanostructures on photovoltaic devices can significantly improve the device energy conversion efficiency by enhancing the device light harvesting capability as well as carrier collection efficiency.
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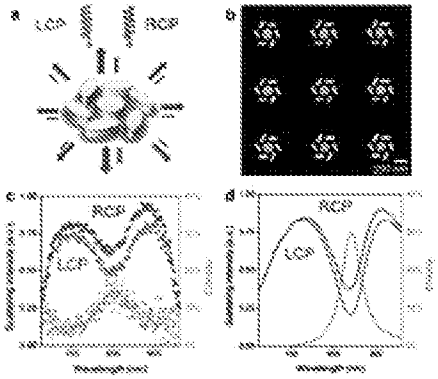
Interaction grand potential between calcium-silicate-hydrate nanoparticles at the molecular level

PATENT
REEL: 037821 FRAME: 0636



Nanoscale, 2016, **8**,4160-4172
DOI: 10.1039/C5NR08142D, Paper
Patrick A. Bonnaud, Christophe Labbez, Ryuji Miura, Ai Suzuki, Naoto Miyamoto, Nozomu Hatakeyama, Akira Miyamoto, Krystyn J. Van Vliet
Mean forces and interaction grand potentials between calcium-silicate-hydrate particles.
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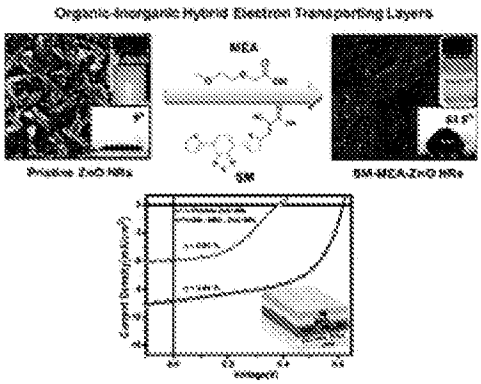
Planar plasmonic chiral nanostructures



Nanoscale, 2016, **8**,3900-3905
DOI: 10.1039/C5NR09302C, Communication
Shuai Zu, Yanjun Bao, Zheyu Fang
A strong chiral optical response induced at a plasmonic Fano resonance in a planar Au heptamer nanostructure was experimentally and theoretically demonstrated.
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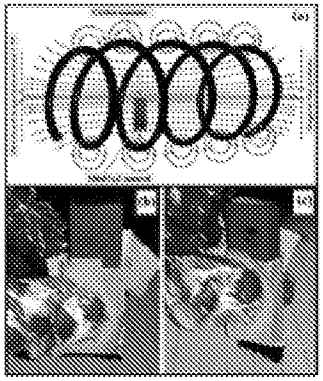
Co-functionalized organic/inorganic hybrid ZnO nanorods as electron transporting layers for inverted organic solar cells

PATENT
REEL: 037821 FRAME: 0637



Nanoscale, 2016, Advance Article
DOI: 10.1039/C5NR08849F, Paper
Swapnil B. Ambade, Rohan B. Ambade, Seung Hun Eom, Myung-Jin Baek, Sushil S. Bagde, Rajaram S. Mane, Soo-Hyoung Lee
The first hybrid co-functionalization of solution processed planar ZnO nanorod ETLs in iOSCs with organic small molecule based on a D-A-D configuration with meticulous control of aggregation.
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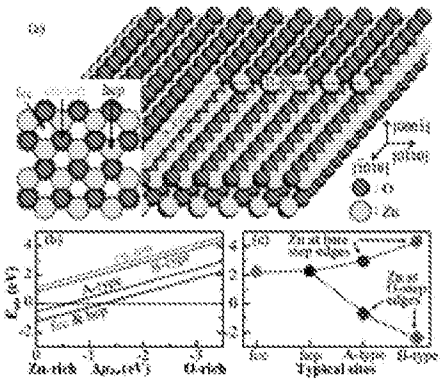
Fe3C-filled carbon nanotubes: permanent cylindrical nanomagnets possessing exotic magnetic properties



Nanoscale, 2016, **8**,4299-4310
DOI: 10.1039/C5NR09188H, Paper
Reetu Kumari, Lucky Krishnia, Vinay Kumar, Sandeep Singh, H. K. Singh, R. K. Kotnala, R. R. Juluri, U. M. Bhatta, P. V. Satyam, Brajesh S. Yadav, Zainab Naqvi, Pawan K. Tyagi
We study how confinement affects the magnetism of Fe_3C filled CNTs and stress induced structural phase transition. A model describing the growth mechanism as well as *in situ* pole formation in nanorod is discussed.
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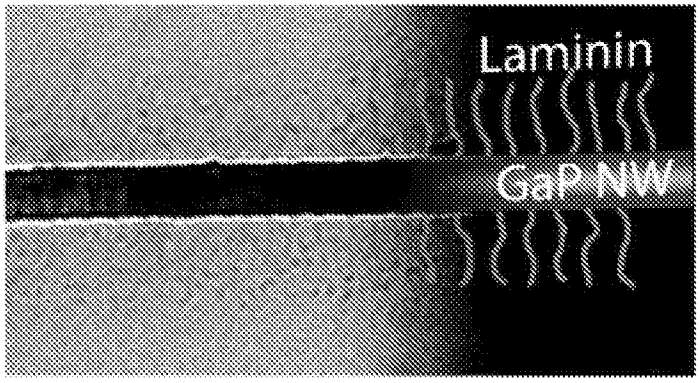
Effects of nitrogen dopants on the atomic step kinetics and electronic structures of O-polar ZnO

PATENT
REEL: 037821 FRAME: 0638



Nanoscale, 2016, **8**,4381-4386
DOI: 10.1039/C5NR09060A, Paper
Hao Wang, Huahan Zhan, Yinghui Zhou, Yaping Wu, Xiaohang Chen, Huiqiong Wang, Junyong Kang
Oxygen-polar ZnO films are grown in step flow mode by molecular beam epitaxy.
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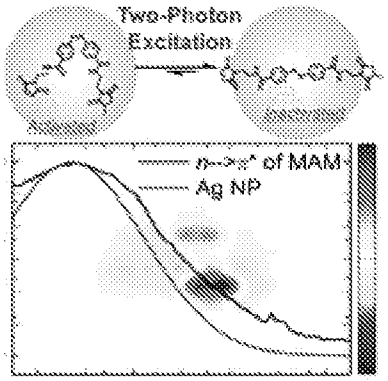
Electron microscopy imaging of proteins on gallium phosphide semiconductor nanowires



Nanoscale, 2016, **8**,3936-3943
DOI: 10.1039/C5NR08888G, Communication
Martin Hjort, Mikael Bauer, Stefan Gunnarsson, Erik Marsell, Alexei A. Zakharov, Gunnel Karlsson, Elodie Sanfins, Christelle N. Prinz, Reine Wallenberg, Tommy Cedervall, Anders Mikkelsen
We have imaged GaP nanowires (NWs) incubated with human laminin, serum albumin (HSA), and blood plasma using both cryo-transmission electron microscopy and synchrotron based X-ray photoemission electron microscopy.
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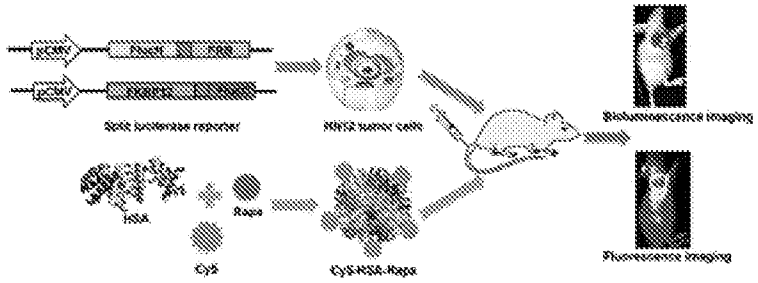
Plasmon-enhanced two-photon-induced isomerization for highly-localized light-based actuation of inorganic/organic interfaces

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REEL: 037821 FRAME: 0639



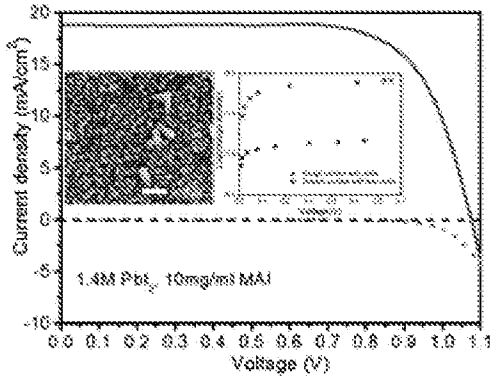
Nanoscale, 2016, **8**,4194-4202
DOI: 10.1039/C5NR07973J, Paper
Chang-Keun Lim, Xin Li, Yue Li, Kurt L. M. Drew, J. Pablo Palafox-Hernandez, Zhenghua Tang, Alexander Baev, Andrey N. Kuzmin, Marc R. Knecht, Tiffany R. Walsh, Mark T. Swihart, Hans Agren, Paras N. Prasad
Plasmon-enhanced two-photon isomerization of non-donor/acceptor modified azobenzene on Ag NPs.
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Combined image guided monitoring the pharmacokinetics of rapamycin loaded human serum albumin nanoparticles with a split luciferase reporter



Nanoscale, 2016, **8**,3991-4000
DOI: 10.1039/C5NR07308A, Paper
Fu Wang, Kai Yang, Zhe Wang, Ying Ma, J. Silvio Gutkind, Naoki Hida, Gang Niu, Jie Tian
This integrated imaging platform could provide more reliable respective PK profiles of a loaded drug and its carrier.
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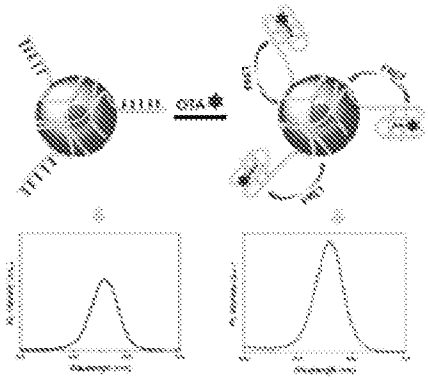
Influence of void-free perovskite capping layer on the charge recombination process in high performance CH3NH3PbI3 perovskite solar cells



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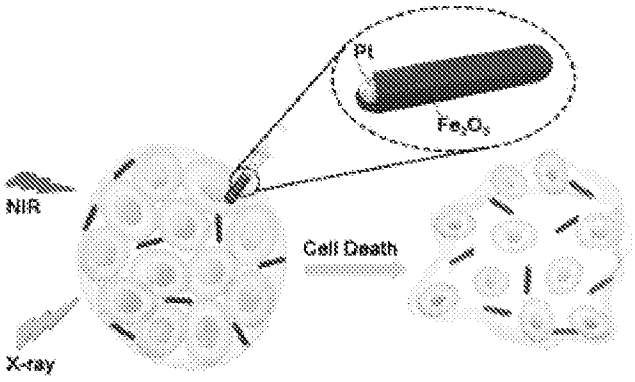
Nanoscale, 2016, **8**,4181-4193
DOI: 10.1039/C5NR06362K, Paper
Kunwu Fu, Christopher T. Nelson, Mary Cooper Scott, Andrew Minor, Nripan Mathews, Lydia Helena Wong
Uniform surface coverage of perovskite capping layer formed with less void formation reduces charge recombination and enhances device performance.
The content of this RSS Feed (c) The Royal Society of Chemistry

A self-assembly aptasensor based on thick-shell quantum dots for sensing of ochratoxin A



Nanoscale, 2016, **8**,4127-4133
DOI: 10.1039/C5NR08284F, Paper
Xianfeng Chu, Xiaowen Dou, Ruizheng Liang, Menghua Li, Weijun Kong, Xihui Yang, Jiaoyang Luo, Meihua Yang, Ming Zhao
A tunable-valency self-assembling aptasensor based on a thick-shell quantum dot was fabricated for ochratoxin A (OTA).
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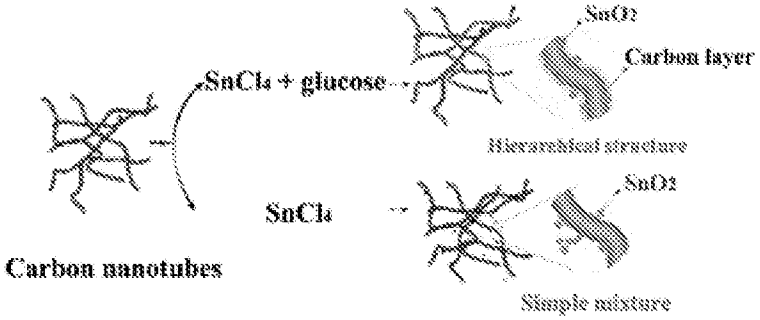
Facile preparation of hybrid core-shell nanorods for photothermal and radiation combined therapy



Nanoscale, 2016, **8**,3895-3899
DOI: 10.1039/C5NR09102K, Communication
Yaoyao Deng, Erdong Li, Xiaju Cheng, Jing Zhu, Shuanglong Lu, Cuicui Ge, Hongwei Gu, Yue Pan
Water-soluble platinum@iron oxide core-shell nanorods were synthesized and explored for NIR photothermal and X-ray radiation combined therapy.
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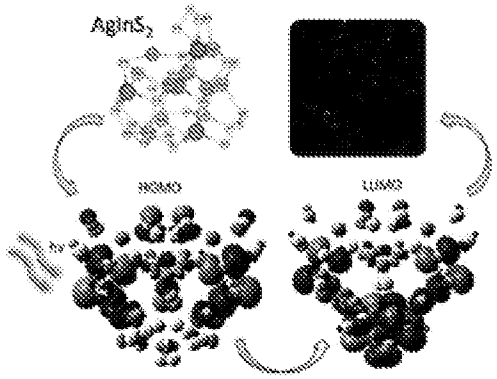
PATENT
REEL: 037821 FRAME: 0641

Carbon coated SnO2 nanoparticles anchored on CNT as a superior anode material for lithium-ion batteries



Nanoscale, 2016, **8**,4121-4126
DOI: 10.1039/C5NR07996A, Paper
Chunrong Ma, Weimin Zhang, Yu-Shi He, Qiang Gong, Haiying Che, Zi-Feng Ma
High performance hierarchically structured carbon covering SnO_2 nanoparticles on CNTs were synthesized *via* a facile glucose mediated hydrothermal method and subsequent calcination as an anode for lithium-ion batteries.
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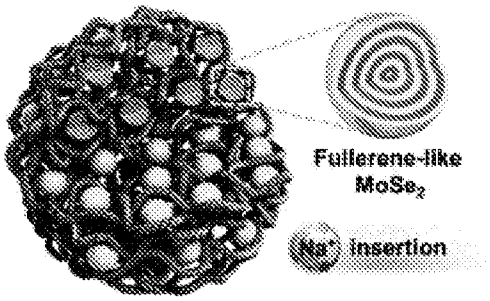
Two blinking mechanisms in highly confined AgInS2 and AgInS2/ZnS quantum dots evaluated by single particle spectroscopy



Nanoscale, 2016, **8**,4151-4159
DOI: 10.1039/C5NR07992F, Paper
B. Cichy, R. Rich, A. Olejniczak, Z. Gryczynski, W. Strek
Ternary $AgInS_2$ quantum dots (QDs) have been found as promising cadmium-free, red-shifted, and tunable luminescent bio-probes with efficient Stokes and anti-Stokes excitations and luminescence lifetimes (*ca.* 100 ns) convenient for time resolved techniques.
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Fullerene-like MoSe2 nanoparticles-embedded CNT balls with excellent structural stability for highly reversible sodium-ion storage

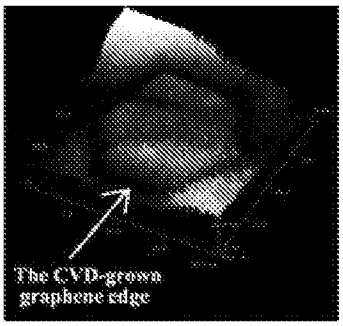
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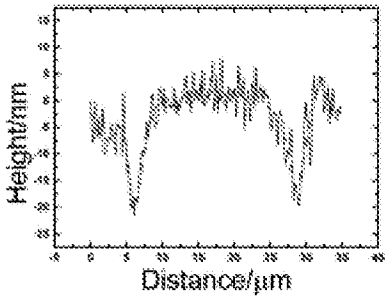


Fullerene-like $MoSe_2$ nanoparticles embedded CNT ball

Nanoscale, 2016, **8**,4209-4216
DOI: 10.1039/C5NR07733H, Paper
Seung Ho Choi, Yun Chan Kang
Three-dimensional (3D) porous-structured carbon nanotube (CNT) balls embedded with metal selenide nanocrystals were prepared by a simple two-step process. The fullerene-like $MoSe_2$/CNT composite balls, selected as the first target material, showed excellent sodium-ion storage properties.
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Edge morphology evolution of graphene domains during chemical vapor deposition cooling revealed through hydrogen etching

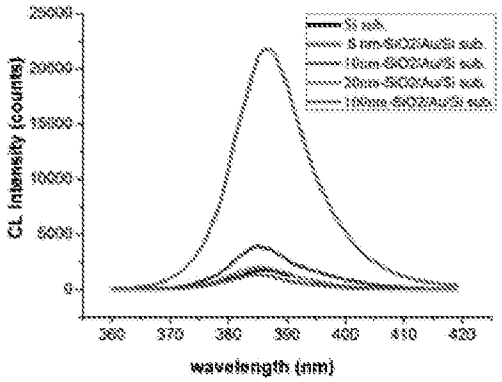




Nanoscale, 2016, **8**,4145-4150
DOI: 10.1039/C5NR06624G, Paper
Haoran Zhang, Yanhui Zhang, Yaqian Zhang, Zhiying Chen, Yanping Sui, Xiaoming Ge, Guanghui Yu, Zhi Jin, Xinyu Liu
The CVD cooling process induced graphene edge evolution, such as nanoparticle accumulation and graphene edge sinking. The results revealed the peculiar graphene-Cu movement during CVD cooling.
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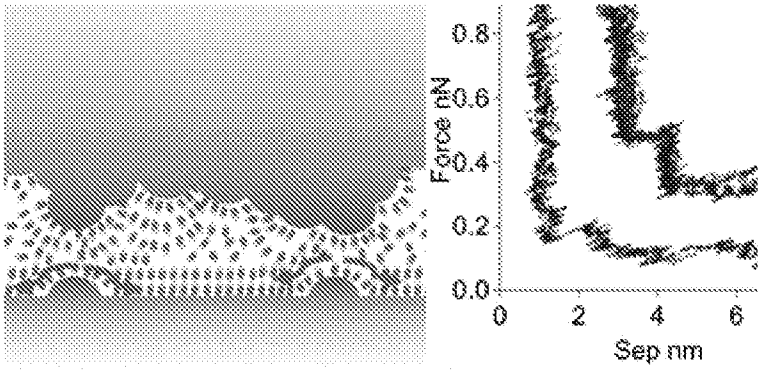
Strongly enhanced ultraviolet emission of an Au@SiO2/ZnO plasmonic hybrid nanostructure

PATENT
REEL: 037821 FRAME: 0643



Nanoscale, 2016, **8**,4030-4036
DOI: 10.1039/C5NR06153A, Paper
Li Wang, Xiaodong Wang, Shengcheng Mao, Hua Wu, Xia Guo, Yuan Ji, Xiaodong Han
We present the surface plasmon polariton (SPP)-enhanced ultraviolet (UV) emission of an Au@SiO_2/ZnO hybrid nanostructure.
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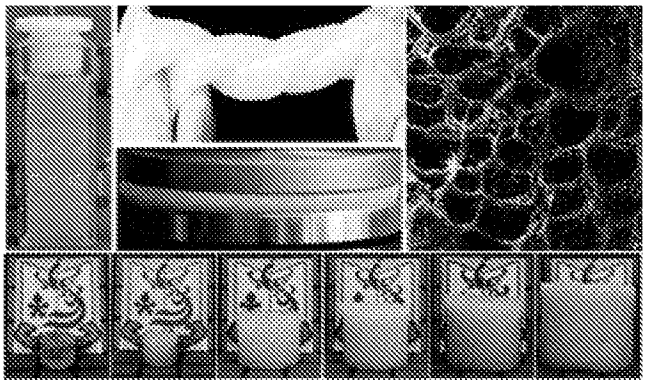
Layering of ionic liquids on rough surfaces



Nanoscale, 2016, **8**,4094-4106
DOI: 10.1039/C5NR07805A, Paper
Alexis Sheehan, L. Andres Jurado, Shivaprakash N. Ramakrishna, Andrea Arcifa, Antonella Rossi, Nicholas D. Spencer, Rosa M. Espinosa-Marzal
Structural forces reveal the ordered structure of one ionic liquid at rough interfaces of well-defined nanoscale roughness, also under nanoconfinement.
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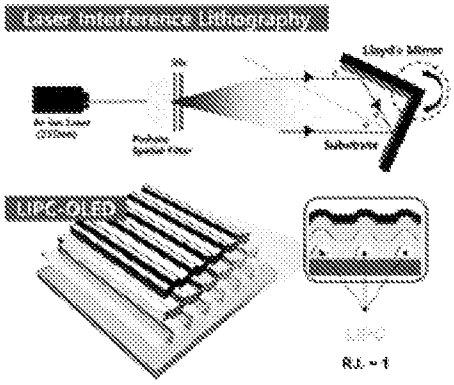
Aqueous compatible boron nitride nanosheets for high-performance hydrogels

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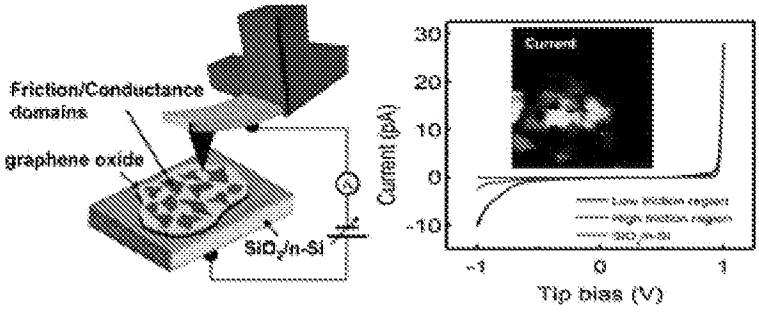
Nanoscale, 2016, **8**,4260-4266
DOI: 10.1039/C5NR07578E, Paper
Xiaozhen Hu, Jiahui Liu, Qiuju He, Yuan Meng, Liu Cao, Ya-Ping Sun, Jijie Chen, Fushen Lu
Aqueous dispersible boron nitride nanosheets were produced and used to fabricate nanocomposite hydrogels with high water retentivity and flexibility.
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An extremely low-index photonic crystal layer for enhanced light extraction from organic light-emitting diodes



Nanoscale, 2016, **8**,4113-4120
DOI: 10.1039/C5NR07312J, Paper
Yong Sub Shim, Ju Hyun Hwang, Cheol Hwee Park, Sun-Gyu Jung, Young Wook Park, Byeong-Kwon Ju
This paper reports organic light-emitting diodes (OLEDs) with improved light extraction fabricated by embedding an extremely low-index photonic crystal (LIPC) layer.
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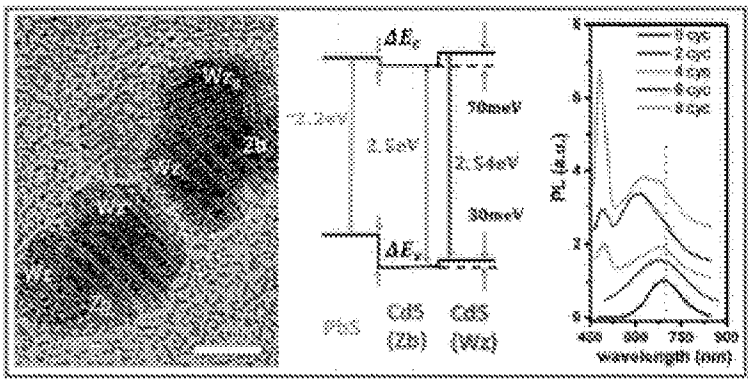
Friction and conductance imaging of sp2- and sp3-hybridized subdomains on single-layer graphene oxide



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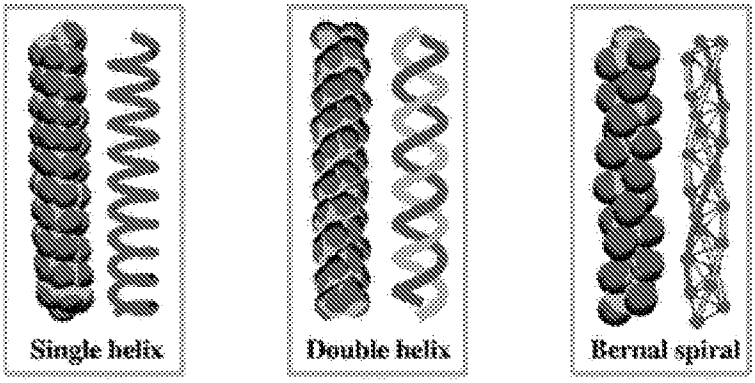
Nanoscale, 2016, **8**,4063-4069
DOI: 10.1039/C5NR06469D, Paper
Hyunsoo Lee, Narae Son, Hu Young Jeong, Tae Gun Kim, Gyeong Sook Bang, Jong Yun Kim, Gi Woong Shim, Kalyan C. Goddeti, Jong Hun Kim, Namdong Kim, Hyun-Joon Shin, Wondong Kim, Sehun Kim, Sung-Yool Choi, Jeong Young Park
We investigated the subdomain structures of graphene oxide with friction and conductance mappings.
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Dual emission in asymmetric "giant" PbS/CdS/CdS core/shell/shell quantum dots



Nanoscale, 2016, **8**,4217-4226
DOI: 10.1039/C5NR08881J, Paper
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Haiguang Zhao, Gianluca Sirigu, Andrea Parisini, Andrea Camellini, Giuseppe Nicotra, Federico Rosei, Vittorio Morandi, Margherita Zavelani-Rossi, Alberto Vomiero
Dual emission in asymmetric "giant" PbS/CdS/CdS core/shell/shell quantum dots enables color monitoring/modulation and control in the visible/NIR region for advanced applications.
The content of this RSS Feed (c) The Royal Society of Chemistry

Supracolloidal helices from soft Janus particles by tuning the particle softness



Nanoscale, 2016, **8**,4070-4076
DOI: 10.1039/C5NR07011B, Paper
Qing-Zhi Zou, Zhan-Wei Li, Zhong-Yuan Lu, Zhao-Yan Sun
Supracolloidal helices including single helices, double helices, and Bernal spirals are observed through the self-

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assembly of soft Janus particles by properly tuning particle softness.
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Nitrogen and sulfur co-doped graphene aerogels as an efficient metal-free catalyst for oxygen reduction reaction in an alkaline solution

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA22136F, Paper
Mei Wu, Zhiyu Dou, Jingjing Chang, Lili Cui
Nitrogen and sulfur dual-doped three dimensional (3D) graphene aerogels (N-S-GAs) are firstly prepared through pyrolyzing poly[5-amino-1,3,4-thiadiazole-2-thiol] coated graphene aerogels (PATT-GAs) as a metal-free oxygen reduction reaction (ORR) catalyst. 3D structures...
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An Ultrafast Hydrogel Photocrosslinking Method for Direct Laser Bioprinting

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA24910D, Communication
Zongjie Wang, Xian Jin, Ru Dai, Jonathan F. Holzman, Keekyoung Kim
Photocrosslinking is a widely-used method to generate cell-laden hydrogels for tissue engineering. At present, it usually takes more than 30 seconds to crosslink hydrogels using UV illumination, and this delay...
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Efficient and selective glucosylation of prenylated phenolic compounds by Mucor hiemalis

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C6RA00072J, Paper
Shuai Ji, Wen-fei Liang, Zi-wei Li, Jin Feng, Qi Wang, Xue Qiao, Min Ye
A highly regio- and stereo-specific biocatalytic reaction to produce the glucosides of natural prenylated phenolic compounds by Mucor hiemalis CGMCC 3.14114 is described. M. hiemalis could efficiently catalyze [small beta]-O-glucosylation of...
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Water turbidity sensing using a smartphone

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C6RA02483A, Paper
iftak hussain, Kamal Uddin Ahamad, Pabitra Nath
This paper demonstrates a rapid, cost-effective and field-portable smartphone based turbidimeter that measures turbidity of water samples collected from different natural water resources and in drinking water. The working of...
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Mild, efficient, and environmentally friendly synthesis of symmetrical N, N-alkylidenebisamides under solvent-free conditions catalyzed by H7[(P2W17O61)FeIII(H2O)]

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C6RA01811D, Paper
reza tayebee, tayebe kunany, Behrooz Maleki, Farokhzad Zonoz, R.M. Kakhki
A series of symmetrical N, N'-alkylidenebisamides were successfully synthesized via a one-pot three-component green and environmentally friendly condensation of aliphatic and/or aromatic aldehydes with benzamide by the mediation of 2.5...
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Optical temperature sensing with minimized heating effect using core-shell upconversion nanoparticles

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA27237H, Paper
Weibo Chen, Chengjian Shi, Taojunyu Tao, Meixi Ji, Xiangwen Sang, Shuhong Zheng, Xiaofeng Liu, Jianrong Qiu
Lanthanide activated upconversion nanoparticles (UCNPs) have been widely applied for bioimaging and sensing. Their bio-medical applications are usually limited by the thermal effect accompanied by UC emission, as most efficient...
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Modulating the permeability of the ferritin channels

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA25056K, Paper
Caterina Bernacchioni, Veronica Ghini, ELizabeth C Theil, Paola Turano
Twentyfour-mer ferritins are present in all kingdoms of life and play an essential role as iron storage proteins. The formation of a caged iron biomineral is driven by enzymatic reaction...
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Graphene oxide decorated with Cu(I)Br nanoparticles: A reusable catalyst for the synthesis of potent bis(indolyl)methane based anti HIV drugs

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C6RA02458K, Communication
Ananya Srivastava, Aakanksha Agarwal, S. K. Gupta, Nidhi Jain
A GO-Cu(I)Br nanocatalyst has been prepared, and applied for the synthesis of bis(indolyl)methanes. The catalyst is highly effective, is required in much lower amount (0.05 mol%), and is recyclable up...

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Copper Catalyzed Coupling of Protecting Group Free and Sterically Hindered 2-Bromobenzyl Tertiary Alcohols with Phenols and Anilines: Facile Synthesis of Xanthenes and Dihydroacridines

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C6RA03447K, Paper
Satyanarayana Gedu, Mahendar Lodi
A simple and efficient method for the synthesis of xanthenes and dihydroacridines containing a quaternary carbon atom at 9th-position, is presented. Significantly, the protocol facilitated the smooth participation of sterically...
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Glucose-assisted hydrothermal synthesis of few-layer reduced graphene oxide wrapped mesoporous TiO2 submicrospheres with enhanced electrochemical performance for lithium-ion batteries

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA26817F, Paper
Jun Peng, Gang Wang, Yongtao Zuo, Gang Li, Feng Yu, Bin Dai, Xuhong Guo
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Metabolites identification and pharmacokinetic study of Lamiophlomis rotata in rats

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA25264D, Paper
feng zhang, Ming-Ping La, Xiaobin Gong, shouhong gao, Zhijun Wu, lianna sun, xia tao, wansheng chen
An ultra-high liquid chromatography coupled with time-of-flight mass spectrometry (LC-TOF/MS) technique and a subsequent LC-MS/MS method were developed to speculate the metabolite profiles of Lamiophlomis rotata extract in rat biological...
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Naringin ameliorates radiation-induced hepatic damage through modulation of Nrf2 and NF-[small kappa]B pathways

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C6RA01102K, Paper
Krishnendu Manna, Amitava Khan, Sushobhan Biswas, Ujjal Das, Aaveri Sengupta, Dipanwita Mukherjee, Anindita Chakraborty, Sanjit Dey
Understanding the mechanism of ionizing radiation (IR)-induced systemic stress and its modulation by phytocomponents has great significance for the development of novel phyto-radioprotectors. The present study was intended to evaluate...
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Hydrothermal self-assembly of graphene foams with controllable pore size

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RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA26088D, Paper
Wei Deng, Qile Fang, Xufeng Zhou, Hailiang Cao, Zhaoping Liu
Pore size is a critical parameter that affects the basic physicochemical properties and applications of porous graphene foam, but the preparation of graphene foam with controllable pore size is still...
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Magnetite nanoparticles enable a rapid conversion of volatile fatty acids to methane

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C6RA02280D, Paper
Zhiman Yang, Rongbo Guo, Xiaoshuang Shi, Chuanshui Wang, Lin Wang, Meng Dai
The objective was to evaluate whether paddy soil enrichments obtained in the presence of magnetite and propionate (named as SEM) can accelerate methane production from the mixed VFAs. To do...
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First-principles investigation of effects of Ni and Y co-doped on destabilized MgH2

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA23996F, Paper
Gaili Sun, Yuanyuan Li, Xinxin Zhao, Jianbao Wu, Yiming Mi, Lili Wang
The Ni and Y co-doping effect on structural stabilities and dehydrogenation properties of destabilized MgH2 were studied by first-principles calculations. Ni and Y dopants prefer to occupy the Mg3 and...
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Following nanoparticles in complex turbid media

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA21166B, Paper
Alesya Mikhailovskaya, Jerome Crassous, Anniina Salonen, Dominique Langevin
Diffusing wave spectroscopy (DWS) was used to determine the size and volume fraction of nanoparticles (NP) within a foam taken as an example of a turbid media. The presence of...
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Anti-allergic Prenylated Hydroquinones and Alkaloids from the Fruiting Body of Ganoderma calidophilum

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C6RA01466F, Paper
Sheng-Zhuo Huang, Baohui CHENG, Qing-Yun Ma, Qi Wang, Fandong Kong, Hao-Fu Dai, Shu Qi Qiu, Peng Yuan Zheng, Zhi Qiang Liu, You-Xing Zhao
Six new prenylated hydroquinones named ganocalidin A-F (1-6) and two new ganocalicine A (7) and B (8) together with sixteen known compounds (9-24) were isolated from EtOAc extract of the...
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Effect of sodium doping on microstructure, lattice distortion and magnetic properties of GdMnO3 tiny single crystals

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA19631K, Paper
Anshuman Nandy, Anirban Roychowdhury, Tanusree Kar, Dipankar Das, Swapan Kumar Pradhan

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REEL: 037821 FRAME: 0651

Perovskite structured undoped and 10 mol% monovalent Na-doped GdMnO3 compounds are prepared by the sol-gel method. Sintering of these compounds at 1000 [o]C for 12h results in formation of well...
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Hybrid Photosensitizer Based on Amphiphilic Block Copolymer Stabilized Silver Nanoparticles for Highly Efficient Photodynamic Inactivation of Bacteria

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C6RA01660J, Paper
Rui Ding, Xinjun Yu, Peng Wang, Jinnan Zhang, Yan Zhou, Xian Cao, Hong Tang, Neil Ayres, Peng Zhang
We report the development of a type of novel hybrid photosensitizers for photodynamic inactivation of broad-spectrum bacteria. Thiol-modified amphiphilic block copolymer, poly(N-isopropylacrylamide-block-styrene), was synthesized and characterized. Subsequently, silver nanoparticles stabilized...
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Performance of mesoporous silicas (MCM-41 and SBA-15) and carbon (CMK-3) in removal of gas-phase naphthalene: adsorption capacity, rate and regenerability

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA27289K, Paper
Yingshu Liu, Ziyi Li, Xiong Yang, Yi Xing, Chuen-Jinn Tsai, Quan Yang, Zhanying Wang, Ralph T. Yang
The adsorption isotherms of naphthalene on three typical mesoporous adsorbents, MCM-41, SBA-15 and CMK-3 at 125 [degree]C were determined by column tests, with feed concentrations ranging from 7.63[times]10-5 to 4.64[times]10-2...
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Plant leaves as templates for soft lithography

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA25890A, Communication
Wenming Wu, Rosanne Marieke Guijt, Yuliya E. Silina, Marcus Koch, Andreas Manz
We report a simple fast, practical and effective method for the replication of the complex venation patterns of natural leaves into PDMS. Optimising the amount of crosslinker enabled the replication...
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Spectrofluorimetric determination of Hg2+ and Pb2+ using Acetylcholinesterase (AChE)-based formation of silver nanoparticles

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C6RA00193A, Paper
Nanda Kumar D, Jaydeep Roy, Sruthi Ann Alex, N Chandrasekaran, Amitava Mukherjee
Abstract We herein report a novel fluorimetric detection method for Hg2+ and Pb2+ based on in situ formation of AgNPs, where thiocholine (TCh), a product obtained by the hydrolysis of...
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Structural and computational study of some new nano-structured Hg(II) compounds: a combined X-ray, Hirshfeld Surface and NBO analyses

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA22899A, Paper
Morteza Montazerozohori, Ardavan Masoudiasl, Thomas Doert, Heidi Seykens

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REEL: 037821 FRAME: 0652

In this study, synthesis of some new five coordinated mercury(II) complexes of a nitrogen donor Schiff base ligand is reported. The complexes were characterized by FT-IR, 1HNMR, 13CNMR, UV-visible, ESI-mass...
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Effect of Nd3+ substitution for Bi3+ on dielectric properties and conduction behavior of Aurivillius NdBi4Ti3FeO15 ceramics

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA27821J, Paper
Fida Rehman, Hai-Bo Jin, Wang Lin, Abbas Tanver, Su De-Zhi, Jinbo Li
$NdBi_4Ti_3FeO_{15}$ and $Bi_5Ti_3FeO_{15}$ ceramics were prepared by solid state reaction. The effect of Nd^{3+} on dielectric and electrical properties was investigated in a wide range of frequency and temperature by...
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Mechanism for formation and growth of carbonaceous spheres from sucrose by hydrothermal carbonization

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA26725K, Paper
Yujie Qi, Mu Zhang, Lin Qi, Yang Qi
We report a new three-step mechanism for the formation and growth of carbonaceous spheres by hydrothermal carbonization of saccharides using sucrose as precursor material. Carbonaceous spheres with small diameter and...
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Group 4 Alkoxide Complexes containing [NNO]-type Scaffold: Synthesis, Structural Characterization and Polymerization Studies

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA26721H, Paper
Dipa Mandal, Debashis Chakraborty, Ramkumar V, Dillip Kumar Chand
A series of Ti(IV), Zr(IV) and Hf(IV) complexes are synthesized by complexation of [NNO]-type tridentate Schiff base ligands {2-amino-3-((E)-(2-hydroxybenzylidene)amino)maleonitrile}, L1(H)2; {2-amino-3-((E)-(2-hydroxy-3,5-dimethylbenzyl-idene)amino)maleonitrile}, L2(H)2 and {2-amino-3-((E)-(3-(tert-butyl)-2-hydroxy-5-methylbenzylidene)amino)maleonitrile}, L3(H)2 with suitable group 4 metal...
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Anti-sintering ZrO2-modified Ni/[small alpha]-Al2O3 catalyst for CO methanation

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA28057E, Paper
Qing Liu, Fangna Gu, Ziyi Zhong, Guangwen Xu, Fabing Su
To obviously reduce sintering behavior of Ni particles in Ni/[small alpha]-Al2O3 catalysts during CO methanation reaction, ZrO2 was deposited onto the Ni/[small alpha]-Al2O3 catalyst surface by a modified impregnation method. It was...
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Preparation of nano-MnO2 surface-modified reduced graphene oxide/PVDF flat sheet membrane for adsorptive removal of aqueous Ni(II)

PATENT
REEL: 037821 FRAME: 0653

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA20776B, Paper
Renjie Li, lifen Liu, Yuehua Zhang, Fenglin Yang
In this paper, nanoscale MnO2 particles was attached onto the surface of PVDF flat sheet membrane, step by step, first through dispersion of graphene oxide (GO) in PVDF membrane, then...
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Effect of the alloying element on the temperature-dependent ideal shear strength of [gamma][prime or minute]-Ni3Al

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA24108A, Paper
xiaoxia wu, Chongyu Wang
The temperature-dependent ideal shear strength ([small tau]IS) of [gamma][prime or minute]-Ni3Al and the effects of alloying (Re, Ru, Mo, Cr, Co, W, and Ta) were studied in terms of first-principles calculations within the...
The content of this RSS Feed (c) The Royal Society of Chemistry

Investigation on Heat Resistance, Wettability and Hemocompatibility of Polylactide Membrane via Surface Crosslinking Induced Crystallization

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA27030H, Paper
fu liu, Zhu Xiong, Ailin Gao, Haibo Lin, Xuemin Yu, yunze wang, yi wang
Polylactide (PLA) has attracted much attention as a sustainable and environmentally friendly material. However, the poor heat resistance restrains its potential application as porous membrane. Herein, PLA membrane with excellent...
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Complex toxicological interaction between ionic liquid and pesticide to Vibrio qinghaiensis sp.-Q67

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA27096K, Paper
Qu Rui, Shushen Liu, Chen Fu, Li Kai
Ionic liquids (ILs) and pesticides may coexist in ecosystems, because more and more people try to extract pesticide from various samples by ILs. Many researches indicated that the toxicities of...
The content of this RSS Feed (c) The Royal Society of Chemistry

Multifunctional single-drug loaded nanoparticles for enhanced cancer treatment with low toxicity in vivo

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA26372G, Paper
Yuwei Cong, Zigui Wang, Shasha He, Dongfang Zhou, Jizhen Li, Zhigang Xie, Xuesi Chen, Xiabin Jing, Yubin Huang
Platinum(II) are used for treating over a half of cancers in clinic. However, the application is accompanied with acquired resistance and severe toxic side effects. To address the challenges, a...
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PATENT
REEL: 037821 FRAME: 0654

Effect of Hydrogen Ion Implantation on Cholesterol Sensing Using Enzyme-Free Laponite-Montmorillonite Electrodes

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA27523G, Paper
Nidhi Joshi, Abhimanyu Sharma, Asokan Kandasami, Kamla Rawat, Dinakar Kanjilal
Ion irradiation experiments were performed on Laponite-Montmorillonite/Indium Tin Oxide (L-MMT/ITO) films using 20 keV H2+ ion beam with variable fluence ranging from 1012 - 1016 ions/cm2 and the electrochemical profiling...
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Fabrication of WO3 nanorods on Graphene Nanosheets for Improved Visible Light-Induced Photocapacitive and Photocatalytic Performance

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA24575C, Paper
Mohammad Ehtisham Khan, Mohammad Mansoob Khan, Moo Hwan Cho
Tungsten oxide (WO3) nanorods were grown on graphene (G) nanosheets using a template-free and surfactant-less hydrothermal process at 200 [degree]C. X-ray diffraction, transmission electron microscopy and X-ray photoelectron spectroscopy analysis...
The content of this RSS Feed (c) The Royal Society of Chemistry

Novel Wearable Polyacrylonitrile/Phase-change Materials Sheath/Core Nano-fibers Fabricated by Coaxial Electro-spinning

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C6RA00281A, Paper
yafan wan, Yaodong Liu, Pucha Zhou, Hongxiang Chen
This study focused on the preparation of wearable polyacrylonitrile (PAN)/phase-change material (PCM) sheath/core nano-fibers by coaxial electro-spinning technology. PAN was used as sheath material to make fibers comfortable to human...
The content of this RSS Feed (c) The Royal Society of Chemistry

Nanocomposite hydrogels of laponite mixed with polymers bearing dopamine and cholic acid pendants

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA26316F, Communication
Yongguang Jia, Julian X. X. Zhu
A nanocomposite hydrogel system was formulated by mixing laponite in water with a terpolymer based on N,N'-dimethylacrylamide and comonomers bearing natural compounds dopamine and cholic acid as pendant groups. The...
The content of this RSS Feed (c) The Royal Society of Chemistry

Cell-laden alginate/polyacrylamide beads as carrier for stem cell delivery: preparation and characterization

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA26447B, Paper
Deepti Rana, Aleya Tabasum, Murugan Ramalingam
Stem cells based therapies employ engraftment or systemic administration methods for the delivery of stem

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REEL: 037821 FRAME: 0655

cells into the target tissues to enhance their regenerative potential. However, majority of the stem...
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Stable Stereocomplex Micelles from Y-shaped Amphiphilic Copolymers MPEG-(scPLA)2: Preparation and Characteristics

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C6RA00699J, Paper
Weiwei Zhang, Delong Zhang, Xiaoshan Fan, Guangyue Bai, Yuming Guo, Zhiguo Hu
Four new Y-shaped miktoarm amphiphilic copolymers were synthesized by ring-opening polymerization (ROP) and click chemistry. The structure of these copolymers was determined by nuclear magnetic resonance (NMR), fourier transform infrared...
The content of this RSS Feed (c) The Royal Society of Chemistry

Synthesis of SiO2 Coated Zero-valent Iron/Palladium Bimetallic Nanoparticles and Application in a Nano-biological Combined System for 2,2'4,4'-Tetrabromodiphenyl ether Degradation

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA22388A, Paper
Yuancai Lv, Yuancai Chen, Yongyou Hu, Zhuyu Niu
Polybrominated diphenyl ethers (PBDEs) are emerging persistent organic pollutants and the degradation of PBDEs is still a significant challenge owing to their extreme persistence and toxicity. In this study, the...
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Morphology-Controlled Synthesis SrTiO3/TiO2 Heterostructures and Their Photocatalytic Performance for Water Splitting

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C6RA03472A, Paper
Minh Ngoc Ha, feng zhu, Zhifu Liu, lichao wang, linyan liu, Guanzhong LU, Zhe Zhao
The SrTiO3/TiO2 heterostructures different morphologies like nanocubes, nanoparticles, nanospheres, and nanofibers were synthesized via a facile hydrothermal process using TiO2 as both template and precursor in Sr(OH)2 solution. Their structure,...
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Synthesis of Mo-doped TiO2 Nanowires/Reduced Graphene Oxide Composites with Enhanced Photodegradation Performance under Visible Light Irradiation

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA24164B, Paper
Shanshan Zhu, Yuming Dong, Xiao-Feng Xia, Xiang Liu, Hexing Li
In this research, anatase type Mo-doped TiO_2 nanowires/reduced graphene oxide (Mo-TiO_2NWs/RGO) composites were successfully synthesized using a one-step alkali hydrothermal method followed by a calcination treatment at 500°C, in which...
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Enhancing coulombic efficiency and rate capability of high capacity lithium excess layered oxide cathode material by electrocatalysis of nanogold

PATENT
REEL: 037821 FRAME: 0656

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA26667J, Paper
Quanxin Ma, Deying Mu, Yuanlong Liu, Shibo Yin, Changsong Dai
Lithium-rich cathode material modified with nanogold (Au@LMNCO) for lithium-ion (Li-ion) batteries was prepared using co-precipitation, solid-state reaction and surface treatment techniques. Au@LMNCO was prepared by thermally spraying gold on the...
The content of this RSS Feed (c) The Royal Society of Chemistry

Cellulose nanofibre aerogel filter with tuneable pore structure for oil/water separation and recovery

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA27413C, Communication
Zhiyong He, Xiwang Zhang, Warren Batchelor
A cellulose nanofibre aerogel filter with tuneable pore structure exhibiting super-hydrophilic and underwater-super-oleophobic behaviours is synthesized by a facile method of cross-linking between cellulose fibres and polyamideamine-epichlorohydrin (PAE). The prepared...
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Improved electrochemical performances of layered lithium rich oxide 0.6Li[Li1/3Mn2/3]O2[round bullet, filled]0.4LiMn5/12Ni5/12Co1/6O2 by Zr doping

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA22330J, Paper
Zheng Ma, Jichun Huang, Jingbin Quan, Lin Mei, Jun Guo, Decheng Li
A series of layered lithium-rich oxides 0.6Li[Li1/3Mn2/3(1-x)Zr2/3x]O2[round bullet, filled]0.4LiMn5/12Ni5/12Co1/6O2 (0 [less-than-or-equal] x [less-than-or-equal] 10%) have been prepared by spray-dry method. The crystal structural and morphological properties of all samples have been studied...
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A Novel Phthalonitrile Monomer with Low Post Cure Temperature and Short Cure Time

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA25431K, Paper
liping sheng, changping yin, jiayu xiao
To depress the post cure temperature and time, 3-(2-aminophenoxy)-phthalonitrile (3-APN) was designed and synthesized via the nucleophilic displacement reaction of 3-nitrophthalonitrile and o-aminophenol. The structure of the...
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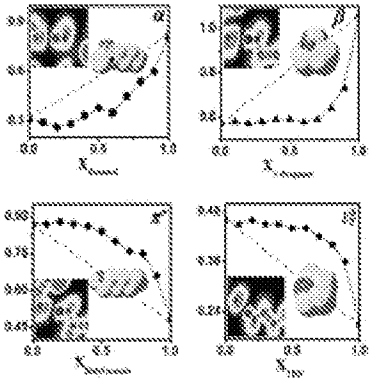
Multi-functionalized Graphene Oxide Complex as a Plasmid Delivery for Targeting Hepatocellular Carcinoma Therapy

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA21475K, Paper
Jun Tang, Ling Zhang, Chunyang Wang, Xiaoqin Wang, Tong Lu, Baofeng Guo, Naiyan Wen, Yanwei Du, Hang Lin, Fangshi Liu
A novel efficient graphene-based gene delivery vector was synthesized by continuously covalent functionalization of graphene oxide (GO) with polyethylenimine (PEI), polyethylene glycol (PEG) and folic acid (FA), followed by the...

PATENT
REEL: 037821 FRAME: 0657

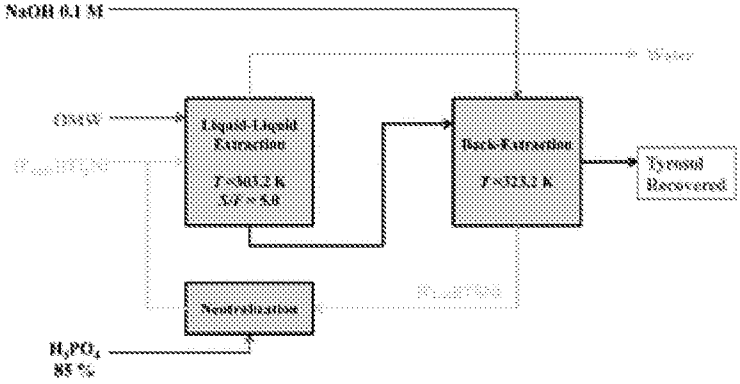
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Probing solvent-solvent and solute-solvent interactions in surfactant binary mixtures: solvatochromic parameters, preferential solvation, and quantum theory of atoms in molecules analysis



RSC Adv., 2016, **6**,18515-18524
DOI: 10.1039/C5RA23942G, Paper
Mona Kohantorabi, Mostafa Fakhraee, Hadi Salari, Mohammad Reza Gholami
The behaviour of solvatochromic absorbance probes within binary mixtures of TX-100/organic solvents.
The content of this RSS Feed (c) The Royal Society of Chemistry

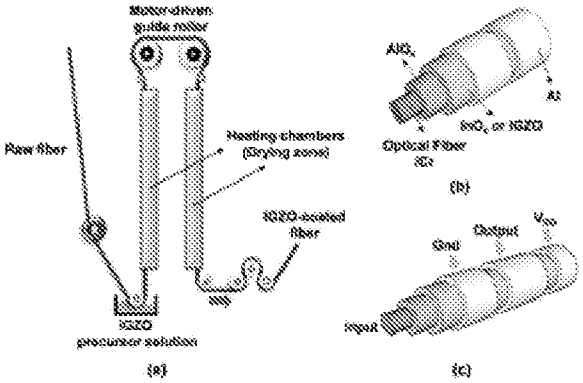
Recovery of tyrosol from aqueous streams using hydrophobic ionic liquids: a first step towards developing sustainable processes for olive mill wastewater (OMW) management



RSC Adv., 2016, **6**,18751-18762
DOI: 10.1039/C5RA26510J, Paper
Marcos Larriba, Salama Omar, Pablo Navarro, Julian Garcia, Francisco Rodriguez, Maria Gonzalez-Miquel
Hydrophobic ILs have been proposed as VOCs replacements for tyrosol recovery from aqueous solutions, revealing promising extraction efficiency and regeneration capacity. This will help developing sustainable processes for olive mill waste management.
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1-Dimensional fiber-based field-effect transistors made by low-temperature photochemically activated sol-gel metal-oxide materials for electronic textiles

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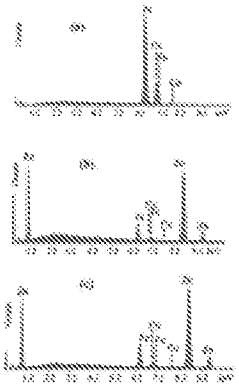


RSC Adv., 2016, **6**,18596-18600
DOI: 10.1039/C5RA21613C, Paper
Chang Jun Park, Jae Sang Heo, Kyung-Tae Kim, Gyengmin Yi, Jingu Kang, Jong S. Park, Yong-Hoon Kim, Sung Kyu Park
We report the high performance metal-oxide fiber field-effect transistors (F-FETs) for electronic textiles (e-textiles).
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Artificial Extracellular Matrix Deliver TGFb1 Regulating Myofibroblasts Differentiation

RSC Adv., 2016, Accepted Manuscript
DOI: 10.1039/C5RA26164C, Paper
Weilu Cheng, Ruodan Xu, Dalong Li, Christian Bortolini, jinmei he, Mingdong Dong, Flemming Besenbacher, Yu-Dong Huang, Menglin Chen
During the wound healing, the contractile activity of myofibroblasts differentiated from the fibroblasts in active transforming growth factor [small beta]1 (TGF[small beta]1) condition has vital functions. As wound dressing biomaterials, it is...
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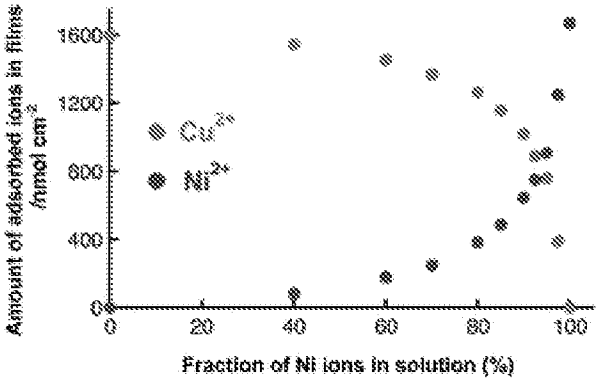
ZnO coated CoFe2O4 nanoparticles for multimodal bio-imaging



RSC Adv., 2016, **6**,18843-18851
DOI: 10.1039/C5RA25953C, Paper
N. Venkatesha, Yasrib Qurishi, Hanudatta S. Atreya, Chandan Srivastava
The potential of $CoFe_2O_4$-ZnO core-shell nanoparticles for fluorescence optical imaging and as a contrast agent for magnetic resonance imaging (MRI) is demonstrated.
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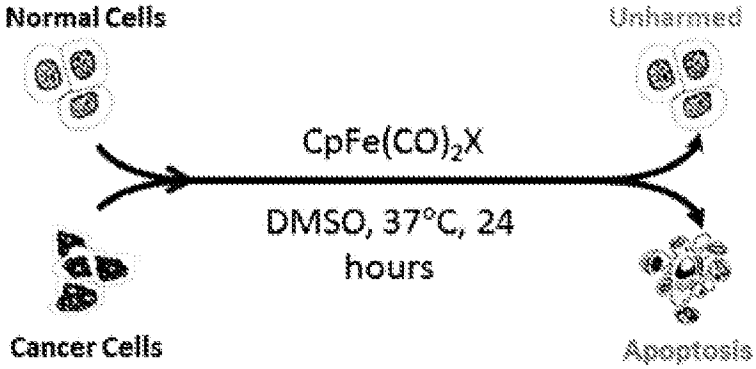
PATENT
REEL: 037821 FRAME: 0659

In situ synthesis of Cu/Ni alloy nanoparticles embedded in thin polymer layers



RSC Adv., 2016, **6**,18895-18898
DOI: 10.1039/C6RA00240D, Communication
Ryo Shimizu, Takaya Kawakami, Yohei Takashima, Takaaki Tsuruoka, Kensuke Akamatsu
In situ formation of Cu-Ni alloy nanoparticles with controlled composition in thin polyimide layers was investigated.
The content of this RSS Feed (c) The Royal Society of Chemistry

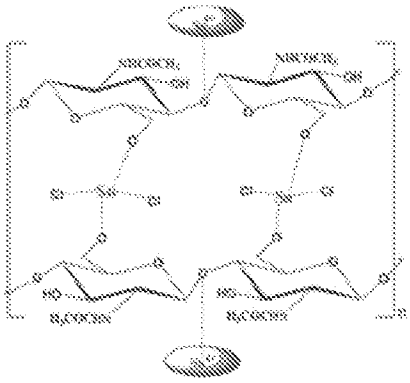
Cyclopentadienyl iron dicarbonyl (CpFe(CO)2) derivatives as apoptosis-inducing agents



RSC Adv., 2016, **6**,18814-18823
DOI: 10.1039/C5RA23891A, Paper
H. T. Poh, P. C. Ho, W. Y. Fan
$CpFe(CO)_2$ complexes kill cancer cells while leaving normal cells unharmed.
The content of this RSS Feed (c) The Royal Society of Chemistry

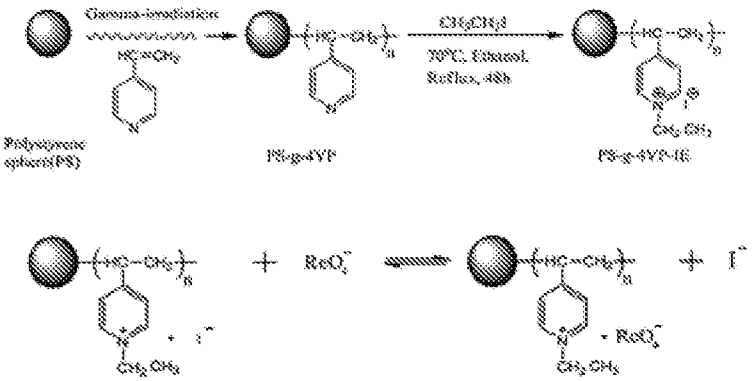
Assimilation of chitin with tin for defluoridation of water

PATENT
REEL: 037821 FRAME: 0660



RSC Adv., 2016, **6**,18936-18945
DOI: 10.1039/C6RA00014B, Paper
A. Shekhawat, S. S. Kahu, D. Saravanan, R. M. Jugade
Chitin, a natural amino polysaccharide, has been incorporated with Sn(VI) for effective adsorption of fluoride from water. The material (SnC) was found to be an eco-friendly adsorbent with defluoridation capacity of 14.77 mg g^{-1}.
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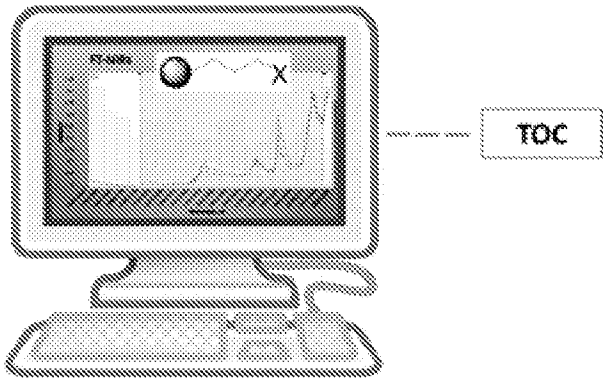
Design of a strong-base anion exchanger and its adsorption and elution behavior for rhenium(VII)



RSC Adv., 2016, **6**,18868-18873
DOI: 10.1039/C5RA25313F, Paper
Jianhua Zu, Maosong Ye, Puyin Wang, Fangdong Tang, Linfeng He
Synthetic route of novel strong-base anion exchanger PS-*g*-4VP-IE, strong-base anion exchanger reaction with perrhenate.
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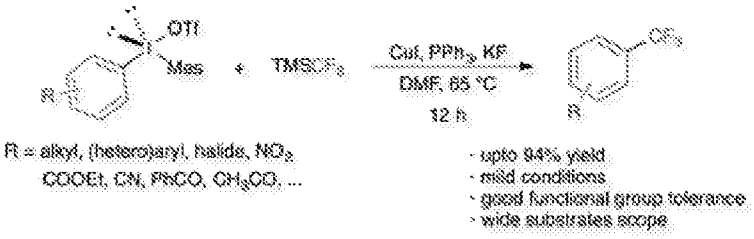
Determination of total organic carbon on hybrid organic-inorganic mesoporous silica by FT-NIR spectroscopy

PATENT
REEL: 037821 FRAME: 0661



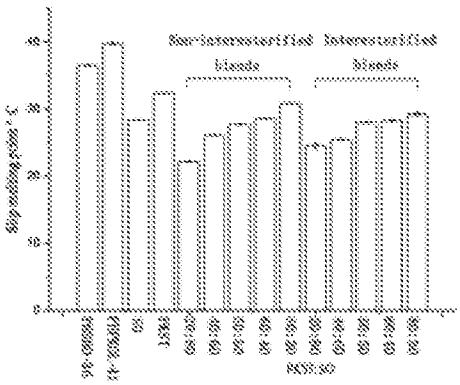
RSC Adv., 2016, **6**,18909-18915
DOI: 10.1039/C6RA01293K, Paper
M. Oliverio, S. Bonacci, M. Nardi, A. Procopio
FT-NIR spectroscopy supported by PLS analysis was used as alternative to thermo-analytical techniques in prediction the organic loading of hybrid silica.
The content of this RSS Feed (c) The Royal Society of Chemistry

Copper-catalysed synthesis of trifluoromethyl(hetero)arenes from di(hetero)aryl-[small lambda]3-iodanes



RSC Adv., 2016, **6**,18525-18529
DOI: 10.1039/C5RA27128B, Communication
Vinay Kumar Pandey, Pazhamalai Anbarasan
Efficient regioselective copper-catalyzed trifluoromethylation of symmetrical and unsymmetrical diaryl-[small lambda]^3-iodanes have been achieved for the synthesis of trifluoromethyl(hetero)arenes in good yield.
The content of this RSS Feed (c) The Royal Society of Chemistry

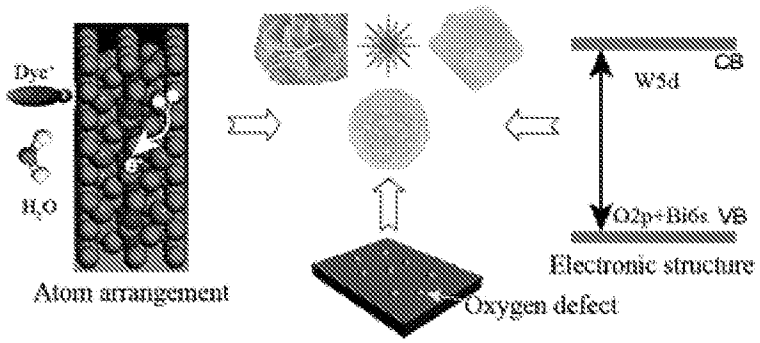
Sheaolein-based cold-soluble powder fats with medium- and long-chain triacylglycerol: production via chemical interesterification using sheaolein and palm kernel stearin



PATENT
REEL: 037821 FRAME: 0662

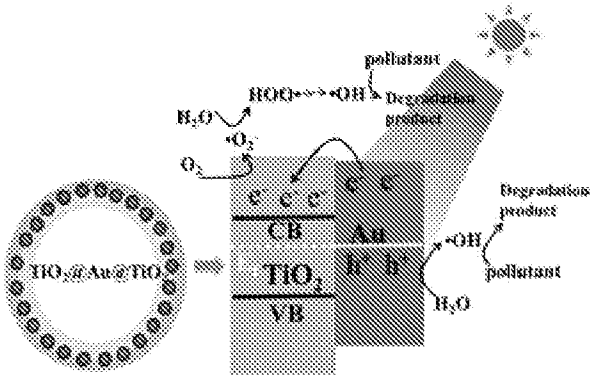
RSC Adv., 2016, **6**,18632-18640
DOI: 10.1039/C5RA27824D, Paper
Zhenbo Xu, Jun Jin, Prakash Adhikari, Jun Liang, Xuebing Xu, Yuanfa Liu, Xingguo Wang
Medium- and long-chain triacylglycerol (MLCT) is increasingly popular because of its anti-obesity ability, and therefore the cold soluble powder fat containing such triacylglycerol is considered as a healthy functional food.
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Insight into the origin of photoreactivity of various well-defined Bi2WO6 crystals: exposed heterojunction-like surface and oxygen defects



RSC Adv., 2016, **6**,18916-18923
DOI: 10.1039/C5RA27295E, Paper
Yongchao Ma, Qingzhi Liu, Qi Wang, Dan Qu, Jinsheng Shi
Three kinds of Bi_2WO_6 with well-defined morphology were prepared. The nanosheet with exposed (020) facets was obtained. The origin of photoreactivity of Bi_2WO_6 photocatalysis was studied.
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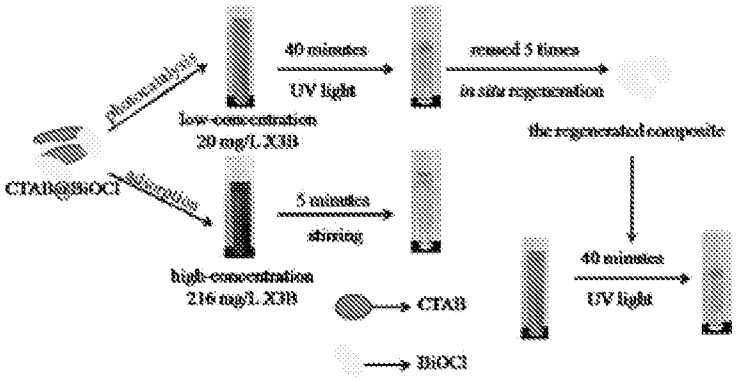
Enhanced photocatalytic activity of a hollow TiO2-Au-TiO2 sandwich structured nanocomposite



RSC Adv., 2016, **6**,18958-18964
DOI: 10.1039/C5RA26646G, Paper
Qianqian Ding, Yunxia Zhang, Guozhong Wang, Hongjian Zhou, Haimin Zhang
The hollow mesoporous TiO_2-Au-TiO_2 nanospheres with stability, large specific surface area can enhance visible-light-induced photocatalytic activity.
The content of this RSS Feed (c) The Royal Society of Chemistry

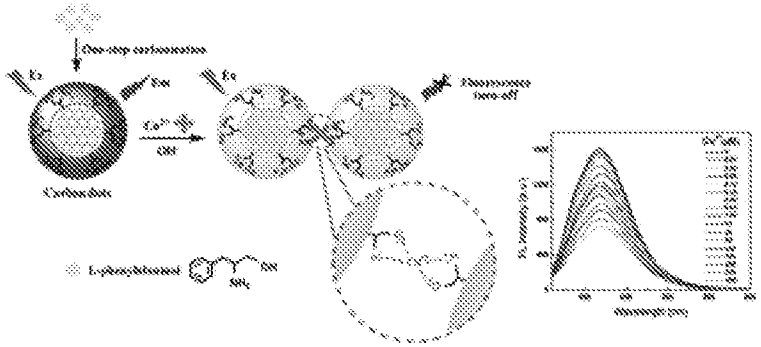
CTAB@BiOCl: a highly adsorptive photocatalyst for eliminating dye contamination

PATENT
REEL: 037821 FRAME: 0663



RSC Adv., 2016, **6**,18577-18582
DOI: 10.1039/C5RA27714K, Paper
Yichang Yu, Zhangjun Hu, Yalei Zhang, Hongwen Gao
The CTAB@BiOCl composite was facilely prepared as a photocatalyst with the high absorption capacity and recycled to effectively treat dye waste water.
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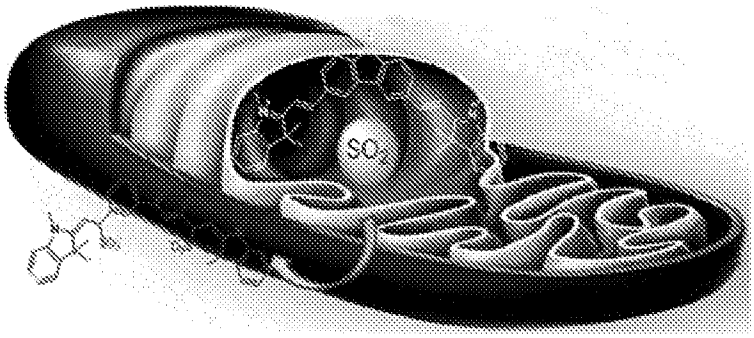
One-step facile synthesis of novel [small beta]-amino alcohol functionalized carbon dots for the fabrication of a selective copper ion sensing interface based on the biuret reaction



RSC Adv., 2016, **6**,18326-18332
DOI: 10.1039/C5RA24348C, Paper
Xi Wang, Xin Shen, Bingzhi Li, Guoyi Jiang, Xuemin Zhou, Huijun Jiang
The detection strategy of [small beta]-amino alcohol functionalized carbon dots for Cu^{2+} based on the biuret reaction.
The content of this RSS Feed (c) The Royal Society of Chemistry

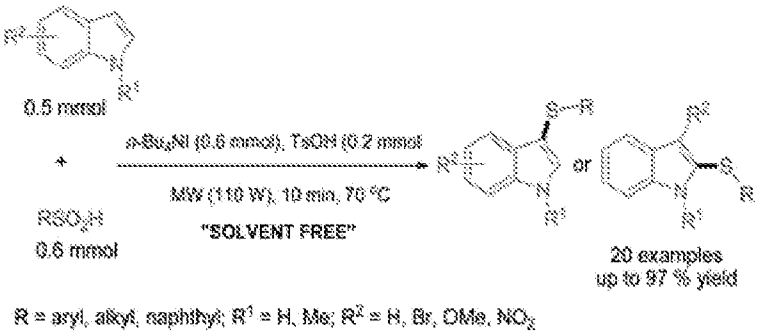
A novel carbazole-based mitochondria-targeted ratiometric fluorescent probe for bisulfite in living cells

PATENT
REEL: 037821 FRAME: 0664



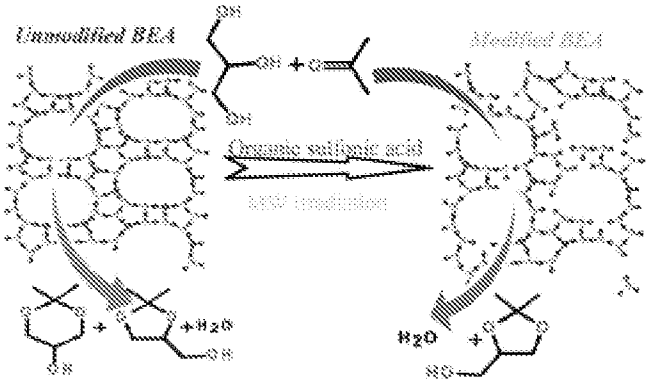
RSC Adv., 2016, **6**,18662-18666
DOI: 10.1039/C5RA27805H, Communication
Gang Wang, Hao Chen, Xiuli Chen, Yongmei Xie
A novel carbazole-indolium based mitochondria-targeted ratiometric fluorescent probe was developed, which could selectively respond to bisulfite among other sulfur-containing species in living cells.
The content of this RSS Feed (c) The Royal Society of Chemistry

Microwave-assisted regioselective sulfenylation of indoles under solvent- and metal-free conditions



RSC Adv., 2016, **6**,18929-18935
DOI: 10.1039/C5RA26425A, Paper
Rajjakfur Rahaman, Namita Devi, Jyoti Rekha Bhagawati, Pranjit Barman
Formation of 3-sulfenylindoles using sulfinic acid as a sulfenylating agent.
The content of this RSS Feed (c) The Royal Society of Chemistry

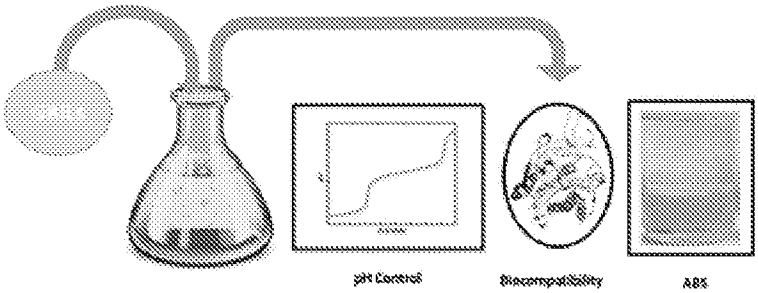
Dealuminated BEA zeolite for selective synthesis of five-membered cyclic acetal from glycerol under ambient conditions



PATENT
REEL: 037821 FRAME: 0665

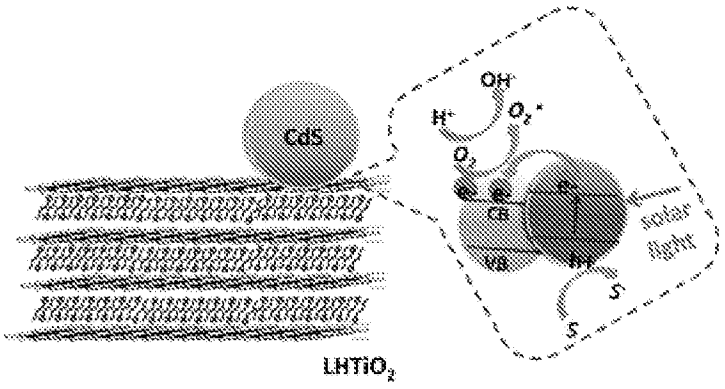
RSC Adv., 2016, **6**,18824-18833
DOI: 10.1039/C6RA01437B, Paper
N. J. Venkatesha, Y. S. Bhat, B. S. Jai Prakash
BEA zeolite is modified using phenoldisulfonic acid to change catalyst characteristics, which helps to form a single cyclic product. A new term called volume space acidity (VSA) provides volume space available for dioxane to dioxalane rearrangement.
The content of this RSS Feed (c) The Royal Society of Chemistry

Extraction of an active enzyme by self-buffering ionic liquids: a green medium for enzymatic research



RSC Adv., 2016, **6**,18567-18576
DOI: 10.1039/C6RA00607H, Paper
Bhupender S. Gupta, Mohamed Taha, Ming-Jer Lee
The extraction of a model enzyme [small alpha]-chymotrypsin in its active conformation from an aqueous solution by using new biocompatible and self-buffering Good's buffer ionic liquids-based aqueous biphasic systemsis demonstrated.
The content of this RSS Feed (c) The Royal Society of Chemistry

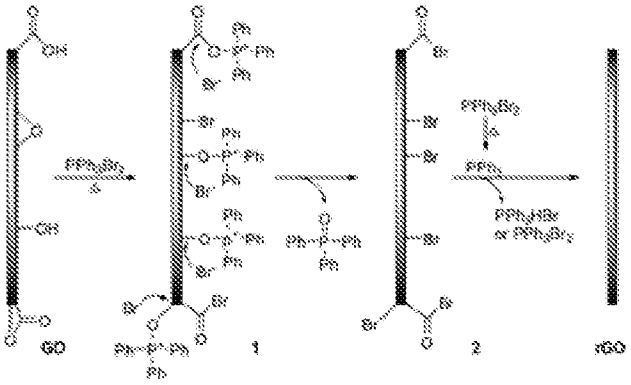
A hybrid organic-inorganic layered TiO2 based nanocomposite for sunlight photocatalysis



RSC Adv., 2016, **6**,18538-18541
DOI: 10.1039/C5RA26981D, Communication
Eglantina Benavente, Carlos Maldonado, Sindy Devis, Leslie Diaz, Harold Lozano, Clivia Sotomayor-Torres, Guillermo Gonzalez
A novel hybrid nanocomposite constituted of single TiO_2 nanosheets sandwiched between stearic acid self-assembled monolayers was synthesized and tested in the photodegradation of methylene blue under sunlight.
The content of this RSS Feed (c) The Royal Society of Chemistry

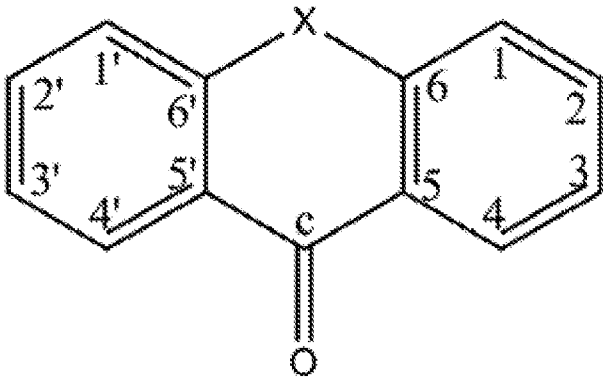
PATENT
REEL: 037821 FRAME: 0666

New approach for the reduction of graphene oxide with triphenylphosphine dihalide



RSC Adv., 2016, **6**,18809-18813
DOI: 10.1039/C5RA26046A, Communication
Hong-Suk Shin, Ki Woong Kim, Yong-goo Kang, Sung Myung, Jong Seung Kim, Ki-Seok An, Ill Young Lee, Sun Sook Lee
We developed a one-flask method for the thermal reduction of graphene oxide (GO) with triphenylphosphine dihalide (Ph_3PX_2) at 180 [degree]C.
The content of this RSS Feed (c) The Royal Society of Chemistry

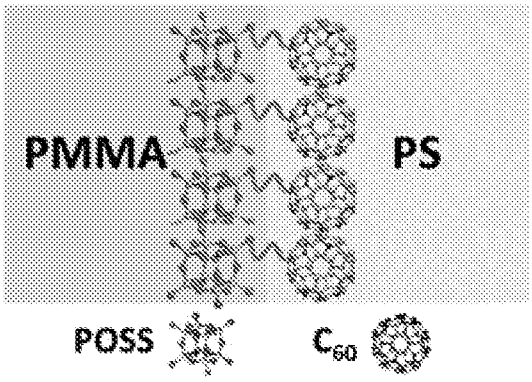
Solvent tunable photophysics of acridone: a quantum chemical perspective



RSC Adv., 2016, **6**,18530-18537
DOI: 10.1039/C5RA27580F, Paper
Vidisha Rai-Constapel, Christel M. Marian
High-level electronic structure methods and quantum chemistry programs have been employed for a thorough investigation of the photophysics of acridone in isolated and solvated states.
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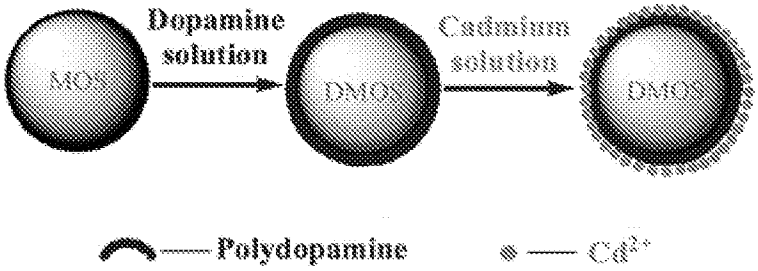
Using POSS-C60 giant molecules as a novel compatibilizer for PS/PMMA polymer blends

PATENT
REEL: 037821 FRAME: 0667



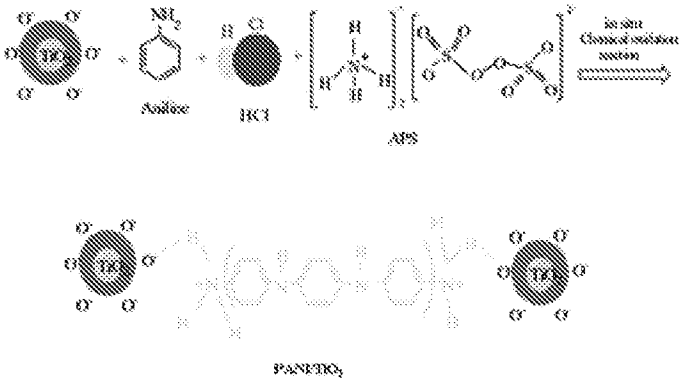
RSC Adv., 2016, **6**,18924-18928
DOI: 10.1039/C6RA00218H, Communication
Di Han, Qin Zhang, Feng Chen, Qiang Fu
Janus POSS-C_{60} (JPC) as a novel compatibilizer.
The content of this RSS Feed (c) The Royal Society of Chemistry

Efficient removal of cadmium using facile functionalized of mesoporous silica via a biomimetic coating



RSC Adv., 2016, **6**,18340-18347
DOI: 10.1039/C5RA24735G, Paper
Yan Chen, Junkai Gao, Xiaofei Wen, Wenfeng Wu
A mesoporous material (DMOS), prepared by grafting polydopamine onto meso-structured silica (MOS), was developed as a sorbent to sequestrate Cd^{2+}.
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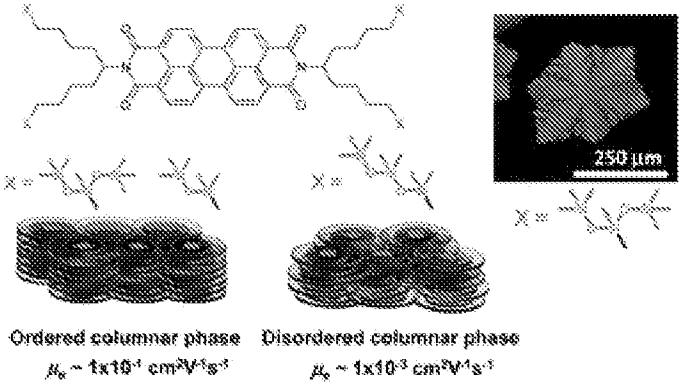
PVDF mixed matrix nano-filtration membranes integrated with 1D-PANI/TiO2 NFs for oil-water emulsion separation



PATENT
REEL: 037821 FRAME: 0668

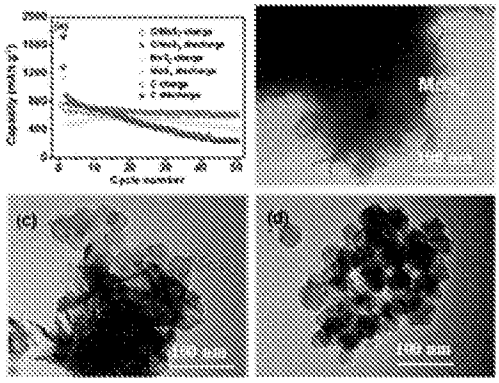
RSC Adv., 2016, **6**,18899-18908
DOI: 10.1039/C5RA27022G, Paper
K. Venkatesh, G. Arthanareeswaran, A. Chandra Bose
In this work, one dimensional (1D) PANI/TiO_2 nanofibers (NFs) were incorporated into polyvinylidene fluoride (PVDF) Mixed Matrix Membranes (MMMs) for the removal of oil and water droplets from oily waste water.
The content of this RSS Feed (c) The Royal Society of Chemistry

A liquid-crystalline perylene tetracarboxylic bisimide derivative bearing trisiloxan-2-yl moieties: influence on mesomorphic properties and electron transport



RSC Adv., 2016, **6**,18703-18710
DOI: 10.1039/C5RA23119A, Paper
Masahiro Funahashi, Nozomi Takeuchi, Akinari Sonoda
Mesomorphic and electron transport properties are compared for liquid-crystalline perylene tetracarboxylic bisimide derivatives bearing linear disiloxane and trisiloxane chains, as well as trisiloxan-2-yl groups.
The content of this RSS Feed (c) The Royal Society of Chemistry

N-doped carbon/MoS2 composites as an excellent battery anode

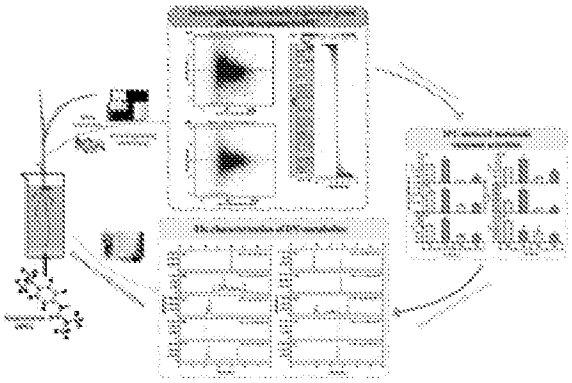


RSC Adv., 2016, **6**,18583-18586
DOI: 10.1039/C5RA24674A, Communication
Fan Yang, Qiang Wan, Xiaochuan Duan, Wei Guo, Yuhua Mao, Jianmin Ma
N-doped carbon/MoS_2 composites manifested high specific capacity of 611 mA h g^{-1} and excellent cycling performance than bare MoS_2 and N-doped carbon.
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RNA-sequencing Oryza sativa transcriptome in response to herbicide isoprotruon

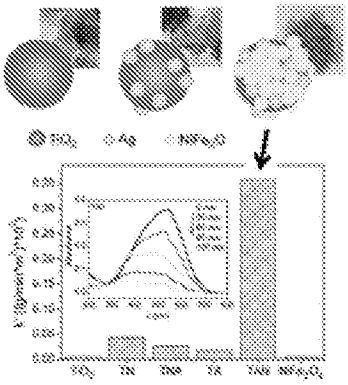
PATENT
REEL: 037821 FRAME: 0669

and characterization of genes involved in IPU detoxification



RSC Adv., 2016, **6**,18852-18867
DOI: 10.1039/C5RA25986J, Paper
Yi Chen Lu, Jing Jing Zhang, Fang Luo, Meng Tian Huang, Hong Yang
The comprehensive analysis of transcriptome and UPLC-MS/MS in rice was performed to explore the regulatory mechanism of mRNA level and chemical metabolism in response to herbicide isoproturon.
The content of this RSS Feed (c) The Royal Society of Chemistry

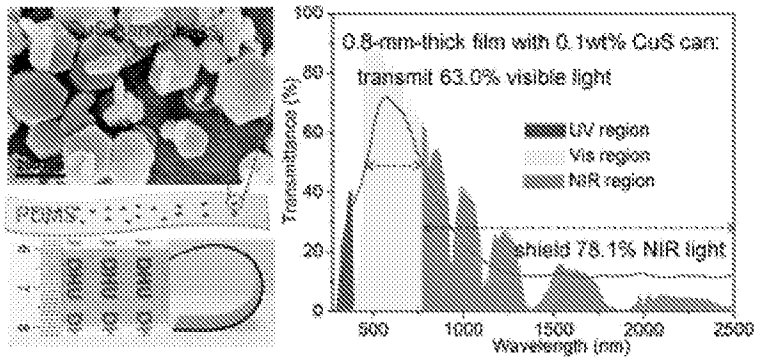
Ag sensitized TiO2 and NiFe2O4 three-component nanoheterostructures: synthesis, electronic structure and strongly enhanced visible light photocatalytic activity



RSC Adv., 2016, **6**,18834-18842
DOI: 10.1039/C6RA00728G, Paper
Andris Sutka, Tanel Kaambre, Rainer Parna, Nicola Dobelin, Martins Vanags, Krisjanis Smits, Vambola Kisand
This study reports on the synthesis and characterisation of two- and three-component visible light active photocatalytic nanoparticle heterostructures, based on TiO_2 and $NiFe_2O_4$ and sensitized with Ag.
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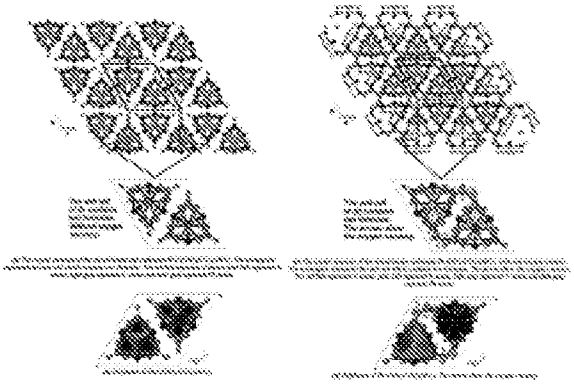
Synthesis of CuS nanoplate-containing PDMS film with excellent near-infrared shielding properties

PATENT
REEL: 037821 FRAME: 0670



RSC Adv., 2016, **6**,18881-18890
DOI: 10.1039/C5RA22611B, Paper
Wenjun Zhong, Nuo Yu, Lisha Zhang, Zixiao Liu, Zhaojie Wang, Junqing Hu, Zhigang Chen
CuS nanoplates have been developed as a near-infrared (NIR) shielding agent, and the corresponding flexible CuS/PDMS composite film can transmit visible light (400-780 nm) but efficiently block NIR light (780-2500 nm).
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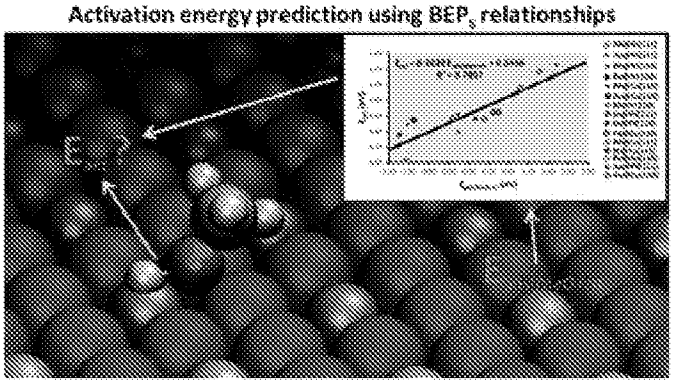
Influence of an oxygen vacancy on the electronic structure of the asymmetric mixed borate-carbonate Pb7O(OH)3(CO3)3(BO3)



RSC Adv., 2016, **6**,18965-18972
DOI: 10.1039/C5RA24601F, Paper
A. H. Reshak, Sushil Auluck
The influence of an oxygen vacancy on the electronic properties of a mixed borate-carbonate compound $Pb_7O(OH)_3(CO_3)_3(BO_3)$ is studied.
The content of this RSS Feed (c) The Royal Society of Chemistry

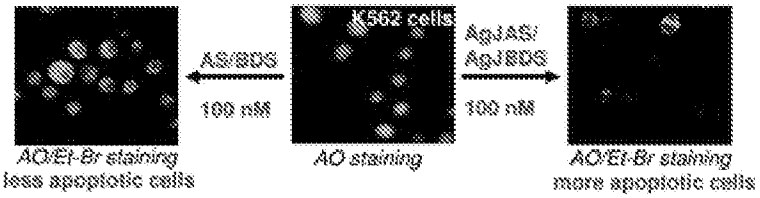
Methanol dissociation on bimetallic surfaces: validity of the general Bronsted-Evans-Polanyi relationship for O-H bond cleavage

PATENT
REEL: 037821 FRAME: 0671



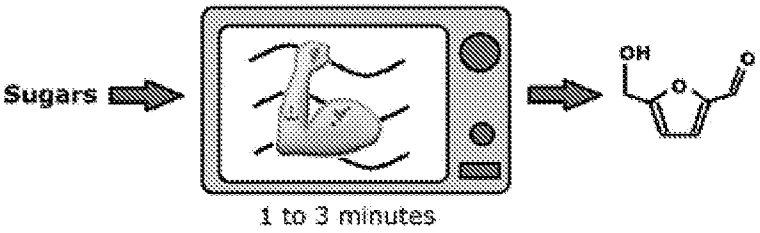
RSC Adv., 2016, **6**,18695-18702
DOI: 10.1039/C6RA01118G, Paper
Jose L. C. Fajin, M. Natalia D. S. Cordeiro, Jose R. B. Gomes
Density functional theory calculations were used to study the dissociation of the O-H bond in methanol on several bimetallic transition metal surfaces, composed of elements showing high or moderate activity towards this reaction, namely, Ni, Rh, Ru, Ir, Pd, Au, Zn and Cu.
The content of this RSS Feed (c) The Royal Society of Chemistry

Jacalin-capped silver nanoparticles minimize the dosage use of the anticancer drug, shikonin derivatives, against human chronic myeloid leukemia



RSC Adv., 2016, **6**,18980-18989
DOI: 10.1039/C5RA27952F, Paper
Khan Behlol Ayaz Ahmed, Santanu Kar Mahapatra, Mamilla R. Charan Raja, Shankar Subramaniam, Megarajan Sengan, Narendran Rajendran, Sandeep Kumar Das, Kuntal Haldar, Somenath Roy, Aravind Sivasubramanian, Veerappan Anbazhagan
Silver nanoparticles enhance the anticancer efficacy of shikonin derivatives.
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Microwave-enhanced aqueous biphasic dehydration of carbohydrates to 5-hydroxymethylfurfural

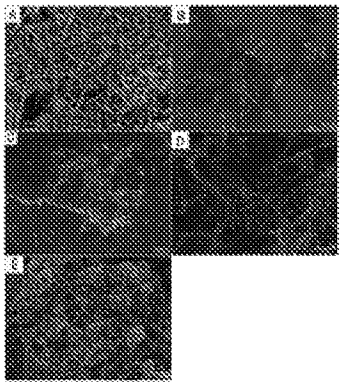


RSC Adv., 2016, **6**,18973-18979
DOI: 10.1039/C5RA25564C, Paper
P. Wrigstedt, J. Keskivali, T. Repo
We describe herein an efficient microwave-assisted aqueous biphasic dehydration of carbohydrates to 5-

PATENT
REEL: 037821 FRAME: 0672

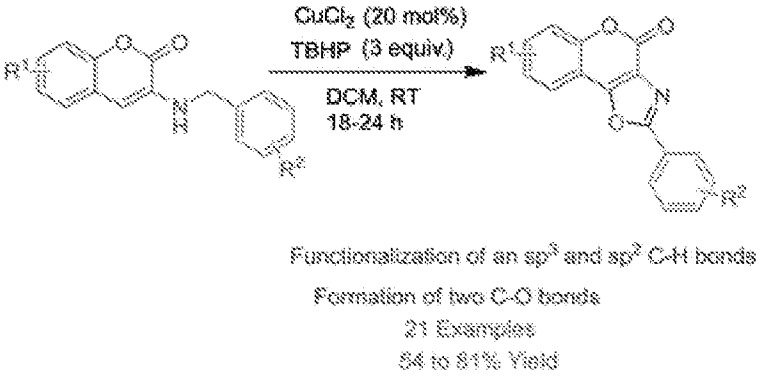
hydroxymethylfurfural (HMF).
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An amperometric glucose biosensor based on a MnO2/graphene composite modified electrode



RSC Adv., 2016, **6**,18654-18661
DOI: 10.1039/C6RA02680J, Paper
Yuge Liu, Xiumei Zhang, Dongning He, Feiyue Ma, Qiong Fu, Yun Hu
In this paper, a novel composite of graphene/MnO_2 (GR/MnO_2) was successfully synthesized by a simple one-step hydrothermal method.
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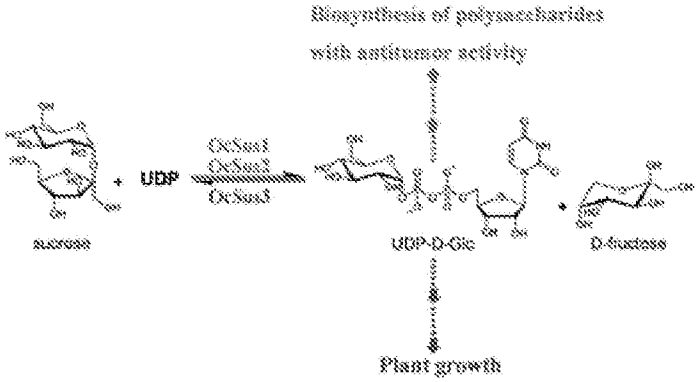
Synthesis of fused oxazole-containing coumarin derivatives via oxidative cross coupling reaction using a combination of CuCl2 and TBHP



RSC Adv., 2016, **6**,18891-18894
DOI: 10.1039/C5RA27993C, Communication
Md. Belal, Abu T. Khan
Various fused oxazoles containing coumarin derivatives were synthesized *via* an oxidative cross coupling reaction by employing 20 mol% $CuCl_2$ as the catalyst and TBHP as an oxidant.
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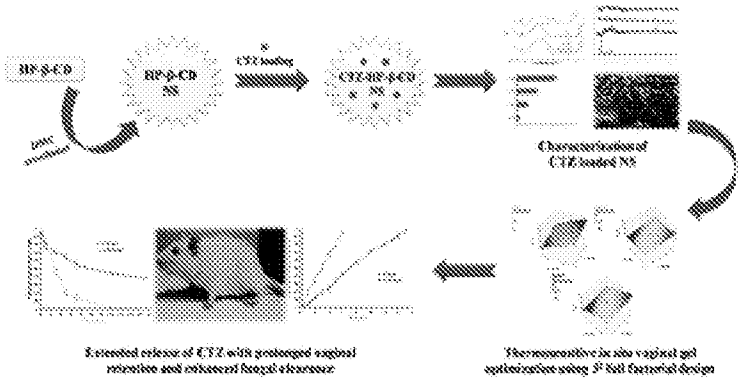
Transcriptome-wide identification of sucrose synthase genes in Ornithogalum caudatum

PATENT
REEL: 037821 FRAME: 0673



RSC Adv., 2016, **6**,18778-18792
DOI: 10.1039/C5RA27611J, Paper
Li-Na Li, Jian-Qiang Kong
A transcriptome-wide discovery and functional identification of a sucrose synthase family was presented. Importantly, OcSus1 and OcSus2 were first verified to be responsible for the biosynthesis of glucose-containing polysaccharides in *O. caudatum*.
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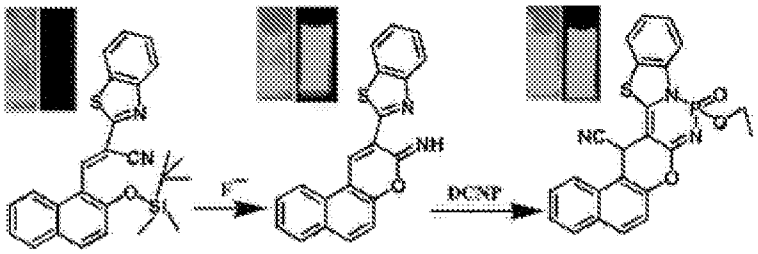
A 32 full factorial design for development and characterization of a nanosponge-based intravaginal in situ gelling system for vulvovaginal candidiasis



RSC Adv., 2016, **6**,18737-18750
DOI: 10.1039/C5RA26218F, Paper
Riyaz Ali M. Osmani, Parthasarathi K. Kulkarni, S. Shanmuganathan, Umme Hani, Atul Srivastava, Prerana M, Chetan G. Shinde, Rohit R. Bhosale
The rationale behind present research effort was to enhance CTZ solubility and efficacy *via* forming complex with hydroxypropyl [small beta]-cyclodextrin (HP-[small beta]-CD) nanosponges.
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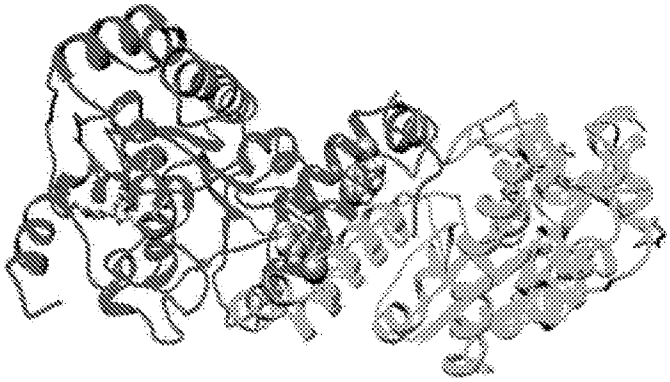
Relay recognition of F- and a nerve-agent mimic diethyl cyano-phosphonate in mixed aqueous media: discrimination of diethyl cyanophosphonate and diethyl chlorophosphate by cyclization induced fluorescence enhancement

PATENT
REEL: 037821 FRAME: 0674



RSC Adv., 2016, **6**,18711-18717
DOI: 10.1039/C5RA24392K, Paper
Avijit Kumar Das, Shyamaprosad Goswami, Ching Kheng Quah, Hoong-Kun Fun
F^- to DCNP detection by relay recognition has been designed and realized for the first time with sequence specificity (F^- [rightward arrow] DCNP) *via* a fluorescence "off-on-on" mechanism.
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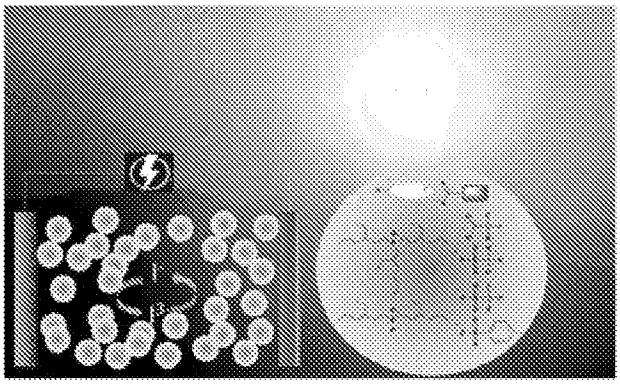
Dimerization and ligand binding in tyrosylprotein sulfotransferase-2 are influenced by molecular motions



RSC Adv., 2016, **6**,18542-18548
DOI: 10.1039/C6RA01899H, Paper
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Warispreet Singh, Tatyana G. Karabencheva-Christova, Olivier Sparagano, Gary W. Black, Petar Y. Petrov, Christo Z. Christov
Tyrosylprotein sulfotransferase-2 catalyses important, but a less explored posttranslational modification of proteins.
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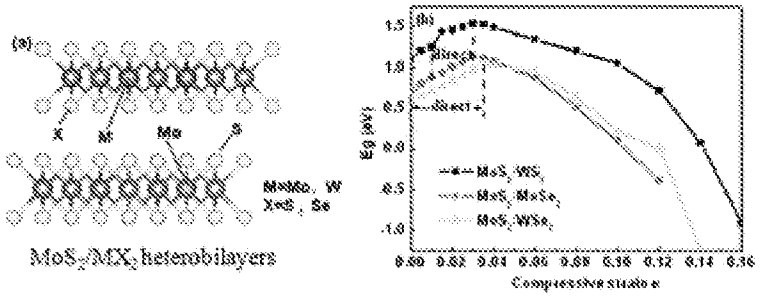
Synthesis and characterization of protic ionic liquids as thermoelectrochemical materials

PATENT
REEL: 037821 FRAME: 0675



RSC Adv., 2016, **6**,18266-18278
DOI: 10.1039/C5RA24835C, Paper
T. A. Siddique, S. Balamurugan, S. M. Said, N. A. Sairi, W. M. D. W. Normazlan
PILs have been designed and synthesized for energy harvesting applications. The module exhibited a maximum S_e value of 420 [small mu]V K^{-1} which is the highest reported for PILs with the I^-/I_3^- redox couple.
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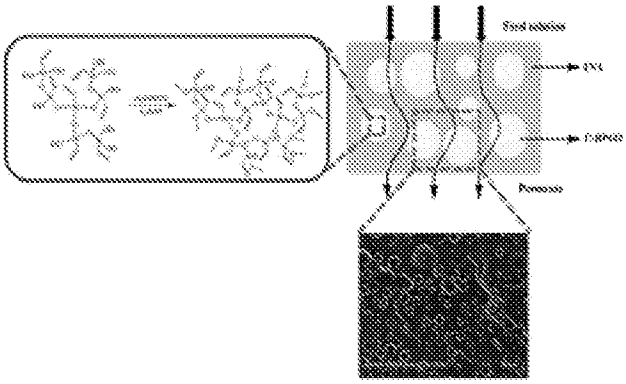
Bandgap engineering of MoS2/MX2 (MX2 = WS2, MoSe2 and WSe2) heterobilayers subjected to biaxial strain and normal compressive strain



RSC Adv., 2016, **6**,18319-18325
DOI: 10.1039/C5RA27871F, Paper
Xiangying Su, Weiwei Ju, Ruizhi Zhang, Chongfeng Guo, Jiming Zheng, Yongliang Yong, Xiaohong Li
Among MoS_2/MX_2 heterobilayers only the MoS_2/WSe_2 system exhibits a direct bandgap, and strain can be used to tune the direct bandgap character of the $MoS_2/MoSe_2$ and MoS_2/WSe_2 heterobilayers.
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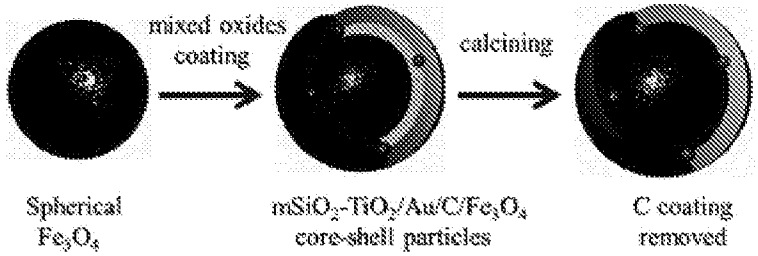
Preparation of jujube-cake structure membranes through in situ polymerization of hyperbranched polysiloxane in ethylene-vinyl acetate matrix for separation of ethyl acetate from water

PATENT
REEL: 037821 FRAME: 0676



RSC Adv., 2016, **6**,18308-18318
DOI: 10.1039/C5RA23790D, Paper
Chun-fang Zhang, Guo-liang Wu, Liang-liang Dong, Jun Tang, Yun-xiang Bai, Yuan-hua Zhu, Qing-sheng Liu, Yu-ping Sun, Jin Gu
The addition of hyperbranched polysiloxane (HPSiO) could improve the hydrophobic of the membranes which is helpful to recover EA from water.
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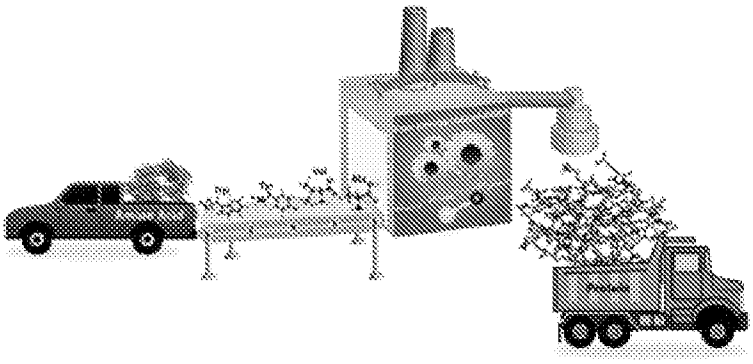
Synthesis and characterization of a multifunctional nanocatalyst based on a novel type of binary-metal-oxide-coated Fe3O4-Au nanoparticle



RSC Adv., 2016, **6**,18685-18694
DOI: 10.1039/C5RA27136C, Paper
Hongxing Zhang, Yiwei Zhang, Yuming Zhou, Chao Zhang, Qianli Wang, Yuanmei Xu, Mingyu Zhang
A novel type of binary-metal-oxide-coated Au nanocatalyst, including a mixed oxide layer, a moveable magnetic Fe_3O_4 core and some Au NPs of 2-5 nm, has been synthesized successfully by a facile hydrothermal synthesis method.
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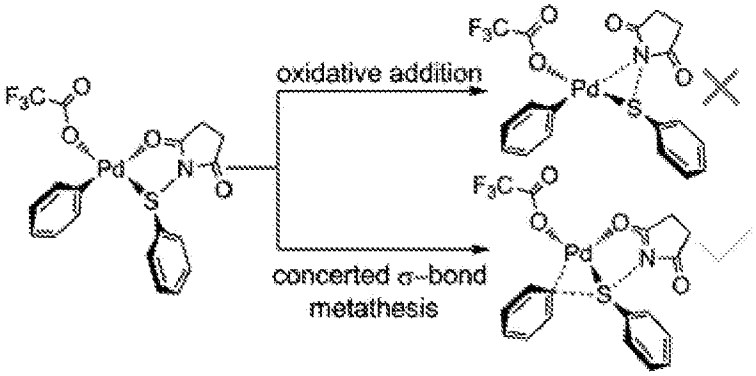
Exploring the structure and stability of amino acids and glycine peptides in biocompatible ionic liquids

PATENT
REEL: 037821 FRAME: 0677



RSC Adv., 2016, **6**,18763-18777
DOI: 10.1039/C5RA26690D, Review Article
Awanish Kumar, Meena Bisht, Pannuru Venkatesu
Amino acids (AAs) are vital components for a variety of biological systems and can be linked through covalent bonds (or peptide bonds) to form a protein structure.
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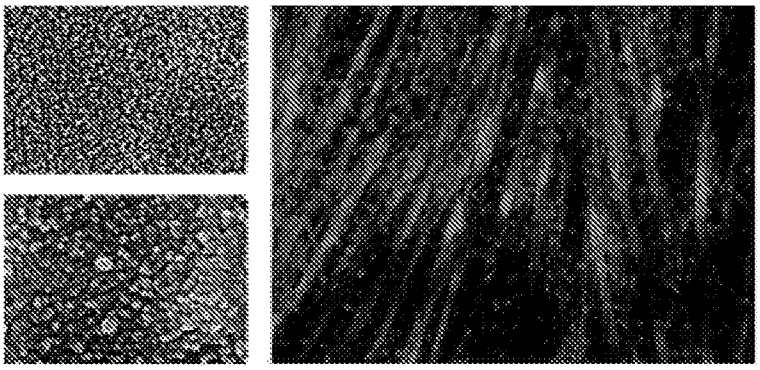
DFT studies on the mechanism of palladium catalyzed arylthiolation of unactive arene to diaryl sulfide



RSC Adv., 2016, **6**,18300-18307
DOI: 10.1039/C5RA27324B, Paper
Ya-ping Zhou, Mei-yan Wang, Sheng Fang, Yu Chen, Jing-yao Liu
The cleavage of S-N bond prefers to take place *via* concerted [sigma]-bond metathesis rather than oxidative addition proposed in experiment.
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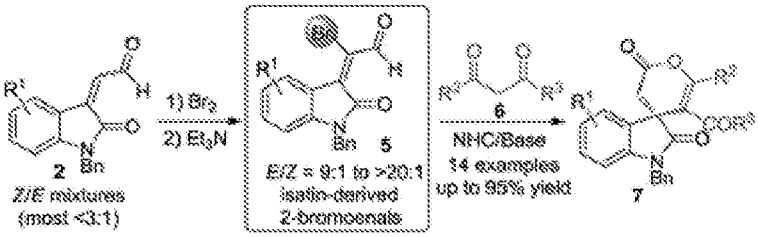
Titanium dioxide nanotube arrays coated with laminin enhance C2C12 skeletal myoblast adhesion and differentiation

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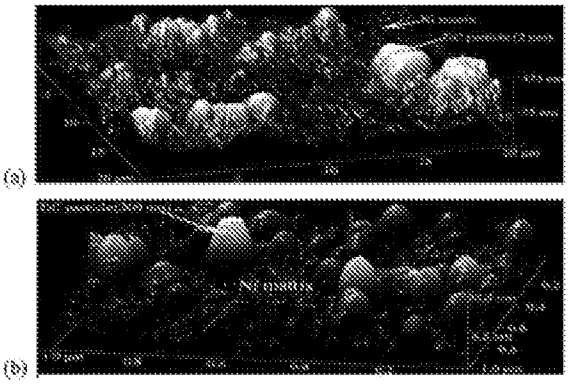
RSC Adv., 2016, **6**,18502-18514
DOI: 10.1039/C6RA00716C, Paper
Giada G. Genchi, Harald Nuhn, Ioannis Liakos, Attilio Marino, Sergio Marras, Athanassia Athanassiou, Virgilio Mattoli, Tejal A. Desai
TiO_2 nanotube arrays of various topography/surface chemistry are tested with C2C12 cells. Improved cell adhesion and differentiation are shown on 10 nm diameter nanotube arrays coated with laminin, encouraging array use for skeletal muscle tissue engineering and stimulation.
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Formal [3 + 3] annulation of isatin-derived 2-bromoenals with 1,3-dicarbonyl compounds enabled by Lewis acid/N-heterocyclic carbene cooperative catalysis



RSC Adv., 2016, **6**,18601-18606
DOI: 10.1039/C5RA27848A, Communication
Junyu Xu, Weiguo Zhang, Yishan Liu, Suzhen Zhu, Ming Liu, Xi Hua, Siyi Chen, Tao Lu, Ding Du
Several novel isatin-derived 2-bromoenals were applied for formal [3 + 3] annulation with 1,3-dicarbonyl compounds enabled by NHC/Lewis acid cooperative catalysis.
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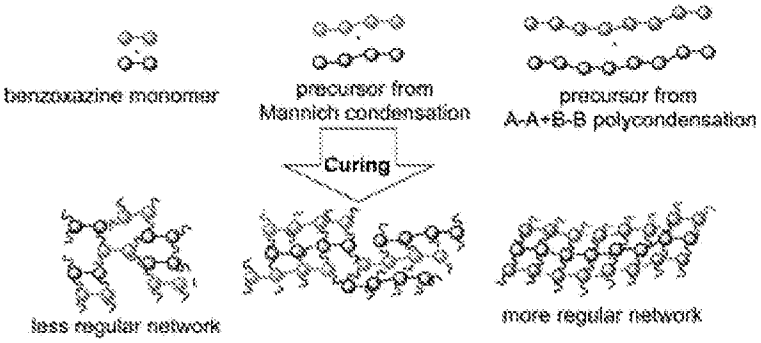
Effect of particle size on the surface activity of TiC-Ni composite coating via the interfacial valence electron localization



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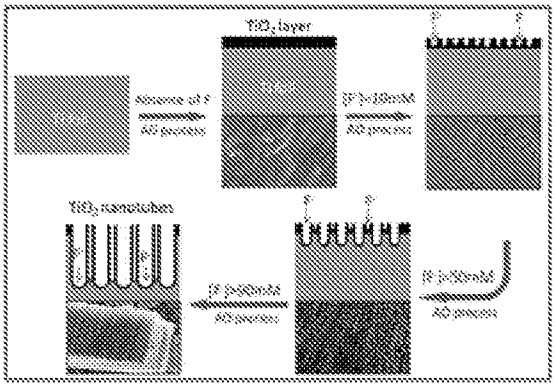
RSC Adv., 2016, **6**,18793-18799
DOI: 10.1039/C5RA24371H, Paper
Zirun Yang, Hao Lu, Ziran Liu, Xianguo Yan, Dongyang Li
Electron work functions and open potentials of electrodeposited Ni, TiC micro- and nano-particle-reinforced Ni matrix coatings were studied to investigate the effects of TiC particle size on the surface activity and corrosion tendency of the coatings.
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The robustness of a thermoset of a main-chain type polybenzoxazine precursor prepared through a strategy of A-A and B-B polycondensation



RSC Adv., 2016, **6**,18678-18684
DOI: 10.1039/C5RA25619D, Paper
Meng Wei Wang, Ru Jong Jeng, Ching Hsuan Lin
A polybenzoxazine precursor was prepared via an A-A and B-B condensation, with a much higher molecular weight than those prepared by Mannich condensation. After curing, the thermoset shows robustness in thermal, mechanical, and dielectric properties.
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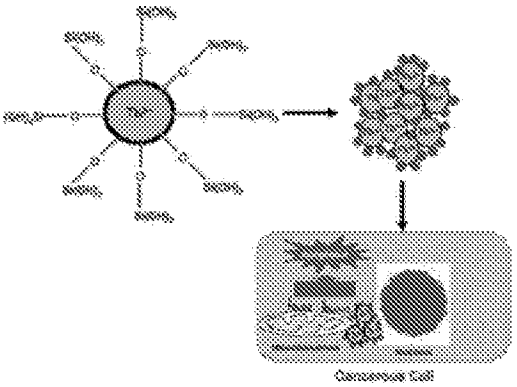
Fluoride concentration controlled TiO2 nanotubes: the interplay of microstructure and photocatalytic performance



RSC Adv., 2016, **6**,18333-18339
DOI: 10.1039/C5RA24732B, Paper
Xueqin Wang, Yanfang Li, Hua Song, Yudong Huang, Ren Su, Flemming Besenbacher
Increasing [F^-] of the electrolyte resulted in an increase of both the length and diameter of TiO_2 NTs, which further improved the photocurrent response and the photodecolorization of RhB.
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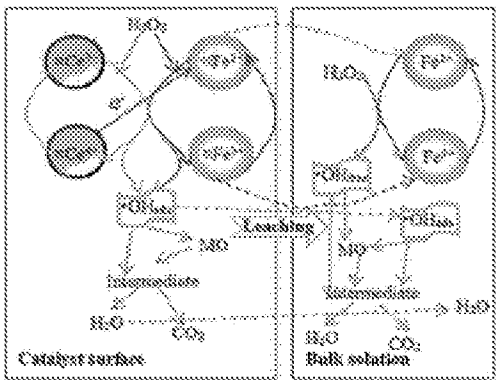
PATENT
REEL: 037821 FRAME: 0680

Design, synthesis and in vitro evaluation of anticancer and antibacterial potential of surface modified Tb(OH)3@SiO2 core-shell nanoparticles



RSC Adv., 2016, **6**,18667-18677
DOI: 10.1039/C5RA17906H, Paper
Shahanavaj Khan, Anees A. Ansari, Abdul Arif Khan, Wael Al-Kattan, Omar Al-Obeed, Rehan Ahmad
In the current study, we modified the surface of $Tb(OH)_3$ nanoparticles with a silica layer to enhance their solubility and biocompatibility.
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[radical dot]OH-initiated heterogeneous oxidation of methyl orange using an Fe-Ce/MCM-41 catalyst



RSC Adv., 2016, **6**,18800-18808
DOI: 10.1039/C5RA26820F, Paper
Shuaijun Wang, Chaocheng Zhao, Dejun Wang, Yongqiang Wang, Fang Liu
Surface-bound [radical dot]OH radicals play a dominant role in the oxidation of methyl orange.
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CARTOUCHE CORPORATION
DWAYNE CARTOUCHE HANS
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Priority: Routine **Application Date:** December 30, 2015

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Registration Number

-APPLICATION-

Title

Title of Work: ISOLATED POLYNUCLEOTIDES AND POLYPEPTIDES AND METHOD OF USING SAME FOR INCREASING NITROGEN USE EFFICIENCY YIELD GROWTH RATE VIGOR BIOMASS OIL CONTENT AND ORABOTIC STRESS TOLERANCE

Completion/Publication

Year of Completion: 2015
Date of 1st Publication: August 06, 2015
Nation of 1st Publication: United States
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Author

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Author Created: text, photograph(s), computer program, artwork, BINARYCODE
Citizen of: United States
Domiciled in: United States
Year Born: 1989

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Copyright Claimant: Dwayne Cartouche Hans
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