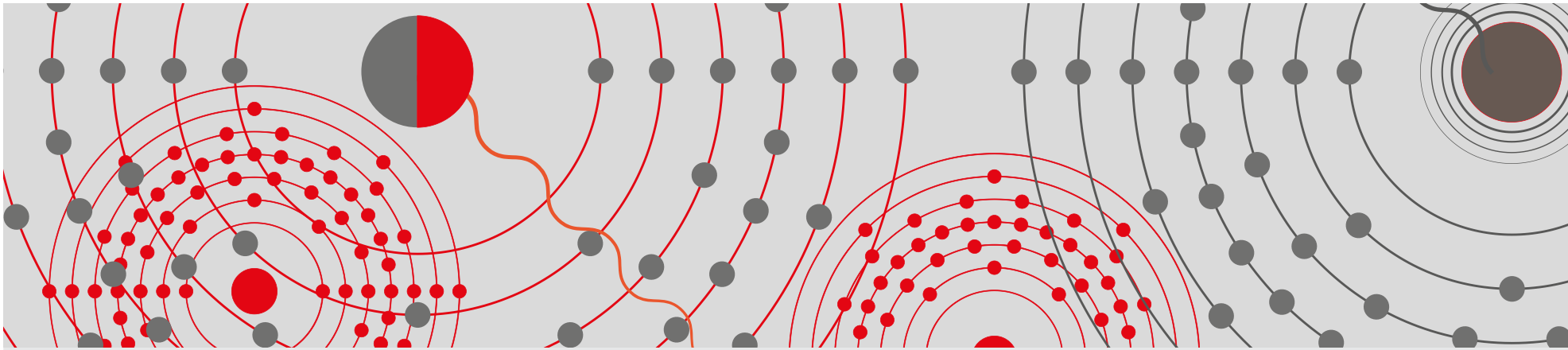
Part of SPRINGER NATURE



Nano

a nature research solution

肖娟秀 （Ph.D）
产品经理
2017年10月26日

nature research

2015年5月两个科学出版商宣布合并

Springer
science+business media

macmillan
Science and Education

npg nature publishing group

SPRINGER NATURE

- Nature Research
- Springer Research
- Open Research

Nano是在2016年6月15日以Nature Research组合的一部分推出

What is Nano?

A comprehensive nanotechnology-specific database has been launched as part of the Nature Research portfolio.

On 15 June 2016, Springer Nature launched Nano, the first non-journal-type product to be marketed by the company within the Nature Research portfolio. Nano is a database, but it is also a discovery tool. It is designed to provide researchers in academia and industry a simple way to retrieve information on nanomaterials and nanodevices. Over 200,000 profiles have been created, and each is based on information extracted mainly from research articles published in 30 journals. By searching the database, users are presented with at-a-glance information on different types of materials or devices related to the keyword used, including composition and properties, and including the source articles and patents from which the information has been extracted.

Realizing a comprehensive catalogue of nanomaterials and nanodevices is important, particularly now, as after a few decades of intense research to understand the fundamental properties of nanostructures, efforts have now shifted to incorporate such structures in commercial devices. But creating a comprehensive catalogue of nano-objects is no easy task. The main challenge is, and possibly will always be, deciding what goes in and what stays out. What size can be used as a threshold under which a material becomes a nanomaterial? The only useful answer is that a nanomaterial has qualitatively different physical and chemical properties from its bulk counterpart, and the size at which this happens varies with each material. To complicate matters, nanomaterials are studied by physicists, engineers, chemists and biologists, and information is scattered in a wide variety of publications.

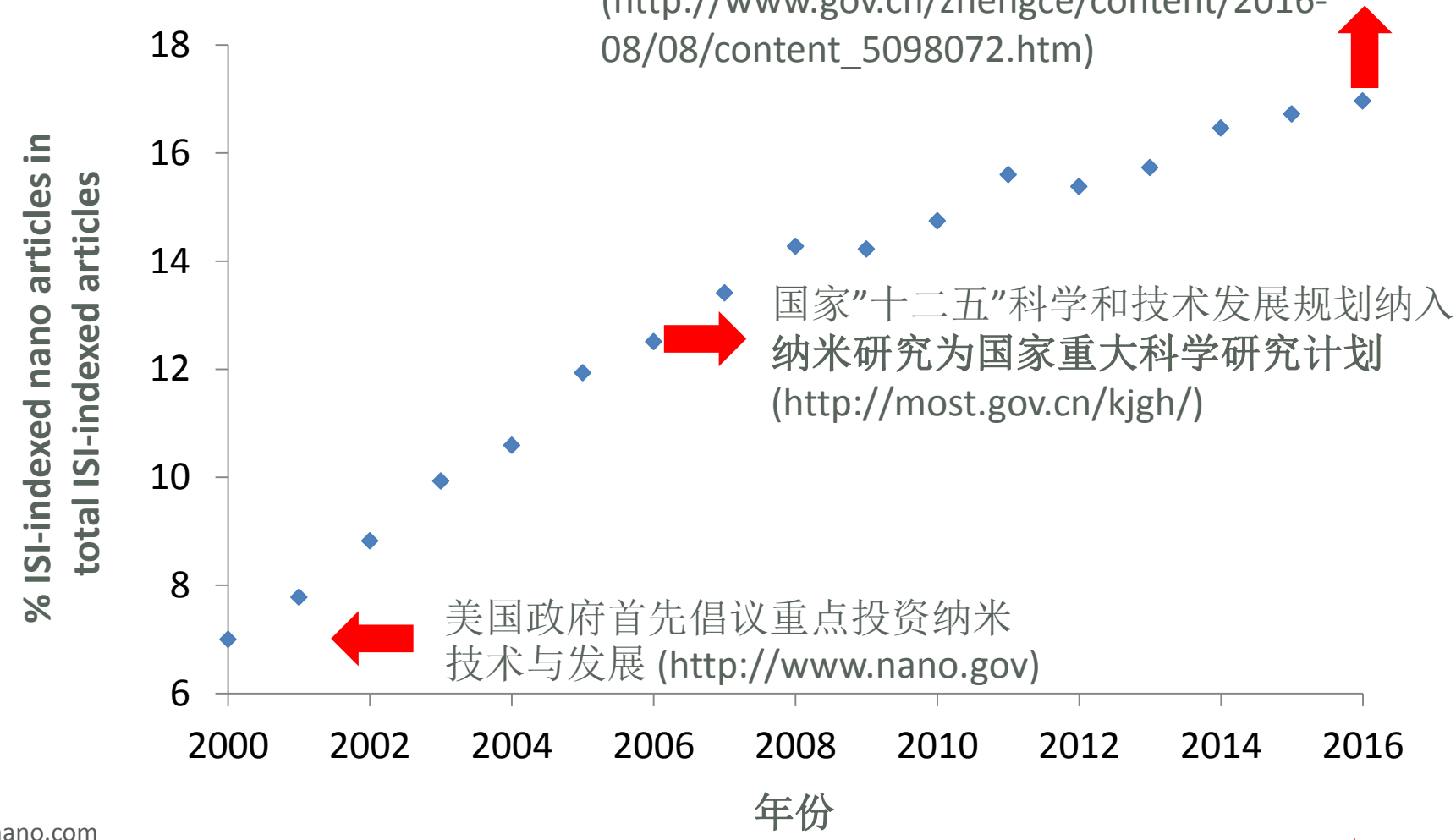
A product such as Nano can help. By collecting information from research articles and patents, it follows the definition of nanomaterials and nanodevices used by the community. Furthermore, the information is not only gathered from specific nanoscience and nanotechnology journals, such as ours or *Nano Letters*, but also from journals such as *Science*, *Angewandte Chemie International Edition* and *Advanced Materials*, to list only a few.

Nano will grow to include more comprehensive information in the future. The plan for the rest of 2016 is to include information from a larger number of journals and to keep updating the database by including information from new publications. In the meantime, the product is ready to be used and we invite you to explore its functionalities, which can be done via institutional trials at http://nano.nature.com/. ❐

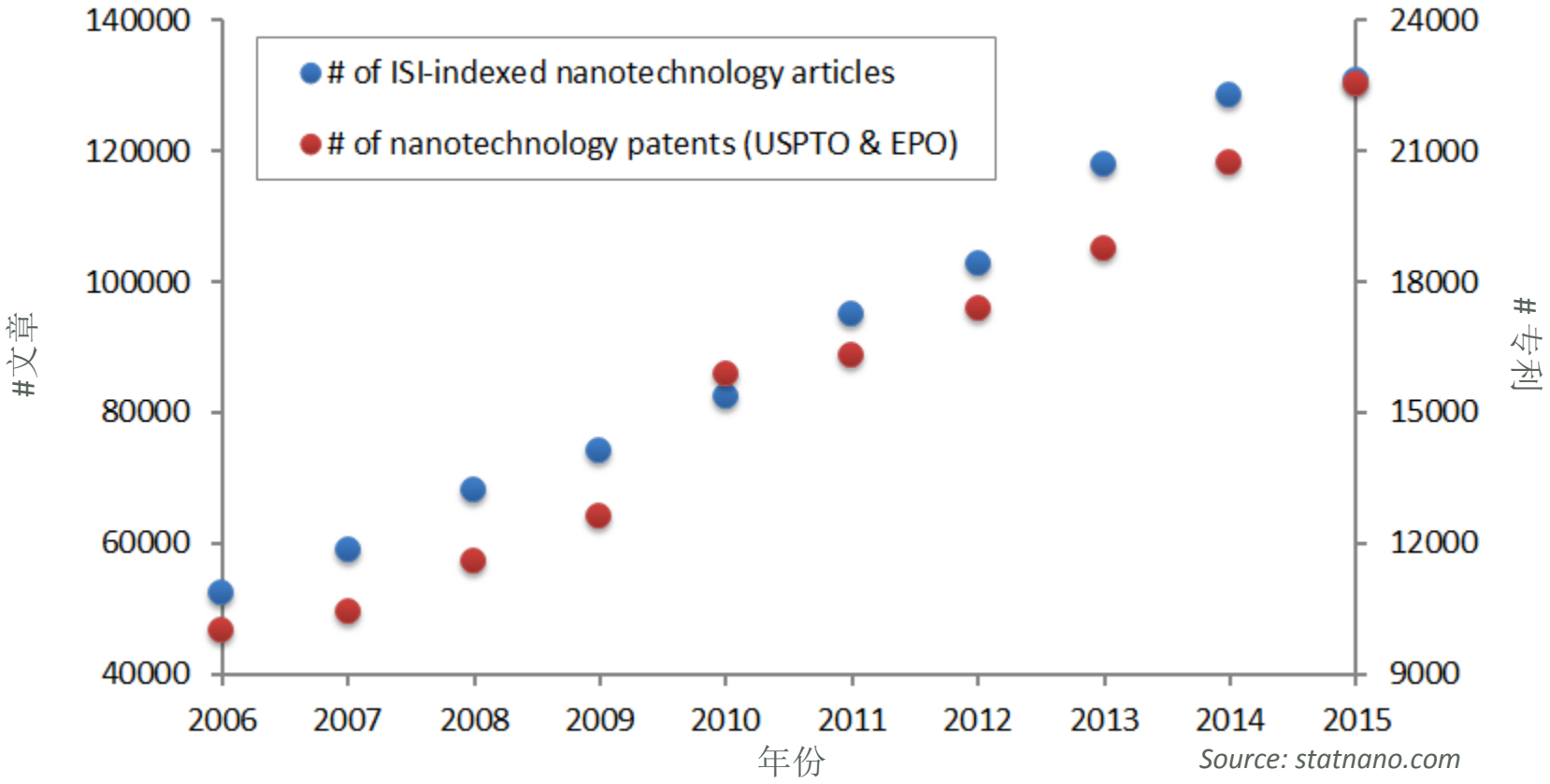
Corrected after print: 20 July 2016

纳米科技在国家战略里的重要性

国家”十三五”科技创新规划纳入**纳米研究为国家科技重大专项、重大科学突破技术及战略性前瞻性重大科学问题**
(http://www.gov.cn/zhengce/content/2016-08/08/content_5098072.htm)



纳米科学技术—飞速发展的科研领域



- 海量的信息和数据分散在各种期刊和专利之中，为了有效的管理和高效的沟通，亟需对信息进行甄别，分类以及索引。
- 对于“纳米材料”，目前并没有一个标准的术语命名。

纳米科技发展概览

FIGURE 1 | GROWTH OF NANOSCIENCE.

The total output of papers related to nanoscience and technology published in journals listed in the SCI has been growing for the past two decades.

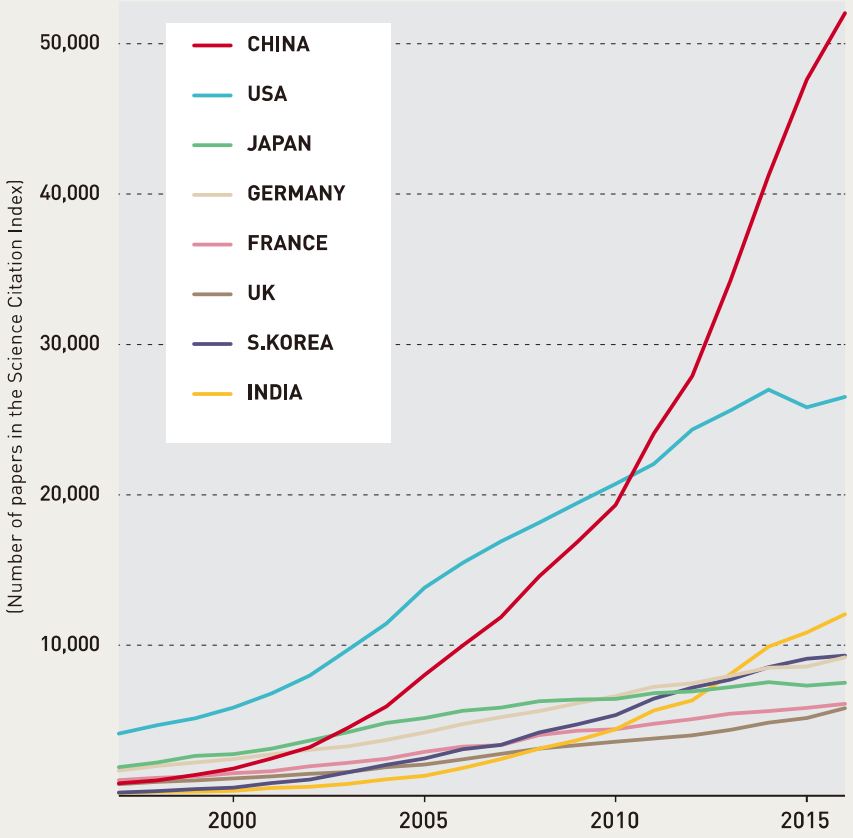
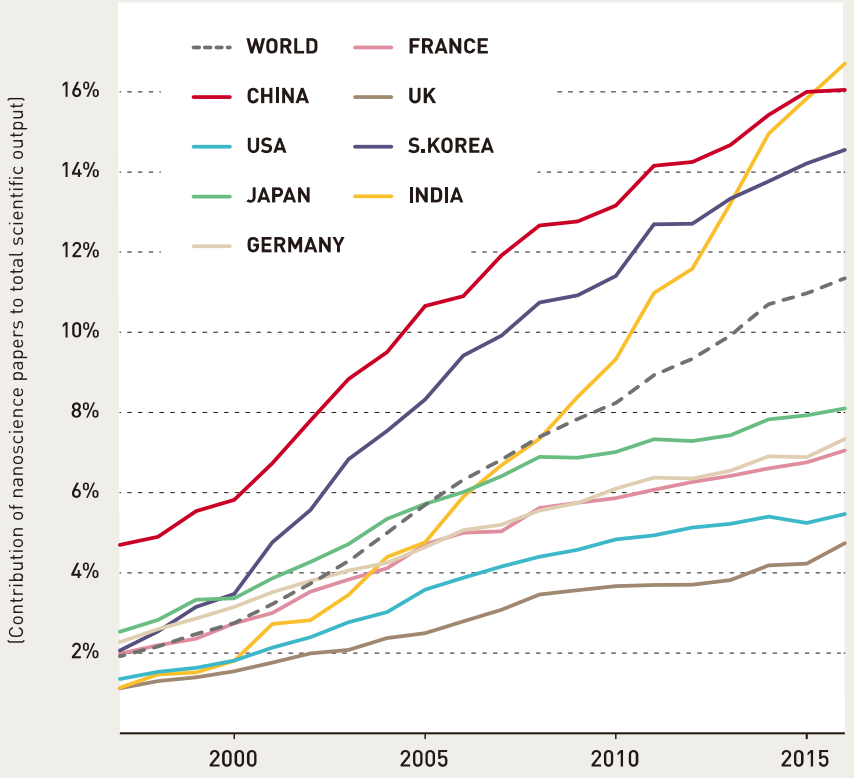


FIGURE 2 | CONTRIBUTION OF NANOSCIENCE TO TOTAL SCIENTIFIC OUTPUT.

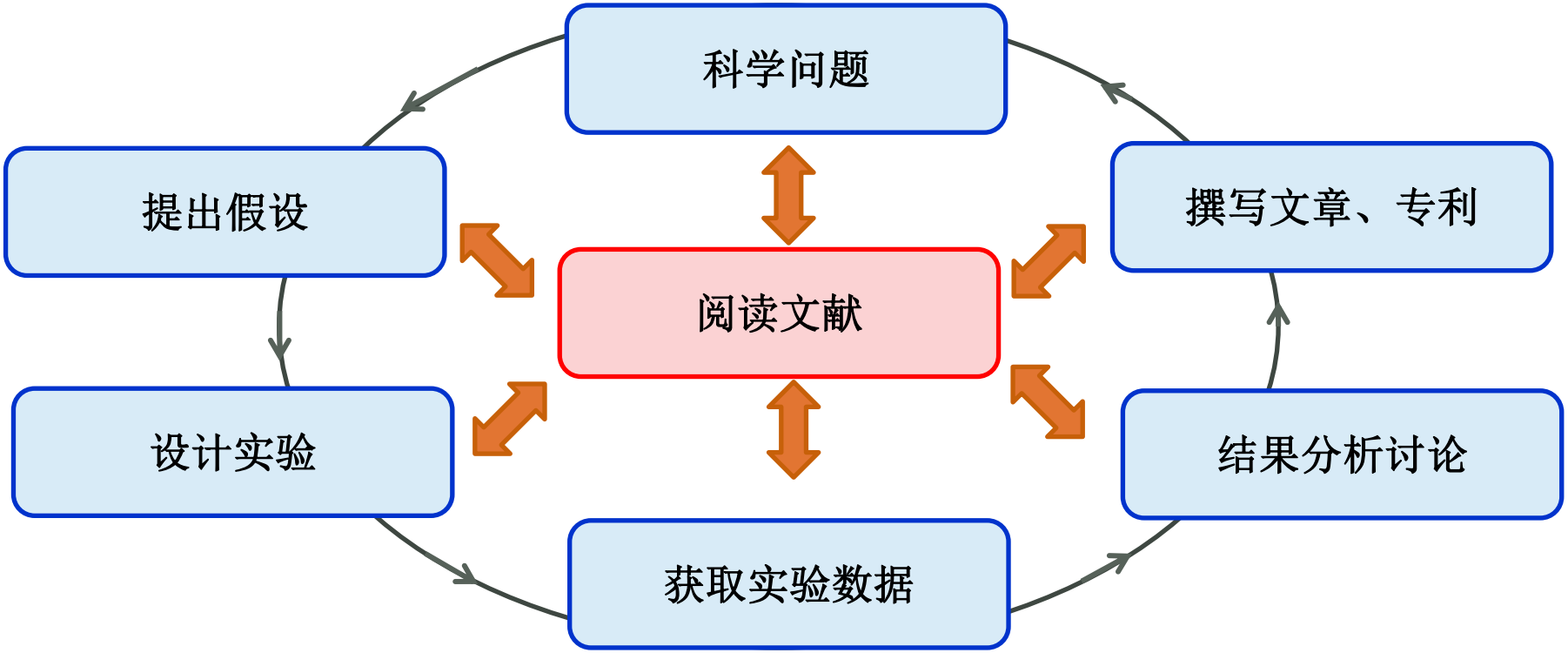
Papers related to nanoscience and technology represents an ever growing fraction of the total scientific output of most countries. For China, South Korea and India, that fraction is now well above the global average.



*中国纳米白皮书：国之大器，始于毫末

科研工作流程


建立科学问题
提出假设
设计实验
获取实验数据
结果分析讨论
撰写文章、专利
文章投稿、专利申请


科学问题
提出假设
撰写文章、专利
阅读文献
设计实验
结果分析讨论
获取实验数据

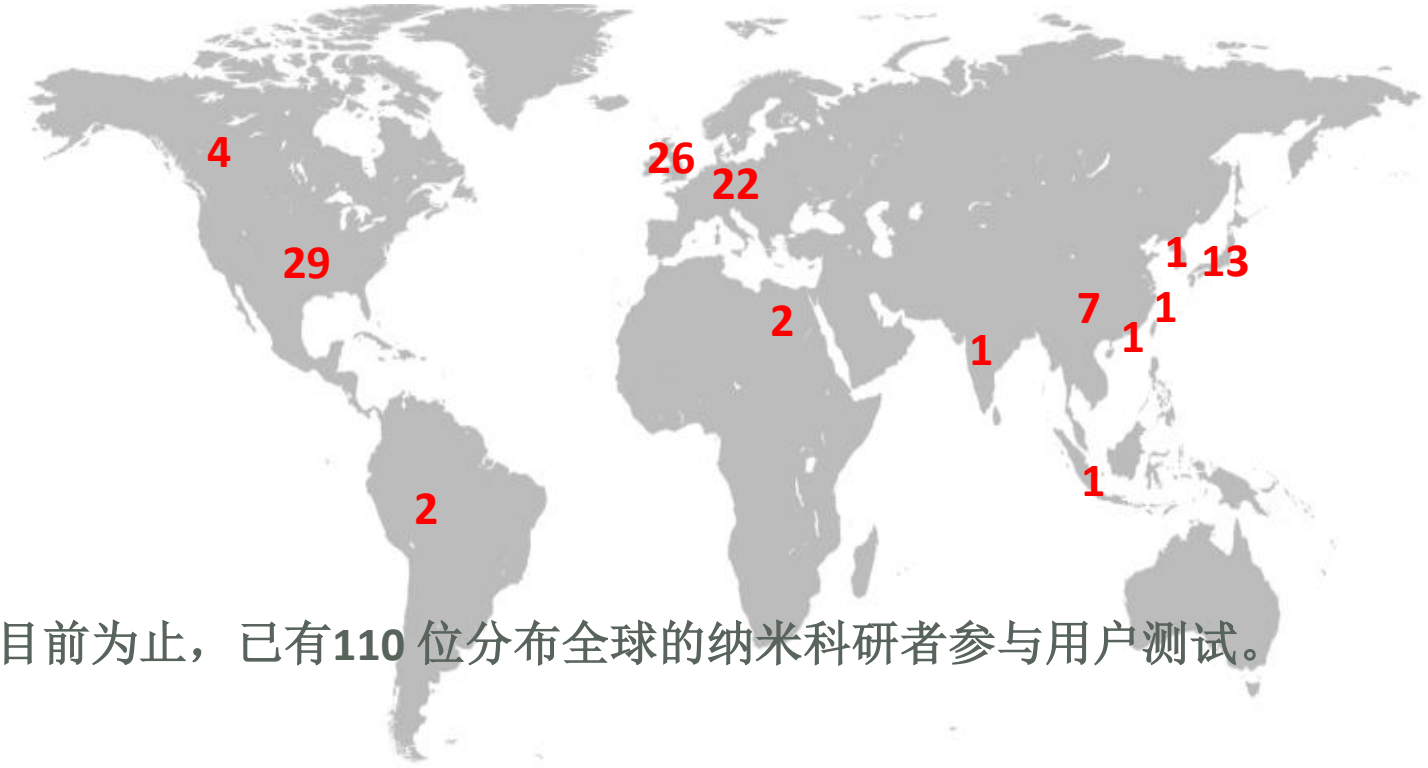
纳米领域科研人员面临的搜索难题

1. **命中率低：** 搜索结果大量不相关
2. **步骤繁琐：** 确认相关性需要进入到原文
3. **来源分散：** 相同或相似的纳米材料/器件信息分散在不同期刊
4. **缺少汇总：** 针对某些确定性能或特殊应用的纳米材料没有统一汇总表
5. **合成步骤缺少简介：** 纳米材料的合成方法和步骤的描述信息量大，阅读耗时、难以辨别与比较

Nano通过用户验证-----可靠的纳米搜索平台

- 基于218个网上访问对象和28位深入电话采访的早期市场调研结果，我们得到一致的反馈“纳米科学研究亟需一款专注于该领域的检索工具”，这让我们坚信启动了Nano项目有重大意义。
- 我们已经展开了多轮用户体验测试，来验证平台功能有效性和实用性，以确保Nano真正地为用户创造价值。与用户的互动从未止步……

i



到目前为止，已有110 位分布全球的纳米科研者参与用户测试。

Nano顾问委员会（更多在加入）

Jens Kroeger, PhD
Chief Technology Officer
Raymor industries and NanoIntegris

Juan Hinestroza, PhD
Assoc. Prof.
Cornell U.

Yanlin Song, PhD
Professor
Inst. Chem., CAS

Omid Farokhzad, MD
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Harvard Medical School

Zhiyong Tang, PhD
Prof. of Materials Chemistry
NCNST, CAS

Harald Krug, Prof.
Swiss Federal Laboratories for
Materials Science and Technology

Seeram Ramakrishna, PhD
Prof. of Faculty of
Engineering, NUS

Case study #1 – A general search

nanosheets and electrical conductivity

Articles

About 79,900 results (**0.12** sec)

Any time
Since 2017
Since 2016
Since 2013
Custom range...

Sort by relevance
Sort by date

include patents
include citations

Create alert

Synthesis of graphene-based **nanosheets** via chemical reduction of exfoliated graphite oxide
S Stankovich, DA Dikin, RD Piner, KA Kohlhaas... - carbon, 2007 - Elsevier
... Synthesis of graphene-based **nanosheets** via chemical reduction of exfoliated graphite oxide. ... By nature, GO is **electrically** insulating (see below) and thus cannot be used, without further ... Notably, it has been demonstrated that the **electrical conductivity** of GO (and presumably its ...
☆ 99 Cited by 8840 Related articles All 20 versions

Processable aqueous dispersions of graphene **nanosheets**
D Li, MB Müller, S Gilje, RB Kaner... - Nature nanotechnology, 2008 - nature.com
... work may lead to the development of a new generation of antistatic coatings that can combine **electrical conductivity** with transparency ... Synthesis of graphene-based **nanosheets** via chemical reduction of exfoliated graphite oxide. ... **Electric** field effect in atomically thin carbon films. ...
☆ 99 Cited by 6272 Related articles All 15 versions

Preparation and **electrical properties** of graphene **nanosheet**/Al 2 O 3 composites
Y Fan, L Wang, J Li, J Li, S Sun, F Chen, L Chen... - Carbon, 2010 - Elsevier
Fully dense graphene **nanosheet** (GNS)/Al2O3 composites with homogeneously distributed GNSs of thicknesses ranging from 2.5 to 20nm have been fabricated from ball milled expanded graphite and Al2O3 by spark plasma sintering. The percolation threshold of
☆ 99 Cited by 227 Related articles All 8 versions

Two-dimensional **nanosheets** produced by liquid exfoliation of layered materials
JN Coleman, M Lotya, A O'Neill, SD Bergin... - ..., 2011 - science.sciencemag.org
... Tae Kim. School of **Electrical** Engineering, Korea University, Seoul, South Korea. ... 1 Optical characterization of **nanosheet** dispersions. ... We performed transmission electron microscopy (TEM) analysis on our dispersions, typically observing 2D flakes consisting of thin **nanosheets**. ...
☆ 99 Cited by 3049 Related articles All 16 versions

Comparison of **electrical properties** between multi-walled carbon nanotube and graphene **nanosheet**/high density polyethylene composites with a segregated network ...
J Du, L Zhao, Y Zeng, L Zhang, F Li, P Liu, C Liu - Carbon, 2011 - Elsevier
Multi-walled carbon nanotube (MWCNT)/high density polyethylene (HDPE) and graphene **nanosheets** (GNS)/HDPE composites with a segregated network structure were prepared by alcohol-assisted dispersion and hot-pressing. Instead of uniform dispersion in polymer
☆ 99 Cited by 194 Related articles All 15 versions

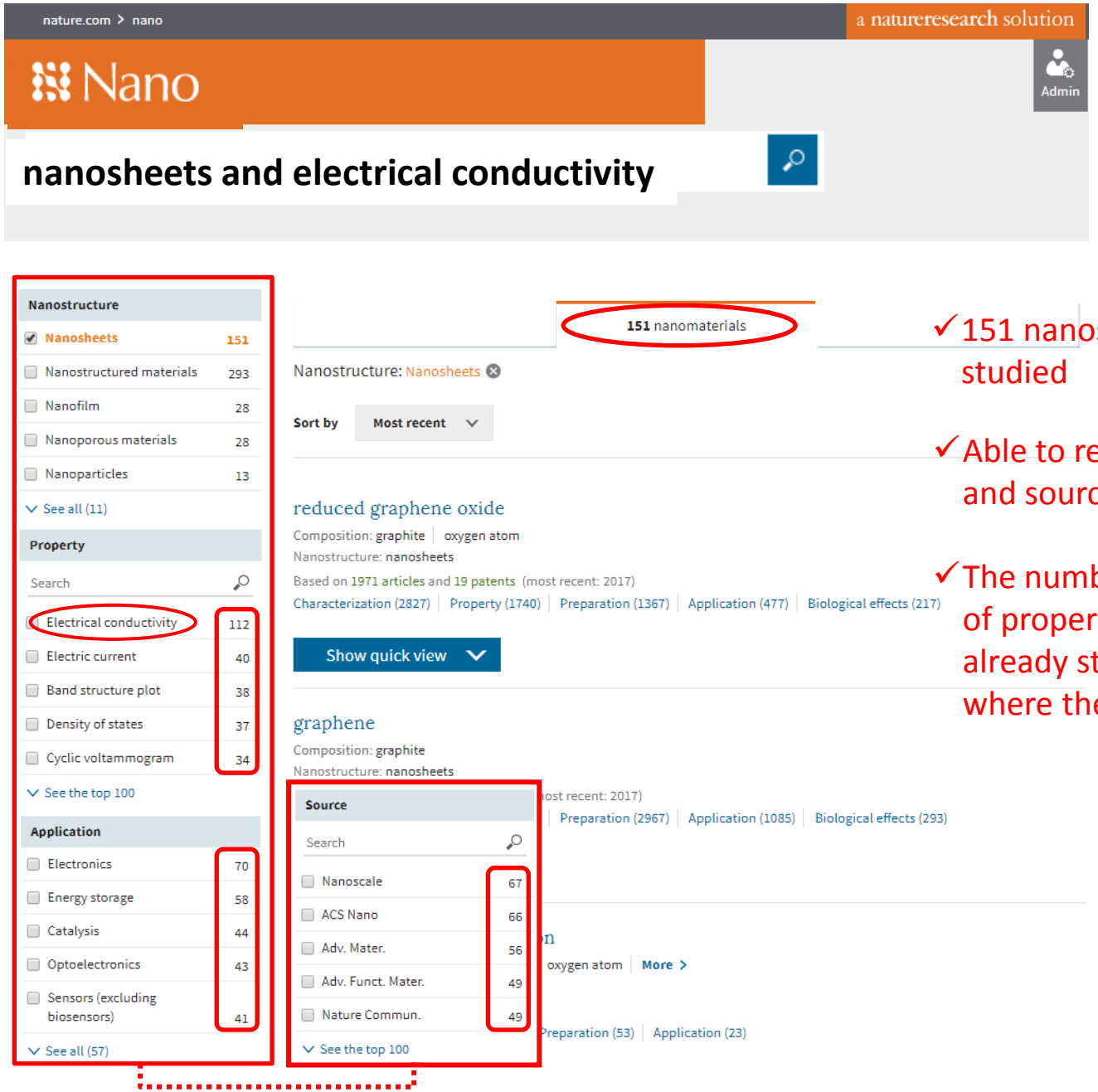
There are so much to read!!!

Are they talking about the same thing?

If not, what are the differences?

Anywhere I find a quick overview and drill down from there rather than going through these?

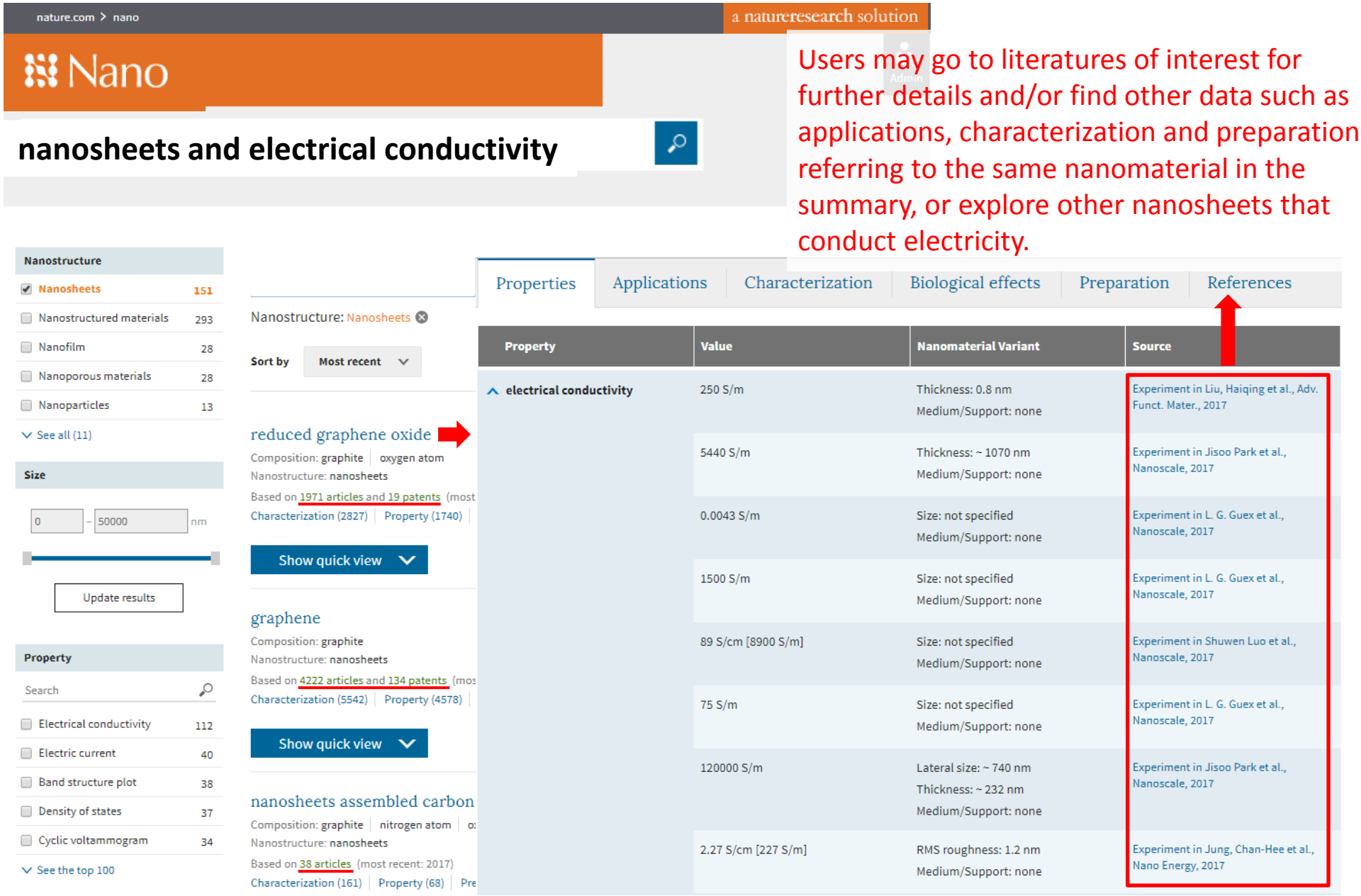
The Nano user journey for a general search



- ✓151 nanosheets with electrical conductivity studied
- ✓Able to refine by property, application and source
- ✓The numbers provide a quick overview of properties and applications that were already studied/explored, and also where these are usually published

The Nano user journey for a general search

Users may go to literatures of interest for further details and/or find other data such as applications, characterization and preparation referring to the same nanomaterial in the summary, or explore other nanosheets that conduct electricity.



Case study #2 – A specific search

discharge capacity of lithium iron phosphate nanoparticles

Articles

About 20,800 results (0.11 sec)

Fabricating genetically engineered high-power **lithium-ion** batteries using multiple virus genes

YJ Lee, H Yi, WJ Kim, K Kang, DS Yun… - …, 2009 - science.sciencemag.org

… Lithium-ion battery electrodes store and release electrical energy by insertion and extraction of Li + ions and electrons **…** has been constrained due to kinetic limitations, which result in poor charge- and **discharge**-rate capability and fading of **capacity** upon prolonged **…**

☆ 99 Cited by 573 Related articles All 12 versions

Relevancy

Nope

Nope

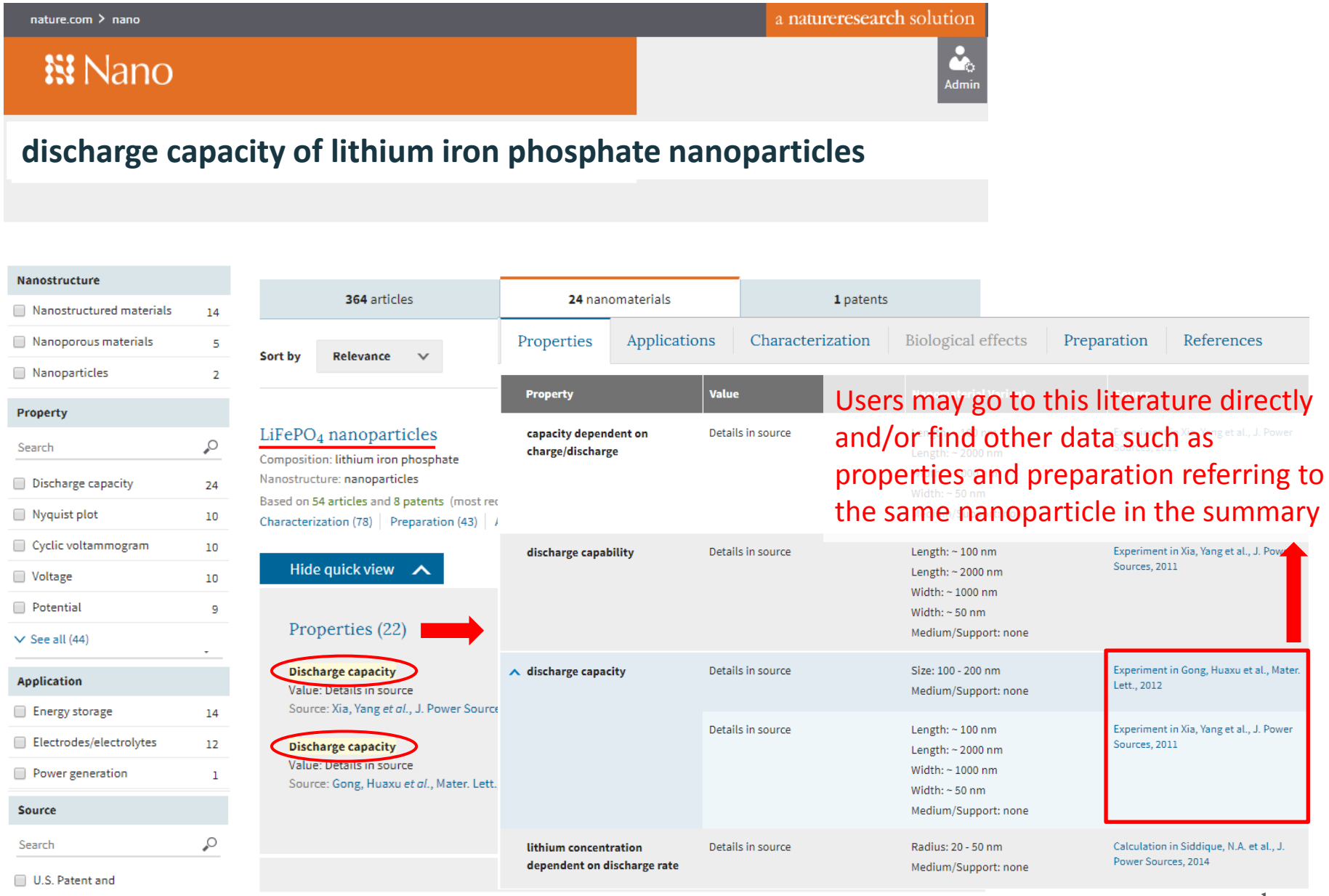
Not likely

Likely

Unsure

Not likely

The Nano user journey for a general search

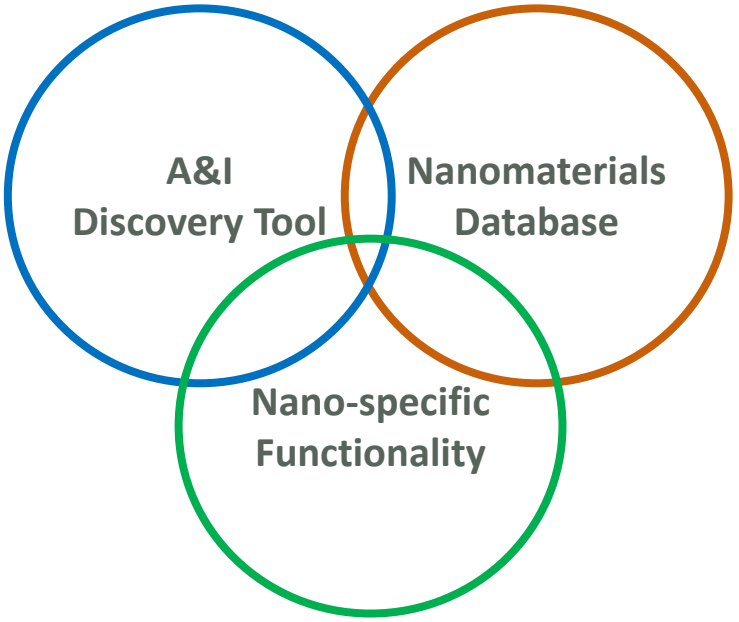


Nano

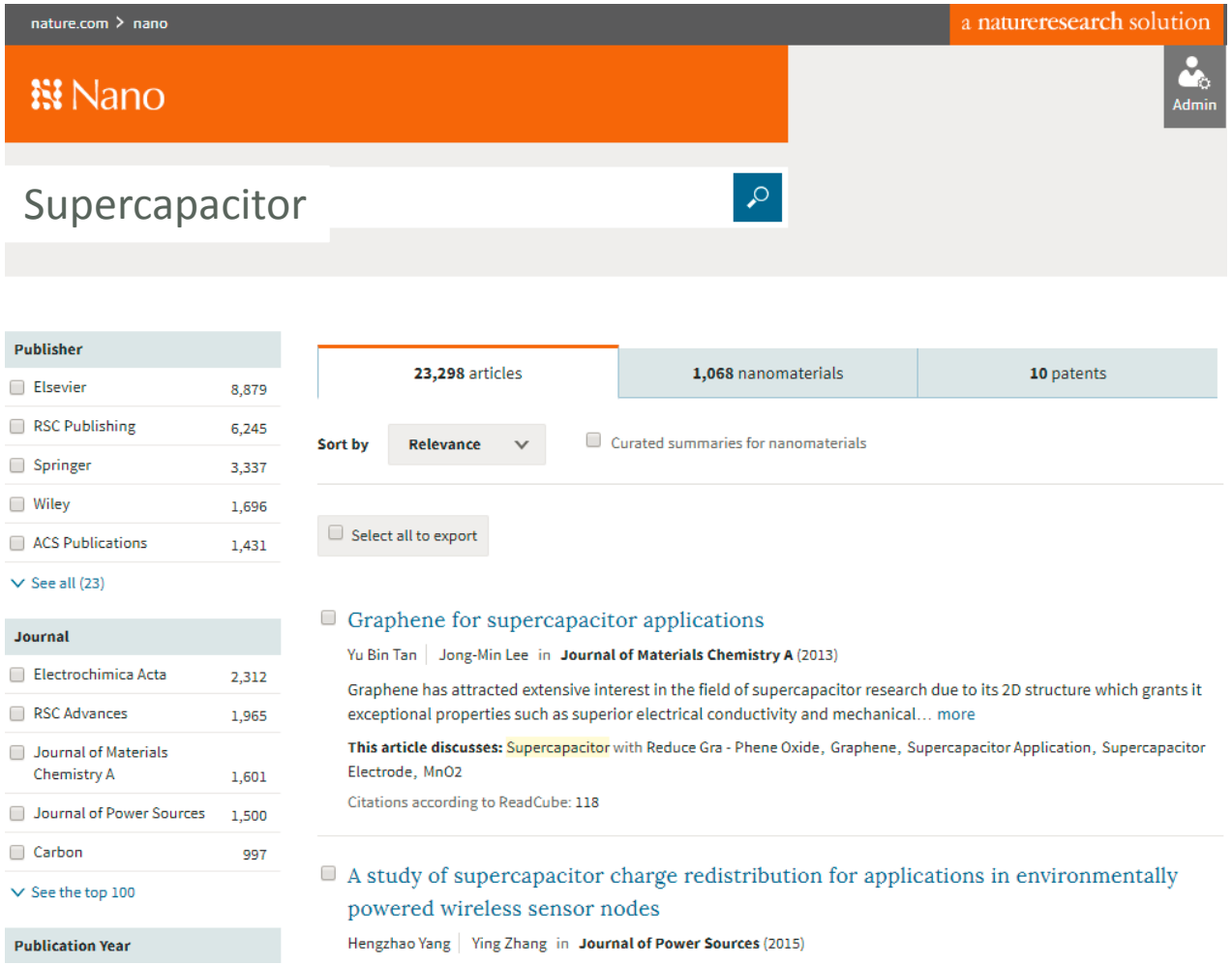
a natureresearch solution

How Nano works for you

- Advance your daily research with access to our machine-learned index of nanotechnology articles by AAAS, ACS, Elsevier, RSC, Springer Nature, Wiley and more



Centralized nanotech-related articles in one space



- **Keep up to date** without going to multiple journal websites and receiving multiple content alerts
- **Gain quick insights** including materials, properties and applications closely related to search input

Gain insight into the content that is closely related to the search input

metal oxide nanoparticles × adsorption

O2 adsorption dependent photoluminescence emission from metal oxide nanoparticles

Amir R. Gheisi | Chris Neygandhi | Andreas K. Sternig ... in **Physical Chemistry Chemical Physics** (2014)

Optical properties of metal oxide nanoparticles are subject to synthesis related defects and impurities. Using photoluminescence spectroscopy and UV diffuse reflectance in conjunction with Auger electron… more

This article discusses: Metal Oxide Nanoparticles with Metal, Nanoparticles, Oxide, Property, Annealing and Adsorption with Surface, Nanoparticles, Emission, Photoluminescence, Metal

Citations: 4

zno nanoparticles × mgo nanoparticles ×

O2 adsorption dependent photoluminescence emission from metal oxide nanoparticles

Amir R. Gheisi | Chris Neygandhi | Andreas K. Sternig ... in **Physical Chemistry Chemical Physics** (2014)

Optical properties of metal oxide nanoparticles are subject to synthesis related defects and impurities. Using photoluminescence spectroscopy and UV diffuse reflectance in conjunction with Auger electron… more

This article discusses: ZnO Nanoparticles with Nanoparticles, Annealing, Oxygen, Synthesis, Emission and MgO Nanoparticles with Nanoparticles, Annealing, Surface, Photoluminescence, Adsorption

Citations: 4

Insights from the same article could be different based on the search inputs

Quick overview of nanomaterial data curated from multiple literatures - Properties

gold nanoparticles

Composition: gold

Nanostructure: nanoparticles

Based on 3710 articles and 113 patents (most recent: 2017)

Characterization (3432) | Preparation (2451) | Property (1871) | Application (871) | Biological effects (724)

Properties

Search for a property

General physical and chemical properties

Property	Value	Nanomaterial Variant	Source
1,4-aminothiophenol detection analytical enhancement factor	Details in source	Size: 30 - 60 nm Tip size: 20 nm Medium: water Support: none	Experiment in Boris Khlebtsov et al., J. Nanopart. Res., 2014
1,4-aminothiophenol detection limit	Details in source	Core size: 100 nm Size: 130 - 170 nm Tip size: 30 nm Medium: water Support: none	Experiment in Boris Khlebtsov et al., J. Nanopart. Res., 2014
100/111 surface energy ratio	Details in source	Size: 1 - 2 nm Medium/Support: none	Calculation in Almora-Barrios, Neyvis et al., Nano Lett., 2014
110/111 surface energy ratio	Details in source	Size: 1 - 2 nm Medium/Support: none	Calculation in Almora-Barrios, Neyvis et al., Nano Lett., 2014
absorbance	Details in source	Diameter: ~ 15.11 - 29.67 nm Medium: water Support: none	Experiment in Duy, Janice et al., J. Nanopart. Res., 2010

Quick overview of nanomaterial data reported in multiple literatures - Applications

gold nanoparticles

Composition: gold

Nanostructure: nanoparticles

Based on 3710 articles and 113 patents (most recent: 2017)

Characterization (3432) | Preparation (2451) | Property (1871) | Application (871) | Biological effects (724)

Applications

Search for an application area

Area	Application	Nanomaterial Variant	Source
agrochemicals	Gloriosa superba seed germination	Size: 5 - 50 nm Medium: Terminalia arjuna extract Support: none	Confirmed in K. Gopinath et al., J. Nanostruct. Chem., 2014
analysis methods	substrate for surface-enhanced Raman scattering (SERS)	Diameter: 39.5 - 75.5 nm Medium/Support: none	Confirmed in Tian, Shu et al., Nano Lett., 2017
catalysis	interfacial catalytic reactions	Core diameter: 65 nm Diameter: ~ 75 nm Spine bottom diameter: 15 nm Spine length: 5 nm Spine top diameter: 5 nm Medium/Support: none	Confirmed in Dan Wang et al., Nanoscale, 2017
coatings	plasmonic substrate	Diameter: 20 - 40 nm Interparticle distance: 5 - 10 nm Medium/Support: none	Confirmed in Lin, Linhan et al., ACS Nano, 2016
cosmetics/sunscreens/lotions	cosmetology	Size: not specified Medium: hydrogen chloride aqueous solution Support: none	Proposed in Anna Dzimitrowicz et al., J. Nanopart. Res., 2015

Quick overview of nanomaterial data reported in multiple literatures - Characterization methods

gold nanoparticles

Composition: gold

Nanostructure: nanoparticles

Based on 3710 articles and 113 patents (most recent: 2017)

Characterization (3432) | Preparation (2451) | Property (1871) | Application (871) | Biological effects (724)

Characterization

Search for a method

Method	Nanomaterial Variant	Source
alternating current	Diameter: ~ 20 nm Medium/Support: none	Experiment in Johannes Walter et al., Nanoscale, 2015
Analytical centrifugation	Diameter: ~ 20 nm Medium/Support: none	Experiment in Johannes Walter et al., Nanoscale, 2015
atomic absorption spectroscopy	Radius: 5 nm Medium/Support: none	Calculation in Yu Luo et al., Proc. Natl. Acad. Sci. USA, 2014
atomic force microscopy	Size: ~ 20 nm Medium/Support: none	Experiment in Satish K. Tuteja et al., Nanoscale, 2017
cathodoluminescence spectroscopy	Edge: 50 nm Thickness: 50 nm Medium/Support: none	Calculation in Losquin, Arthur et al., Nano Lett., 2015

Quick overview of nanomaterial data reported in multiple literatures - Toxicity and biological effects

gold nanoparticles

Composition: gold

Nanostructure: nanoparticles

Based on 3710 articles and 113 patents (most recent: 2017)

Characterization (3432) | Preparation (2451) | Property (1871) | Application (871) | Biological effects (724)

Biological effects

Search for a biological system

Biological system	Test details	Nanomaterial Variant	Source
3-D mouse kidney proximal tubule culture	nontoxic	Size: not specified Medium/Support: none	Astashkina, Anna I. et al., Biomaterials, 2014
3T3-L1 cells	noncytotoxic	Diameter: 25 nm Medium/Support: none	Park, Hyejin et al., Biomaterials, 2014
4T1 cells	noncytotoxic	Diameter: 80 nm Medium/Support: none	Liu, Zhen et al., Biomaterials, 2014
4T1 tumor-bearing athymic female BALB/c nude mouse	no effect on body weight, intravenous (iv)	Size: not specified Medium/Support: none	Du, Yang et al., Adv. Mater., 2016
4T1-fLuc tumor cells	cytotoxic upon NIR laser irradiation	Size: not specified Medium/Support: none	Du, Yang et al., Adv. Mater., 2016

Quick overview of nanomaterial data reported in multiple literatures - Preparation

gold nanoparticles

Composition: gold

Nanostructure: nanoparticles

Based on 3710 articles and 11

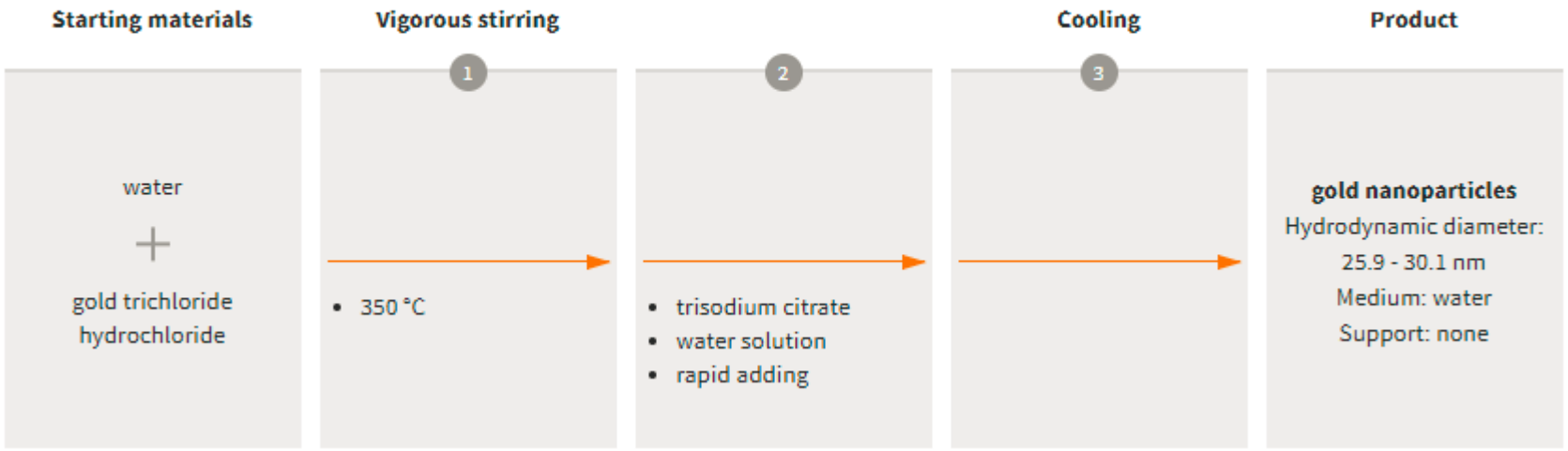
Characterization (3432) | Pre

4.2. Synthesis of gold nanoparticles

AuNPs (20 ± 3 nm; Fig. S12B†) were prepared with the sodium citrate method.[43,48] $HAuCl_4$ (1.25 mL, 4 g L^{-1}) was added into 48.75 mL of ultrapure water with vigorous stirring, and boiled at a high temperature (350 °C). After several minutes, freshly prepared aqueous trisodium citrate solution (1.2 mL, 10 mg mL^{-1}) was added rapidly. After the color of the solution had stabilized, the reaction solution was cooled to room temperature and then stored at 4 °C.

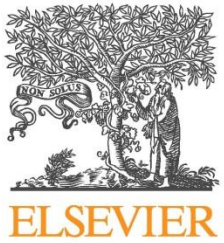
Preparation

Type: Chemical synthesis **Source:** Aihua Qu et al., Nanoscale, 2017



数据来源：业内专家精选的权威期刊

- *ACS Nano,* ACS
- *Advanced Energy Materials,* Wiley
- *Advanced Materials,* Wiley
- *Angewandte Chemie International Edition,* Wiley
- *Biomaterials,* Elsevier
- *Chemistry of Materials,* ACS
- *Journal of the American Chemical Society,* ACS
- *Nano Energy,* Elsevier
- *Nanomedicine: Nanotechnology, Biology and Medicine,* Elsevier
- *Nano Letters,* ACS
- *Nanoscale,* RSC
- *Nanotoxicology,* Taylor & Francis
- *Nature,* Nature Research
- *Nature Materials,* Nature Research
- *Nature Nanotechnology,* Nature Research
- *Proceedings of the National Academy of Sciences of the United States of America, PNAS*
- *Science,* AAAS
- *Small,* Wiley



中国纳米科学与技术发展状况概览

施普林格•自然集团、国家纳米科学中心、中国科学院文献情报中心共同合作，编制了中国纳米白皮书，从高水平文献发表、专利申请、重点发展领域分布、国际合作网络等视角，运用大数据分析和可视化方法，综合专家解读和意见，科学详实地揭示出近年来中国和世界纳米科技的发展态势。文章定性分析与定量分析相结合，主观判断与客观数据相印证。该报告，一方面，让我们看到了过去二十年，纳米科技在世界范围得到了很大的发展，对人类社会生活进步产生了巨大影响；另一方面，我们也看到相关领域的变迁和影响。

中国科学院文献情报中心（国家科学图书馆）
National Science Library, Chinese Academy of Sciences

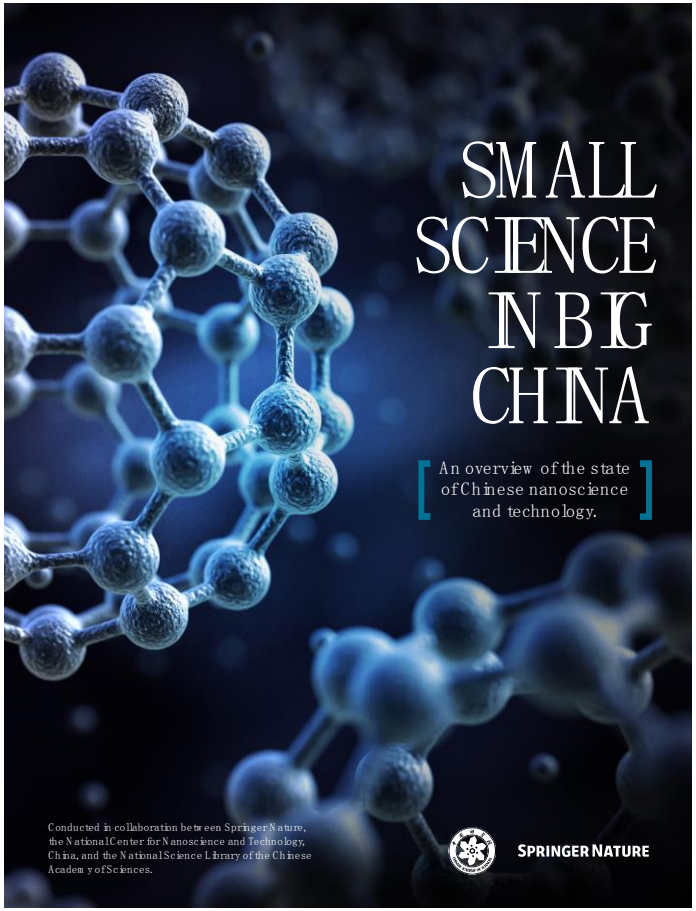
国家纳米科学中心
National Center for Nanoscience and Technology

SPRINGER NATURE

nature research

中国纳米科学与技术发展状况概览

Link for the English version of the White Paper,
https://www.nature.com/press_releases/small_science_in_big_china_-_en.pdf
中文下载链接,
https://www.nature.com/press_releases/small_science_in_big_china_-_ch.pdf



中国科学院文献情报中心(国家科学图书馆)
National Science Library, Chinese Academy of Sciences

国家纳米科学中心
National Center for Nanoscience and Technology

SPRINGER NATURE

谢谢！

更多信息，请访问: nano.nature.com.

更多问题：

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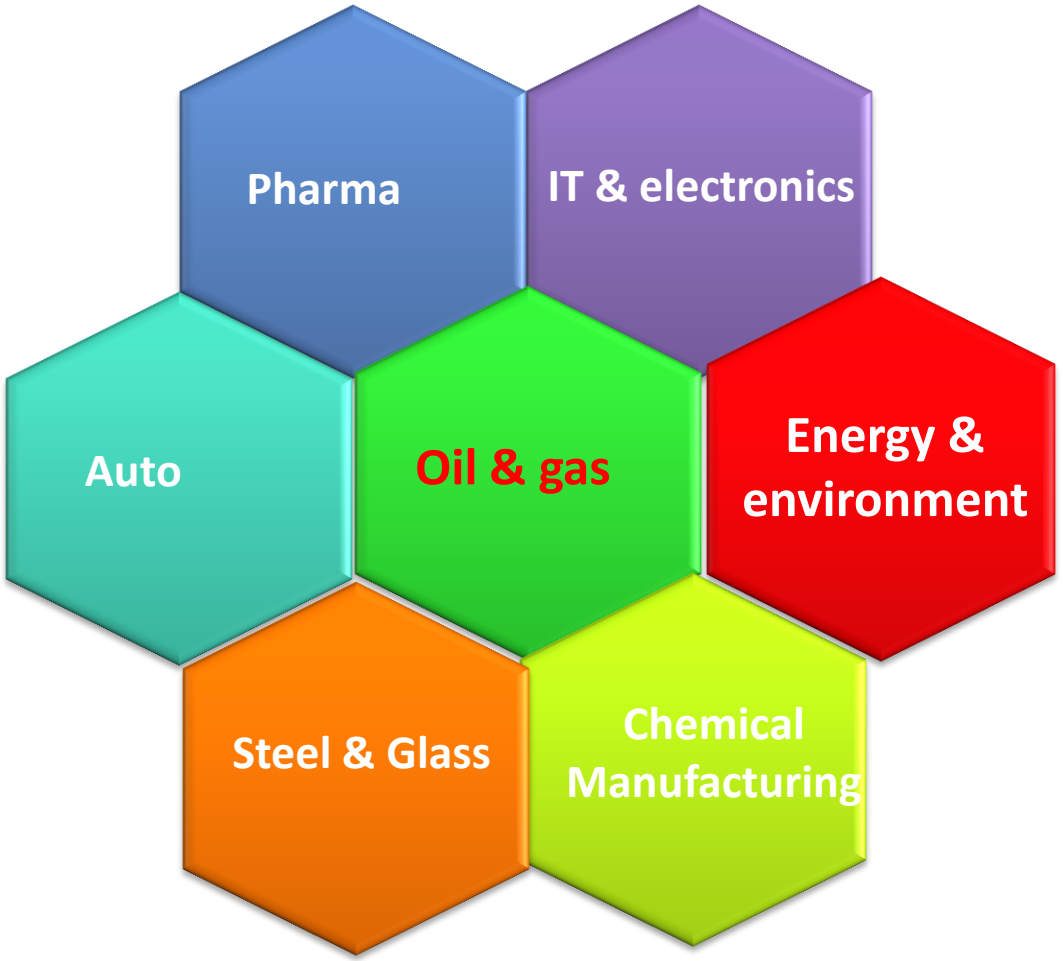
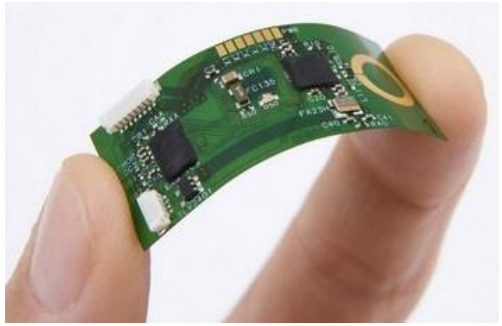
nature research

Nanotech Applications in Multi-industries

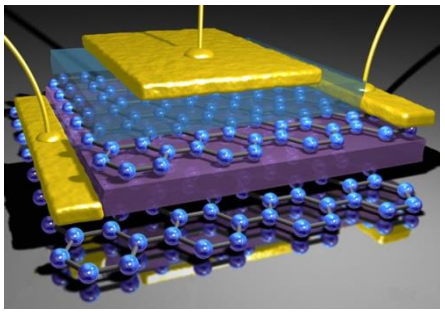


Nanotech for IT and electronics

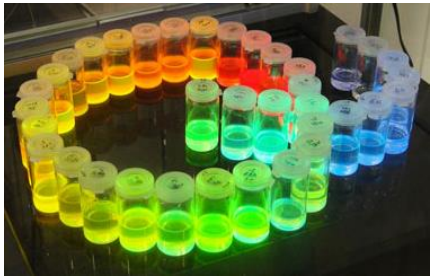
nature research



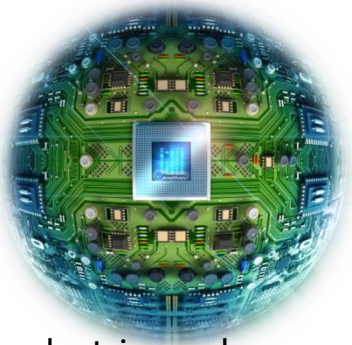
- Si nanophotonics components into CMOS
- CdSe nanocrystals flexible circuits



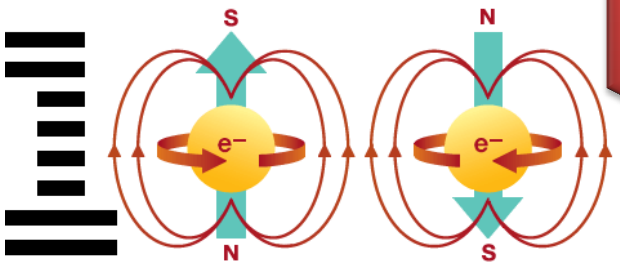
- Molecular-sized transistors
- Graphene transistor



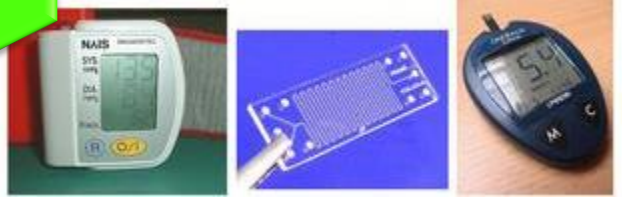
- Nanoemmissive display panel
- Quantum dots display panel



- Magnetoelectric random access memory
- Nanotube-Based Nonvolatile Random Access Memory



- Magnetic quantum dots in spintronics
- GaAs spintronics



- DNA biosensors
- Thermal and piezoelectric biosensors

Flexible/ Integrated Circuits

Transistors

Light/Display

Nanotech in Electronics Industry

New Memories

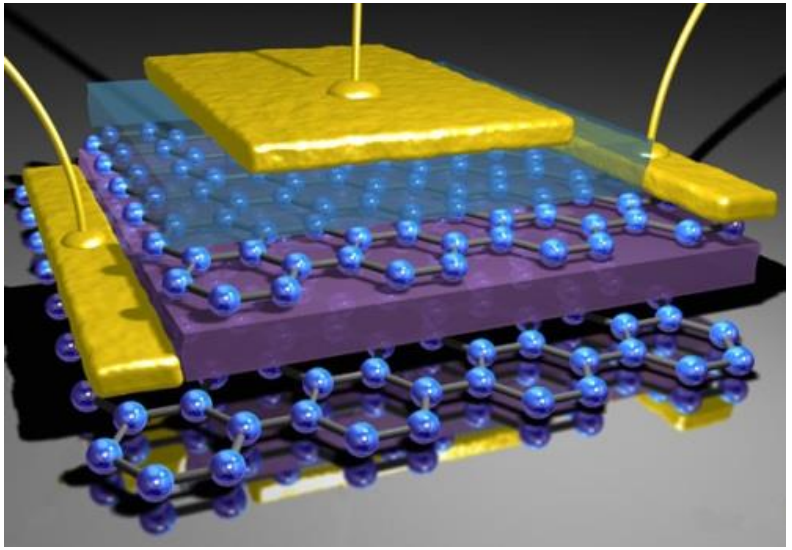
Spintronics

Biosensors

Case study
#1 – A general search

Graphene transistor

search query:
Graphene transistor
https://nano.nature.com/search?workflow=article&term=freeText%3A%22Graphene+transistor%22&new-search=true



nature.com > nano

Nano

a natureresearch solution

Graphene transistor

Publisher

- ACS Publications 565
- RSC Publishing 130
- NPG 111
- Wiley 103
- Springer 99

See all (20)

Journal

- ACS Nano 390
- Nano Letters 144
- Nanoscale 60
- Nano Research 59
- Advanced Materials 45

See all (84)

Publication Year

- 2015 205
- 2014 204
- 2016 188

1,224 articles | **897** nanomaterials | **7** patents

Sort by Relevance

Curated summaries for nanomaterials

Select all to export

- **Gain quick insights** including materials, properties and applications closely related to search input

Enhanced performance of graphene transistor with ion-gel top gate

Junku Liu | Qingkai Qian | Yuan Zou ... in **Carbon** (2013)

High-efficiency dielectrics are promising materials that may enable nanoelectronic devices, such as carbon nanotubes and graphene transistors, to reach their performance limits. A high current on/off ratio,... more

This article discusses: Graphene Transistor with Ion-gel Dielectric, Current Saturation, Current On/off Ratio, Top Gate, Chemical Vapor Deposition Graphene Transistor

Citations: 7

Curated summaries for nanomaterials

discussing: applications | properties | preparations | toxicity...

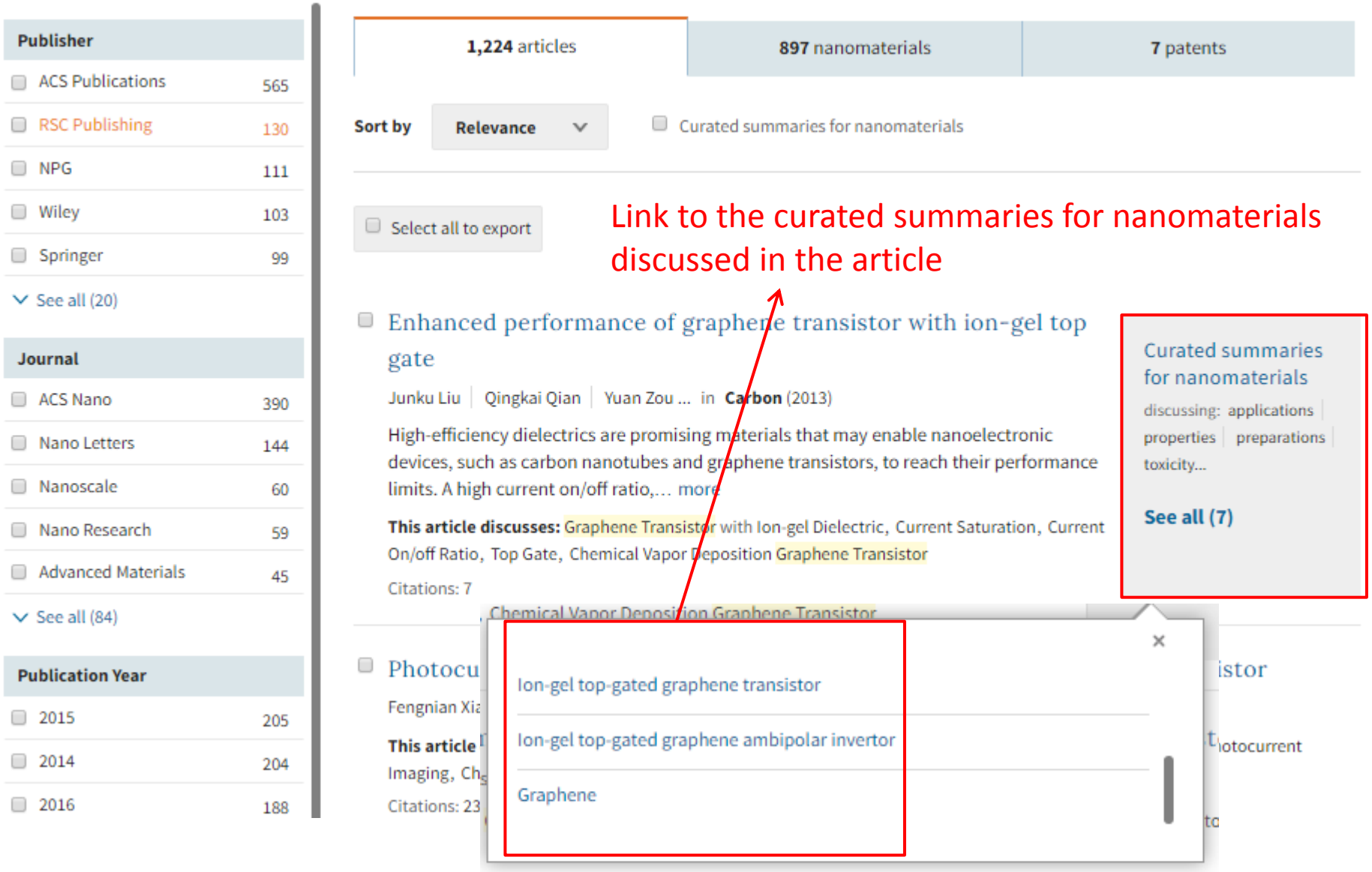
See all (7)

Photocurrent Imaging and Efficient Photon Detection in a Graphene Transistor

Fengnian Xia | Thomas Mueller | Roksana Golizadeh-Mojarad ... in **Nano Letters** (2009)

This article discusses: Graphene Transistor with Photocurrent, Gate Bias, Photocurrent Imaging, Scanning Photocurrent Imaging, Channel

Citations: 237


Publisher
ACS Publications 565
RSC Publishing 130
NPG 111
Wiley 103
Springer 99
See all (20)
Journal
ACS Nano 390
Nano Letters 144
Nanoscale 60
Nano Research 59
Advanced Materials 45
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Link to the curated summaries for nanomaterials discussed in the article
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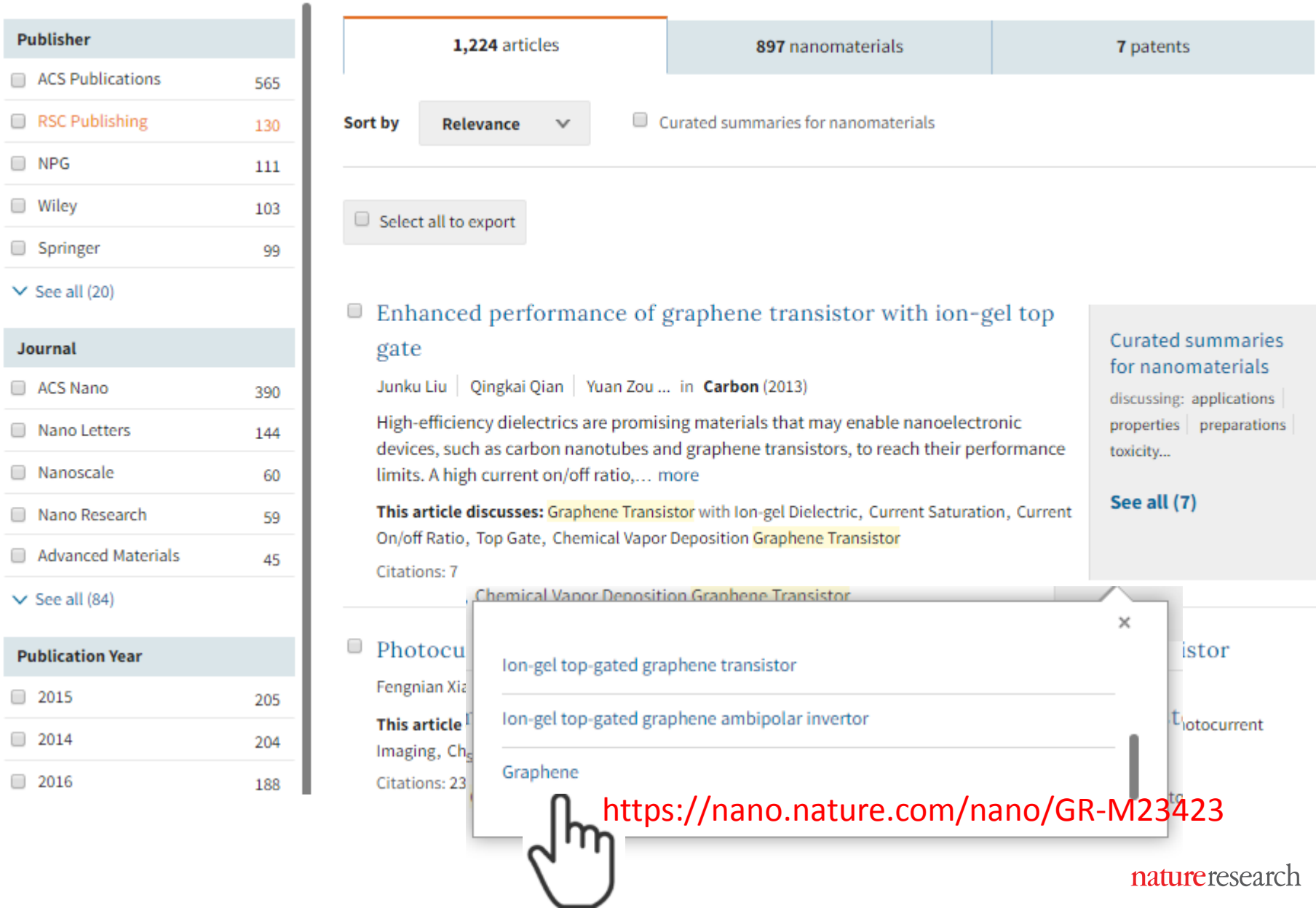
discussing: applications | properties | preparations | toxicity...
See all (7)
Chemical Vapor Deposition Graphene Transistor
Ion-gel top-gated graphene transistor
Ion-gel top-gated graphene ambipolar invertor
Graphene
Photocu
istor
Fengnian Xia
This article
Imaging, Ch
otocurrent
Citations: 23


Publisher
ACS Publications 565
RSC Publishing 130
NPG 111
Wiley 103
Springer 99
See all (20)
Journal
ACS Nano 390
Nano Letters 144
Nanoscale 60
Nano Research 59
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Citations: 7
Curated summaries for nanomaterials
discussing: applications | properties | preparations | toxicity...
See all (7)
Chemical Vapor Deposition Graphene Transistor
Ion-gel top-gated graphene transistor
Ion-gel top-gated graphene ambipolar invertor
Graphene
https://nano.nature.com/nano/GR-M23423
nature research

graphene From 3631 articles and patents

Nanostructure	Size	Experimentally confirmed?
nanosheets	–	Yes

Summary

from 3631 articles and patents

Properties | Characterization | Toxicity and other biological effects | Preparation | Applications | Patent claims | References

Applications

Application	Area	Specific application	Experimentally confirmed	Source
field effect transistor layer	electronics	–	yes	Pawan Kumar Srivastava and Subhasis Ghosh 2015
field effect transistor material	electronics	–	yes	S. J. Zhang *et al.* 2016 Junjie Shi *et al.* 2015
field electron emission devices	tools/devices	–	no	Bertóti, Imre *et al.* 2015
field-effect transistor (FET) channel material	electronics	–	yes	Voiry, Damien *et al.* 2016
field-effect transistor channel layer	electronics	–	no	Nikolai Dontschuk *et al.* 2015
field-effect transistors	electronics	channel layer	no	Ago, Hiroki *et al.* 2016
field-effect transistors	electronics	channel material	no	Jae Hoon Bong *et al.* 2014
field-effect transistors	electronics	connecting electrodes and channel	yes	Chuang, Hsun-Jen *et al.* 2014
field-effect transistors	electronics	conducting layer	yes	Kim, Sung-Soo *et al.* 2015

esearch

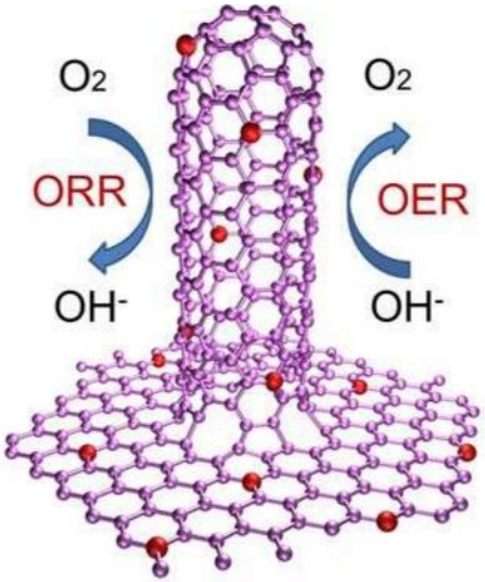
Nanotech for Chemical Manufacturing

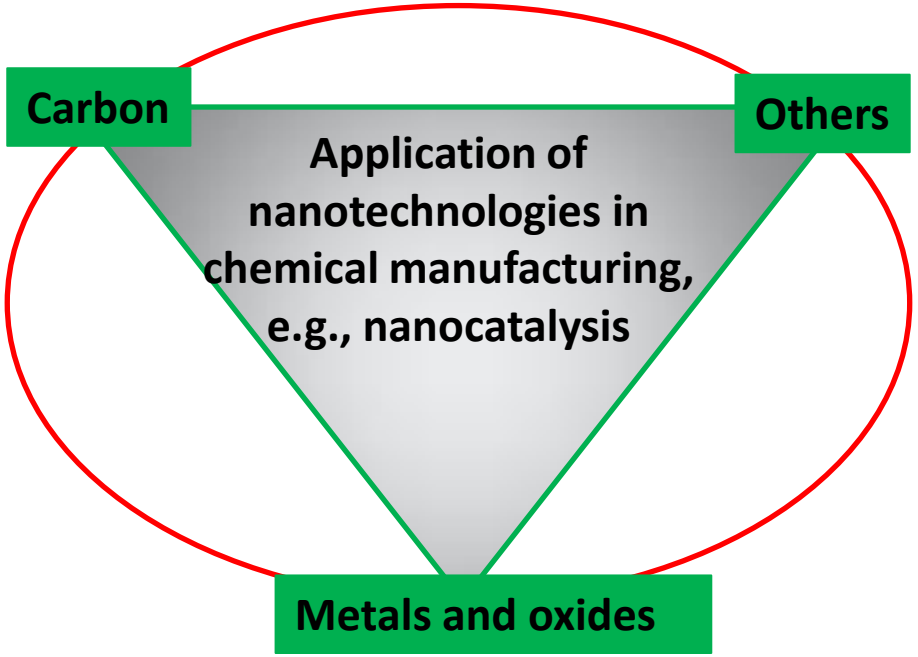
nature research

Nanotechnologies in Chemical Manufacturing[2]

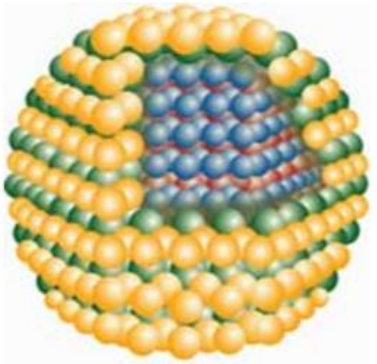
A key objective of nanocatalysis research is to produce catalysts with 100% selectivity, extremely high activity, low energy consumption, and long lifetime.

Rational hybridization of **N-doped graphene/carbon nanotubes** for oxygen reduction and oxygen evolution reaction





Core-shell Evido



- Nanocrystals
- 2-10 nm diameter
- semiconductors

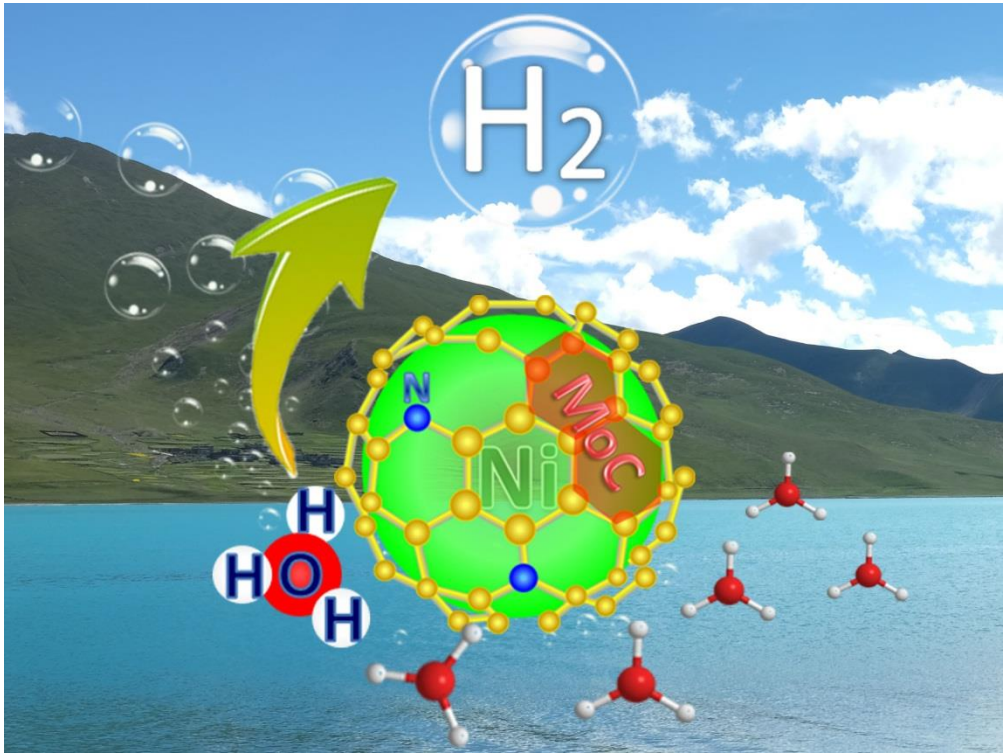
Recent development of using the **traditional noble metals in their nano forms** as nanocatalysts in the reduction of nitroarenes

[2]Nanocatalysis: Applications in the chemical industry, http://www.nanowerk.com/.

Case study
#1 – A general search

The catalysis of nickel nanoparticle

search query:
Nickel nanoparticle catalysis
https://nano.nature.com/search?workflow=nanoObject&term=Nickel+nanoparticle+catalysis&new-search=true



Found summary below and was satisfied:

Results for "Nickel nanoparticle catalysis"

Nanomaterial or Nanodevice

- Nanomaterial 991
- Nanodevice 3

Nanostructure

- Nanostructured materials 515
- Nanoparticles 232
- Nanoporous materials 71
- Nanosheets 53
- Multi-walled carbon nanotube 31

See all (16)

Size

0 – 50000 nm

Update results

Property

Articles and Patents (1,153) | **Nanomaterials and Nanodevices** (994)

Sort by Relevance

https://nano.nature.com/nano/GR-M69647

Nanomaterial

nickel nanoparticles

Composition: nickel
Nanostructure: nanoparticles
Found: nickel nanoparticles
Based on 200 articles and 47 patents (most recent: 2016)

View more details »

Nanomaterial

nickel nanoparticles

Composition: nickel
Nanostructure: nanoparticles | Diameter: 30 - 100 nm
Found: nickel nanoparticles
Based on 77 articles and 5 patents (most recent: 2016)

View more details »

Nanomaterial

nickel nanoparticles

Composition: nickel

Properties

nickel nanoparticles

Table of contents

Catalytic properties

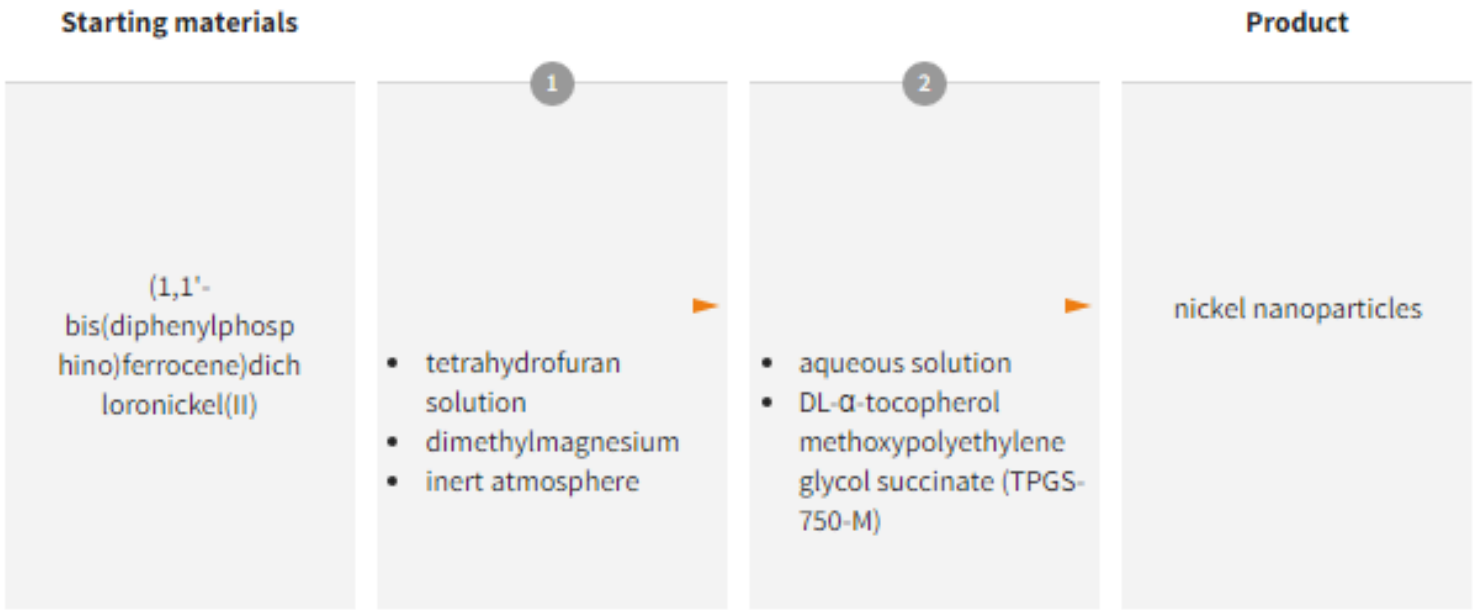
View as table View as list

Reaction	Characteristics studied	Reaction catalysis	Rate constant	Reaction order	Dependent on	Source
4-Nitrophenol reduction	catalytic activity	catalyzed by the nanomaterial	0.0007 s^{-1} [0.042 min^{-1}]	pseudo first order	–	Tian, Ye *et al.* 2015
aryl ether hydrogenation	productivity product selectivity	catalyzed by the nanomaterial	–	–	–	Molinari, Valerio *et al.* 2014
carbon nanotube cutting	activation energy	catalyzed by the nanomaterial	–	–	–	Irina V. Lebedeva *et al.* 2014
electrochemical hydrogen evolution reaction	catalytic activity	catalyzed by the nanomaterial	–	–	–	Wang, Xueqin *et al.* 2015
hydrolysis reaction of ammonia borane	turnover frequency	catalyzed by the nanomaterial	–	–	–	Guanqi Zhao *et al.* 2015

Synthesis

Method 1

Type: Chemical synthesis **Source:** Handa, Sachin *et al.* 2015 (*Angew. Chem., Int. Ed.*)

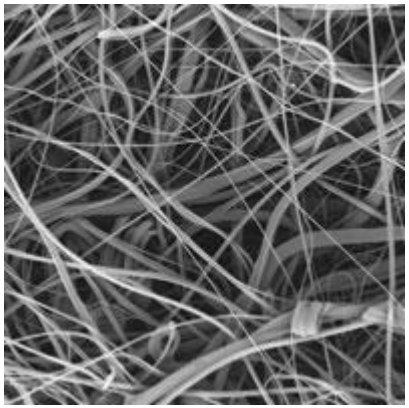


Nanotech for Auto

nature research

Nanotechnologies in Automotives[1]

Nanofilters for clean air in the interior of the car!



nanowerk.com

Environment
- Resource efficiency
- Hydrogen & fuel cells
- Catalysts

Autocatalyst-recycling.umicore.com

Exhaust emission catalyst for the reduction of exhaust emissions!

Application of nanotechnologies in automotives

Comfort
- Passenger wellness
- Product attractiveness
- Easy care, …

Safety
- Active safety
- Passive safety
- Easy to clean, …

Safer rear view with nanocoating!

[1] hessen-nanotech.de

Case story:

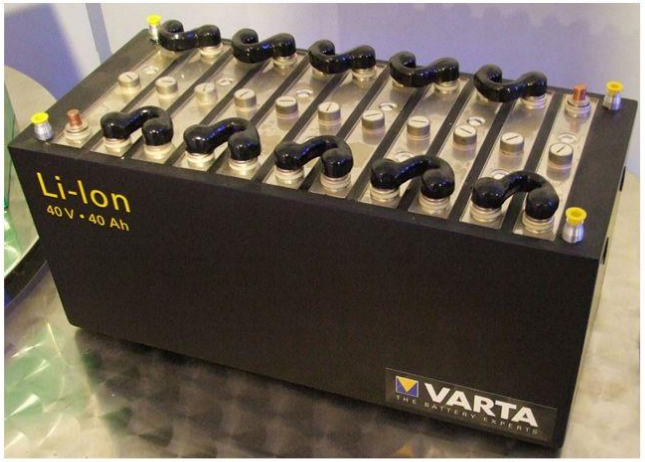
Search for literatures reporting on batteries for fuel cells, and see what nanomaterials can be candidates for batteries with high performance, such as high current density.

Solution – go to nano.nature.com

For example, the search query can be "**Porous materials battery**" and **refined by property "current density"**. Shown below is a table listing the sought literatures by doing this search query (https://nano.nature.com/search?workflow=nanoObject&term=Porous+materials+battery&property=current%20density):

More area = more power

vs.



Nanomaterial/device result set

Results for "Porous materials battery"

Nanomaterial or Nanodevice

- Nanomaterial 140
- Nanodevice 3

Nanostructure

- Nanostructured materials 46
- Nanoparticles 23
- Nanosheets 22
- Nanoporous materials 13
- Nanowires 7

See all (13)

Size

0 – 50000 nm

Update results

Property

Articles and Patents (1,954) | **Nanomaterials and Nanodevices** (143)

Property: Current density

Sort by Relevance

Nanomaterial

mesoporous carbon

Composition: carbon

Nanostructure: nanoporous materials | Pore diameter: 2 - 50 nm

Found: porous graphitic carbon

Based on 312 articles and 8 patents (most recent: 2016)

View more details »

Nanomaterial

activated carbon

Composition: activated carbon

Nanostructure: nanoporous materials | Pore diameter: 0 - 2 nm

Found: nanoporous materials porous carbon nanospheres

Based on 105 articles and 2 patents (most recent: 2016)

View more details »

Click title or "View more details" to see the nanomaterial/device summary

Click X article or Y patent to jump to the reference section of the summary directly

Relevant application in batteries can be found by accessing one summary of "mesoporous carbon", for example (https://nano.nature.com/nano/GR-M278369):

mesoporous carbon

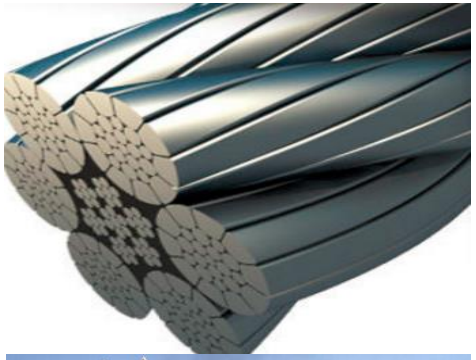
batter 1 of 30

antipyrine delivery	drug delivery	–	yes	Saha, Dipendu *et al.* 2014
aqueous symmetric supercapacitors	energy storage devices	electrode material	yes	Hasegawa, George *et al.* 2016
batteries	power generation	–	no	Natalia Rey-Raap *et al.* 2014
batteries	energy storage devices	–	no	Taubert, Michael *et al.* 2014
biological applications	diagnostics	–	no	Matei Ghimbeu, Camelia *et al.* 2015
biomolecule adsorbent	adsorbents/absorbers/ion exchange materials	–	no	Borchardt, Lars *et al.* 2014
blood purification	medicine/veterinary	–	no	Romero-Anaya, A.J. *et al.* 2014
brackish water desalination	other	capacitive deionization electrode material	yes	Yang, Seung Jae *et al.* 2014
bromine-based battery cathode material	energy storage devices	–	yes	Wang, Chenhui *et al.* 2016
capacitor electrodes	electrodes/electrolytes	–	no	Li, Xiaoan *et al.* 2015
capacitor fabrication	energy storage devices	–	no	PCT patent WO/2014/186207, 20 Nov 2014

Nanotech for Steel and Glass

nature research

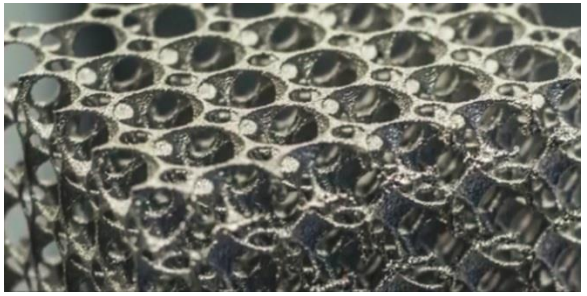
Nanotech for Steel and Glass[3,4]



High strength steel cables

High-strength Zn—Al coated steel
Or vanadium and molybdenum nanoparticles doped steel

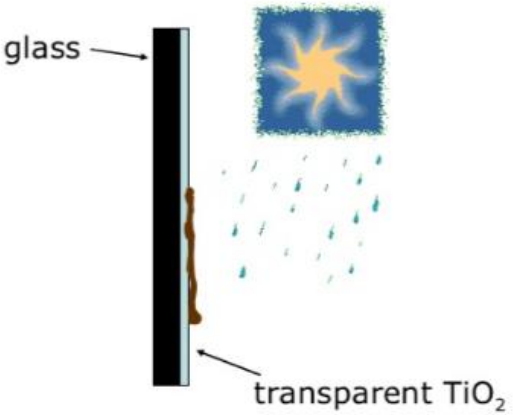
NanoSteel uses 3D metal printer to build **high complexity parts**



Application of nanotechnologies in Steel and Glass

Coatings - Inorganic

Self-cleaning glass
Nano-TiO_2 coated



[3]Dubai Nanotech 2013, Nanoscale-based Concepts for Innovative and Eco-Sustainable Constructive Materials: Challenges and Opportunities for Energy and Environment Applications.
[4]www.3Ders.org

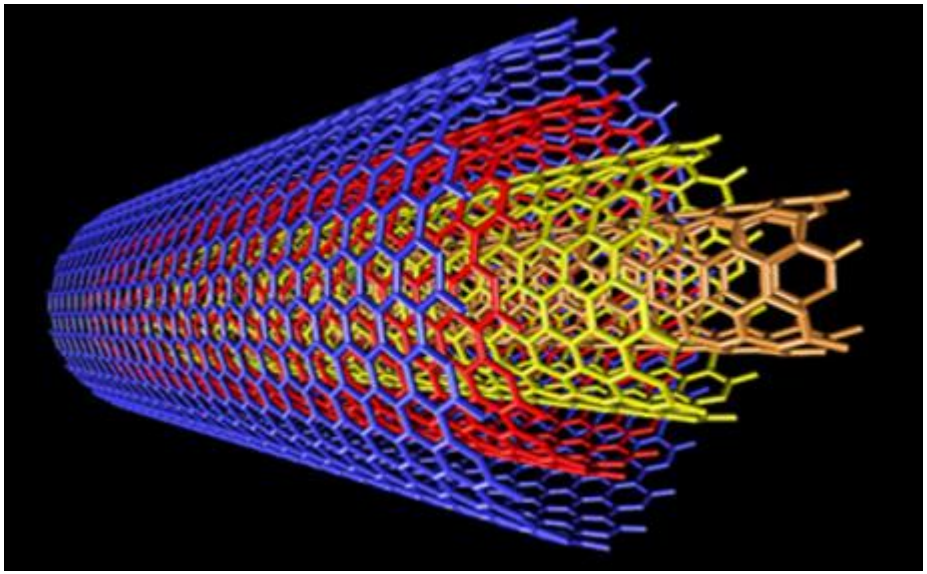
Case study
#1 – A general search

The utilization of nanoscience and nanotechnology in steel translates to enhancement in the properties of steels e.g. tensile strength of steel

Search for the latest literatures reporting **tensile strength and stress of multiple walled carbon nanotubes (MWCNT)**.

Solution – go to nano.nature.com, search “MWCNT”.

Shown below is a table listing the strength and stress of MWCNT. Links to relevant sources can be found in one view.



MWCNT

Table of contents

stiffness	value given	–	experiment	Pour Shahid Saeed Abadi, Parisa *et al.* 2014
storage modulus	value given	–	experiment	Yue, Liang *et al.* 2014
stress	value given	wet-dry cycle number	experiment	Pour Shahid Saeed Abadi, Parisa *et al.* 2014
surface tension energy	value given	–	experiment	Dong Hyup Park *et al.* 2013
temperature-programmed desorption spectrum	value given	–	experiment	Likodimos, Vlassis *et al.* 2014
tensile strength	value given	–	experiment	Gong, Shanshan *et al.* 2015 Zhang, Bin *et al.* 2016
tensile stress	value given	–	experiment	Gong, Shanshan *et al.* 2015 Pan, Zhiyong *et al.* 2016 U.S. patent US20140011007, 9 Jan 2014 Lamei, He *et al.* 2014