

Nano Research

April • 2018

Volume 11 • Number 4



Q K 1 8 1 8 1 3 3

Dynamics and self-assembly of bio-functionalized gold nanoparticles in solution:

Reactive molecular dynamics simulations

Exploration of channel width scaling and edge states in transition metal dichalcogenides

Hierarchical ferric-cobalt-nickel ternary oxide nanowire arrays supported on graphene fibers
as high-performance electrodes for flexible asymmetric supercapacitors



TSINGHUA
UNIVERSITY PRESS



Springer



万方数据

Contents

Research Articles

Dynamics and self-assembly of bio-functionalized gold nanoparticles in solution: Reactive molecular dynamics simulations

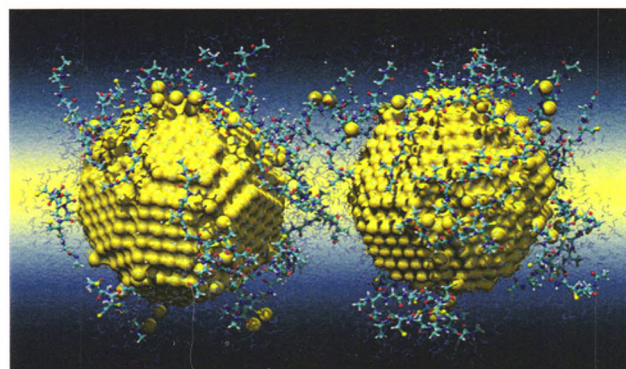
Susanna Monti^{1,2,*}, Giovanni Barcaro³, Luca Sementa³,
Vincenzo Carravetta³, and Hans Ågren^{2,4}

¹ Institute of Chemistry of Organometallic Compounds, Italy

² KTH Royal Institute of Technology, Sweden

³ Institute of Chemical and Physical Processes, Italy

⁴ Siberian Federal University, Russia



The motion and self-interaction of gold nanoparticles functionalized with a cysteine-based peptide are simulated in water solution by means of classical reactive force field approach (ReaxFF).

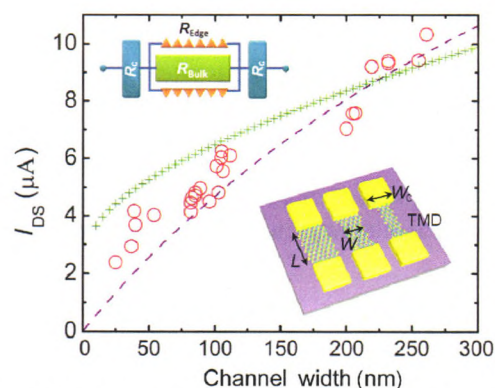
1757–1767

Exploration of channel width scaling and edge states in transition metal dichalcogenides

Feng Zhang^{1,*}, Chia-Hui Lee², Joshua A. Robinson², and
Joerg Appenzeller¹

¹ Purdue University, USA

² The Pennsylvania State University, USA



This article describes a comprehensive study of various transition metal dichalcogenides (TMDs), including semimetallic Td-phase WTe_2 , and semiconducting 2H-phase MoTe_2 and MoS_2 . The materials were analyzed with respect to the impact of channel width scaling on the transport and edge effects in various TMD ribbon geometries.

1768–1774

Hierarchical ferric-cobalt-nickel ternary oxide nanowire arrays supported on graphene fibers as high-performance electrodes for flexible asymmetric supercapacitors

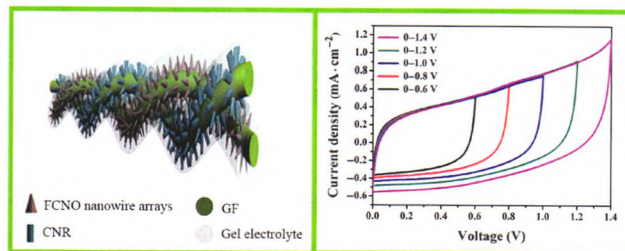
Jingxin Zhao^{1,2}, Chaowei Li², Qichong Zhang², Jun Zhang², Xiaona Wang², Juan Sun², Juanjuan Wang¹, Jixun Xie¹, Ziyin Lin³, Zhuo Li³, Weibang Lu², Conghua Lu^{1,*}, and Yagang Yao^{2,*}

¹ Tianjin University, China

² Suzhou Institute of Nano-tech and Nano-bionics, Chinese Academy of Sciences, China

³ Georgia Institute of Technology, USA

1775–1786



Assembled flexible asymmetric graphene fiber-based supercapacitor devices present excellent flexibility and high specific capacitance.

Application of chemical vapor-deposited monolayer ReSe₂ in the electrocatalytic hydrogen evolution reaction

Shaolong Jiang¹, Zhepeng Zhang¹, Na Zhang¹, Yahuan Huan¹, Yue Gong^{2,3}, Mengxing Sun⁴, Jianping Shi¹, Chunyu Xie¹, Pengfei Yang¹, Qiyi Fang¹, He Li¹, Lianming Tong¹, Dan Xie⁴, Lin Gu^{2,3,5}, Porun Liu⁶, and Yanfeng Zhang^{1,*}

¹ Peking University, China

² Institute of Physics, Chinese Academy of Sciences, China

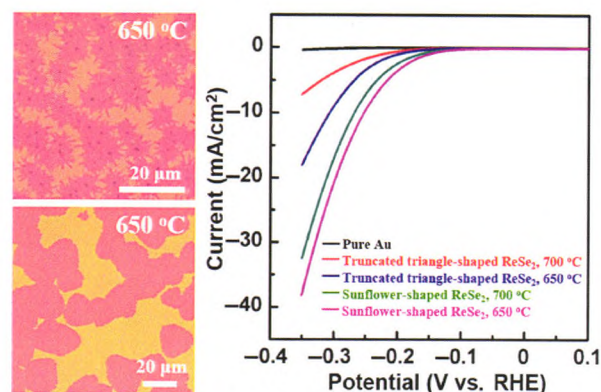
³ University of Chinese Academy of Sciences, China

⁴ Tsinghua University, China

⁵ Collaborative Innovation Center of Quantum Matter, China

⁶ Griffith University, Australia

1787–1797



Structurally anisotropic rhenium diselenide (ReSe₂) with variable domain morphologies (sunflower- or truncated-triangle-shaped) and uniform monolayer thickness was successfully synthesized on SiO₂/Si substrates by ambient-pressure chemical vapor deposition. The prepared monolayer ReSe₂ could be transferred onto Au foil to afford electrodes with promising electrocatalytic activity for the hydrogen evolution reaction.

In situ transformation of Cu₂O@MnO₂ to Cu@Mn(OH)₂ nanosheet-on-nanowire arrays for efficient hydrogen evolution

Li Chen^{1,2}, Xing Zhang^{1,3,*}, Wenjie Jiang^{1,3}, Yun Zhang¹, Linbo Huang^{1,3}, Yuyun Chen¹, Yuguo Yang², Li Li⁴, and Jinsong Hu^{1,3,*}

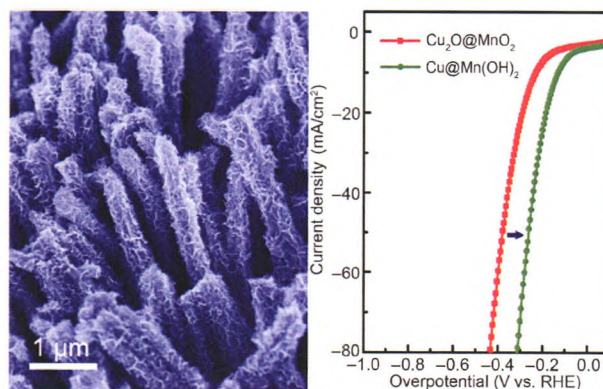
¹ Institute of Chemistry, Chinese Academy of Sciences, China

² Beijing Jiaotong University, China

³ University of Chinese Academy of Sciences, China

⁴ Chongqing University, China

1798–1809



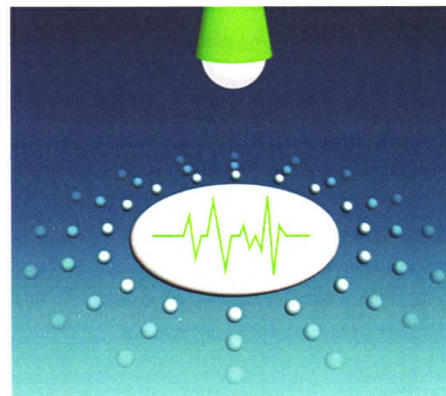
In situ transformation of three-dimensional Cu₂O@MnO₂ into Cu@Mn(OH)₂ nanosheet-on-nanowire arrays significantly boosts the electrocatalytic activity for the hydrogen evolution reaction (HER), demonstrating its potential as a new HER electrocatalyst.

Light-powered direction-controlled micropump

Mingtong Li, Yajun Su, Hui Zhang, and Bin Dong*

Soochow University, China

1810–1821

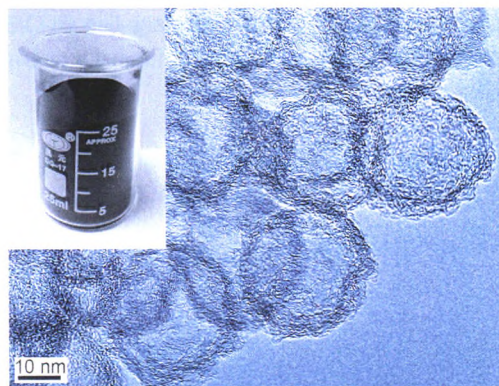


This study presents a light-driven binary micropump based on perovskite and poly[(2-methoxy-5-ethylhexyloxy)-1,4-phenylenevinylene] (MEHPPV) that exhibits controlled pumping directions. The micropump is utilized to realize heartbeat-like pumping and spatial control over colloidal transportation inside a solution.

Scalable synthesis of sub-100 nm hollow carbon nanospheres for energy storage applications

Hongyu Zhao¹, Fan Zhang¹, Shumeng Zhang¹, Shengnan He¹, Fei Shen¹, Xiaogang Han^{1,*}, Yadong Yin², and Chuanbo Gao^{1,*}¹ Xi'an Jiaotong University, China² University of California, Riverside, USA

1822–1833

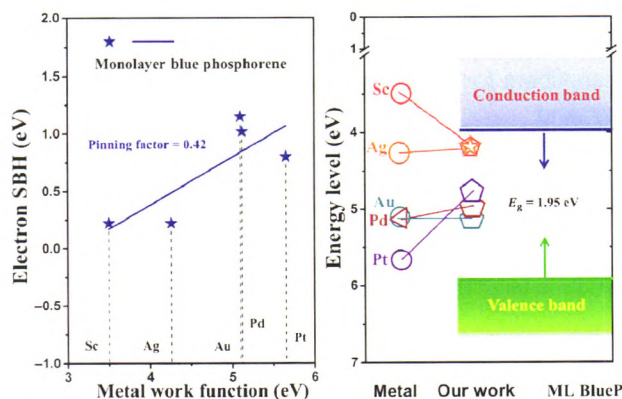


Sub-100 nm hollow carbon nanospheres (as small as ~32.5 nm) have been synthesized in high yield by employing reverse micelles as nanoreactors, and show excellent capacity and cycling stability when used as an anode material for lithium/sodium-ion batteries.

Electrical contacts in monolayer blue phosphorene devices

Jingzhen Li¹, Xiaotian Sun³, Chengyong Xu⁴, Xiuying Zhang¹, Yuanyuan Pan¹, Meng Ye¹, Zhigang Song¹, Ruge Quhe⁵, Yangyang Wang^{1,6}, Han Zhang¹, Ying Guo⁷, Jinbo Yang^{1,2}, Feng Pan^{1,*}, and Jing Lu^{1,2,*}¹ Peking University, China² Collaborative Innovation Center of Quantum Matter, China³ Luoyang Normal University, China⁴ Nanchang Institute of Technology, China⁵ Beijing University of Posts and Telecommunications, China⁶ China Academy of Space Technology, China⁷ Shaanxi University of Technology, China

1834–1849



Ab initio quantum transport simulations show that monolayer blue phosphorene forms n-type Schottky contact with Sc, Ag, and Pt electrodes with lateral electron Schottky barrier heights of 0.22, 0.22, and 0.80 eV, respectively, and it forms p-type Schottky contact with Pd and Au electrodes with lateral hole Schottky barrier heights of 0.79 and 0.61 eV, respectively.

Growth of ZnO self-converted 2D nanosheet zeolitic imidazolate framework membranes by an ammonia-assisted strategy

Yujia Li¹, Lu Lin^{1,2}, Min Tu³, Pei Nian¹, Ashlee J. Howarth², Omar K. Farha^{2,4}, Jieshan Qiu¹, and Xiongfu Zhang^{1,*}

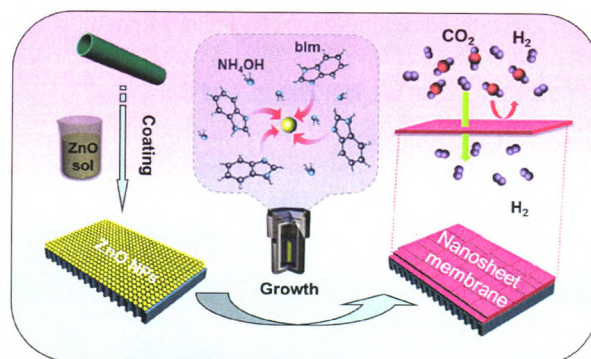
¹ Dalian University of Technology, China

² Northwestern University, USA

³ KU Leuven-University of Leuven, Belgium

⁴ King Abdulaziz University, Saudi Arabia

1850–1860



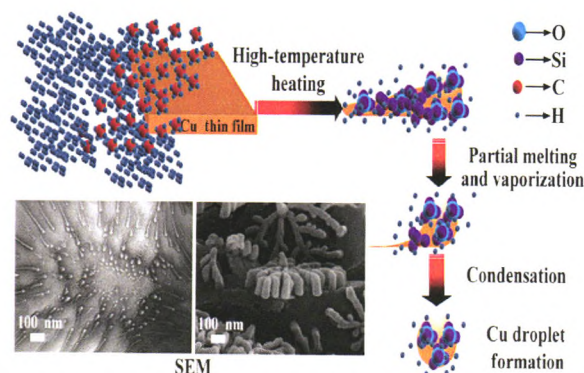
A two-dimensional (2D) nanosheet zeolitic imidazolate framework membrane is fabricated by direct growth based on the localized solvothermal self-conversion of pre-deposited ZnO on a porous Al_2O_3 tube and using ammonium hydroxide as a synthetic modulator. The 2D nanosheet membrane achieved here exhibits excellent molecular sieving performance with high H_2 permeance and selectivity for H_2/CO_2 separation.

One-step synthesis of novel snowflake-like Si-O/Si-C nanostructures on 3D graphene/Cu foam by chemical vapor deposition

Jing Ning, Dong Wang*, Jincheng Zhang*, Xin Feng, Ruixia Zhong, Jiabo Chen, Jianguo Dong, Lixin Guo, and Yue Hao

Xidian University, China

1861–1872



In this work, novel snowflake-like Si-O/Si-C nanostructures with a high specific surface area were synthesized by low-pressure chemical vapor deposition (CVD). The nanostructures showed a high specific capacitance of $\sim 963.2 \text{ mF/cm}^2$ at a scan rate of 1 mV/s . Further, even after 20,000 sequential cycles, the electrode retained 94.4% of its capacitance.

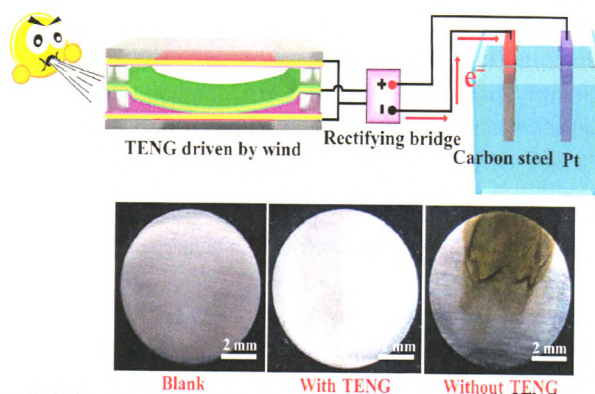
Triboelectrification based on double-layered polyaniline nanofibers for self-powered cathodic protection driven by wind

Siwen Cui^{1,2}, Youbin Zheng¹, Jun Liang¹, and Daoai Wang^{1,*}

¹ Lanzhou Institute of Chemical Physics, Chinese Academy of Sciences, China

² University of Chinese Academy of Sciences, China

1873–1882



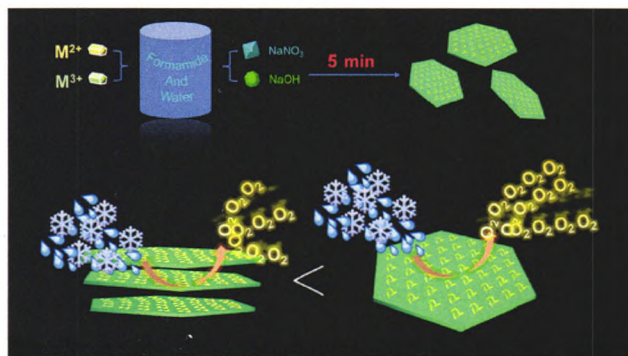
A wind-driven polyaniline nanofibers-based triboelectric nanogenerator (TENG) with a high output performance was used as a novel power source for a self-powered cathodic protection system.

Fast formation of single-unit-cell-thick and defect-rich layered double hydroxide nanosheets with highly enhanced oxygen evolution reaction for water splitting

Rui Gao¹ and Dongpeng Yan^{1,2,*}

¹ Beijing University of Chemical Technology, China

² Beijing Normal University, China



This work presents a combined experimental and theoretical study on two-dimensional (2D) single-unit-cell-thick layered double hydroxide (LDH) nanosheets (NSs) with high oxygen evolution reaction (OER) activities, which have potential applications in water splitting for renewable energy.

1883–1894

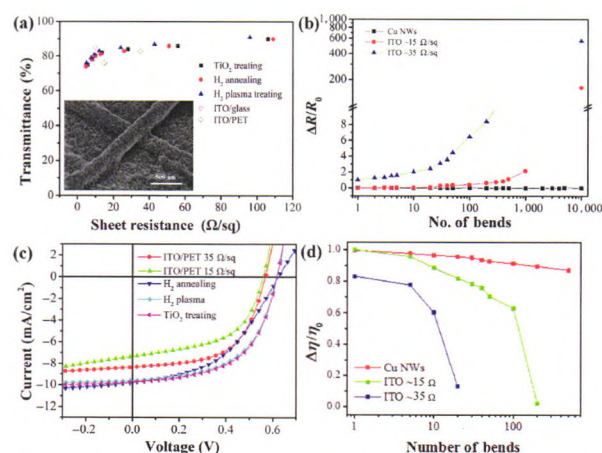
Copper nanowire-TiO₂-polyacrylate composite electrodes with high conductivity and smoothness for flexible polymer solar cells

Haitao Zhai^{1,2}, Yang Li³, Liwei Chen³, Xiao Wang^{1,2},
Liangjing Shi¹, Ranran Wang^{1,*}, and Jing Sun^{1,*}

¹ Shanghai Institute of Ceramics, Chinese Academy of Sciences, China

² University of Chinese Academy of Sciences, China

³ Suzhou Institute of Nano-tech and Nano-bionics, Chinese Academy of Sciences, China



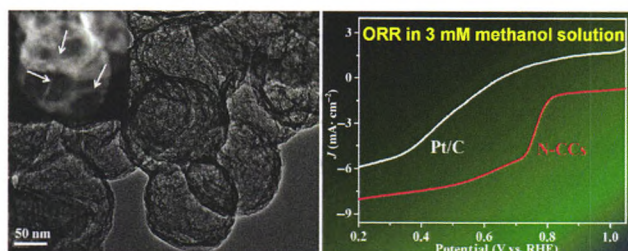
Polymer solar cells with excellent flexibility were fabricated on a copper nanowire-TiO₂-polyacrylate composite electrode. The power conversion efficiency of the cells based on the composite electrode reached 3.11% under a simulated AM1.5G illumination and maintained 90% of their original efficiency after 500 cycles of bending.

1895–1904

N-doped carbon nanocages: Bifunctional electrocatalysts for the oxygen reduction and evolution reactions

Nan Jia, Qiang Weng, Yaru Shi, Xinyan Shi, Xinbing Chen,
Pei Chen*, Zhongwei An, and Yu Chen

Shaanxi Normal University, China



N-doped carbon nanocages (N-CCs) with a porous self-supported architecture and high specific surface area were synthesized by a simple interfacial assembly method. They exhibited long-term operational durability and excellent methanol tolerance during the oxygen reduction reaction.

1905–1916

Fullerene/cobalt porphyrin charge-transfer cocrystals: Excellent thermal stability and high mobility

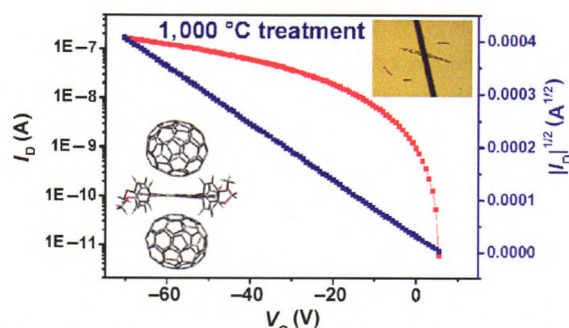
Shushu Zheng^{1,3}, Junwen Zhong¹, Wakana Matsuda², Peng Jin⁴, Muqing Chen¹, Takeshi Akasaka¹, Kazuhito Tsukagoshi^{3,*}, Shu Seki^{2,*}, Jun Zhou³, and Xing Lu^{1,*}

¹ Huazhong University of Science and Technology (HUST), China

² Kyoto University, Japan

³ National Institute for Materials Science (NIMS), Japan

⁴ Hebei University of Technology, China



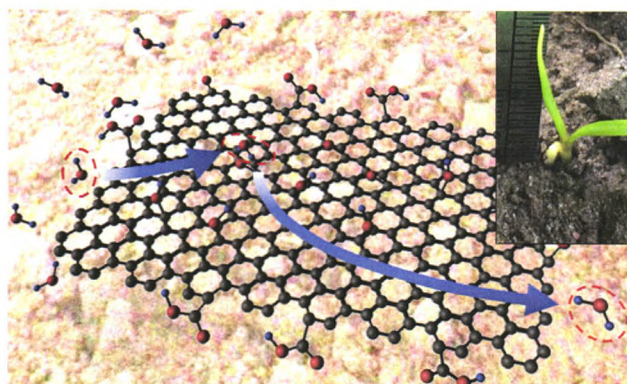
Needle-like fullerene (C_{70})/cobalt porphyrin supramolecular architectures were readily prepared by using a liquid-liquid interfacial precipitation method. These architectures showed excellent electrical conductivity of $1.08 \times 10^3 \Omega^{-1} \cdot \text{m}^{-1}$, high mobility of $4.21 \text{ cm}^2 \cdot \text{V}^{-1} \cdot \text{s}^{-1}$, and good charge transfer properties even after thermal treatment at $1,000^\circ\text{C}$, which are highly promising attributes for the development of future multifunctional electronics.

1917–1927

Graphene oxide as a water transporter promoting germination of plants in soil

Yijia He, Ruirui Hu, Yujia Zhong, Xuanliang Zhao, Qiao Chen, and Hongwei Zhu*

Tsinghua University, China



Graphene oxide (GO) was tested as a moisture retention additive in soil. The hydrophilic nature and water-transporting properties of GO helped to expedite germination and growth of plants.

1928–1937

A low-cost, printable, and stretchable strain sensor based on highly conductive elastic composites with tunable sensitivity for human motion monitoring

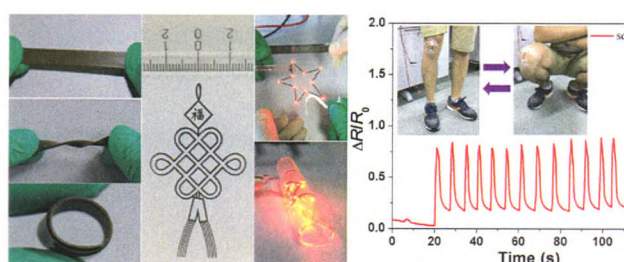
Yougen Hu¹, Tao Zhao¹, Pengli Zhu^{1,*}, Yuan Zhang^{1,2}, Xianwen Liang¹, Rong Sun^{1,*}, and Ching-Ping Wong^{3,4}

¹ Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, China

² University of Science and Technology of China, China

³ Georgia Institute of Technology, USA

⁴ The Chinese University of Hong Kong, Hong Kong, China



Low-cost silver-coated polystyrene spheres (PS@Ag)/polydimethylsiloxane (PDMS) elastic conductive composites fabricated by robust screen printing technology show excellent flexibility and printing adaptability, and exhibit high electrical conductivity, low percolation threshold, and good electrical stability under vigorous mechanical deformation. They also demonstrate excellent strain-sensing performance in monitoring various human motions with high sensitivity and excellent stability.

1938–1955

Semi-transparent polymer solar cells with all-copper nanowire electrodes

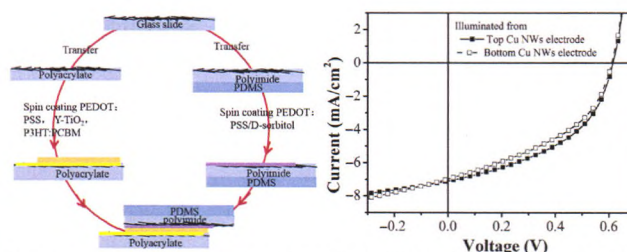
Haitao Zhai^{1,2}, Yang Li³, Liwei Chen³, Xiao Wang^{1,2}, Liangjing Shi¹, Ranran Wang^{1,*}, and Jing Sun^{1,*}

¹ Shanghai Institute of Ceramics, Chinese Academy of Sciences, China

² University of Chinese Academy of Sciences, China

³ Suzhou Institute of Nano-tech and Nano-bionics, Chinese Academy of Sciences, China

1956–1966



Semi-transparent polymer solar cells (PSCs) with all-Cu nanowire (NW) electrodes were fabricated with the structure of polyacrylate (PA)/Cu NWs/poly(3,4-ethylenedioxythiophene):poly(styrenesulfonate) (PEDOT:PSS) (PH1000)/Y-TiO₂/poly(3-hexylthiophene):[6,6]-phenyl-C₆₁-butyric acid 3,4,5-tris(octyloxy) benzyl (P3HT:PC₆₁BM)/PEDOT:PSS (4083)/Cu NWs/polyimide (PI)/polydimethylsiloxane (PDMS). The semi-transparent PSCs showed power conversion efficiencies up to 1.97% and 1.85% from each side with an average transmittance of ~42% in the visible region.

Oxygen-assisted preparation of mechanoluminescent ZnS:Mn for dynamic pressure mapping

Xiandi Wang^{1,2}, Rui Ling^{1,3}, Yufei Zhang^{1,4}, Miaoling Que^{1,2}, Yiyao Peng^{1,2}, and Caofeng Pan^{1,2,*}

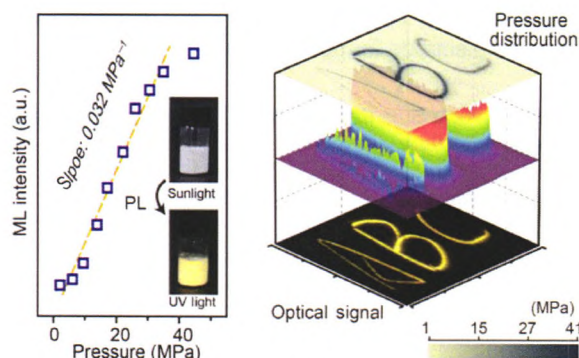
¹ Beijing Institute of Nanoenergy and Nanosystems, Chinese Academy of Sciences, China

² National Center for Nanoscience and Technology (NCNST), China

³ University of Science and Technology Beijing, China

⁴ Beihang University, China

1967–1976



Two-dimensional pressure distribution can be observed using mechanoluminescent ZnS:Mn particles synthesized by solid-state reaction at atmospheric pressure with the assistance of oxygen.

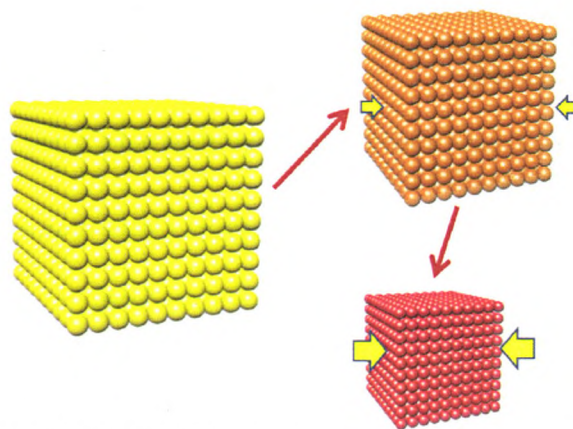
Piezotronic effect on the luminescence of quantum dots for micro/nano-newton force measurement

Yan Zhang^{1,2}, Jiaheng Nie¹, and Lijie Li^{3,*}

¹ University of Electronic Science and Technology of China, China

² National Center for Nanoscience and Technology (NCNST), China

³ Swansea University, UK



Analysis of semiconductor quantum dots applied as nano-newton force sensors based on the control of the luminescence spectrum using the piezotronics effect has been reported.

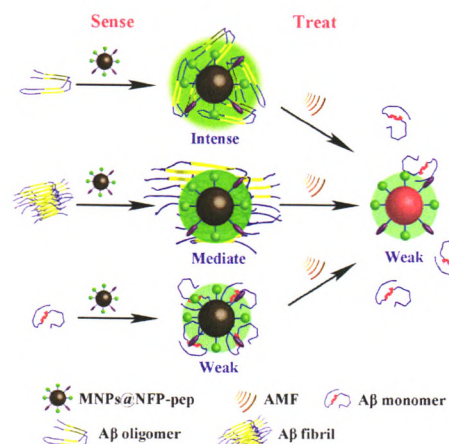
1977–1986

Rational design of a “sense and treat” system to target amyloid aggregates related to Alzheimer’s disease

Zhi Du, Nan Gao*, Yijia Guan, Chao Ding, Yuhuan Sun, Jinsong Ren, and Xiaogang Qu*

Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, China

1987–1997



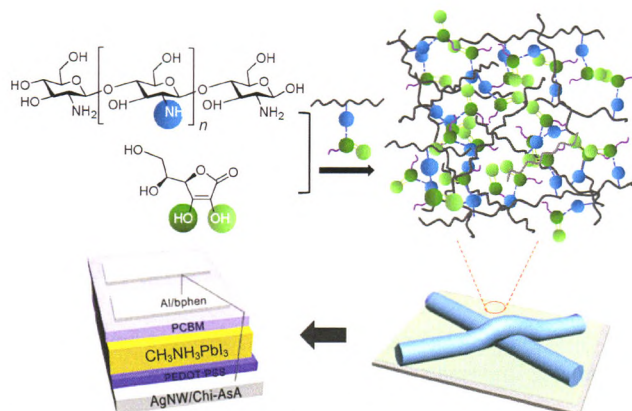
This hybrid system can specifically detect Aβ oligomers, and achieve the wireless deep magnetothermally mediated disassembly of Aβ aggregates with a biologically adaptable alternating magnetic field.

Long-term stable silver nanowire transparent composite as bottom electrode for perovskite solar cells

Yunxia Jin, Yong Sun, Kaiqing Wang, Yani Chen, Ziqi Liang, Yuxi Xu*, and Fei Xiao*

Fudan University, China

1998–2011



A long-term stable, smooth silver nanowire (AgNW) composite with ascorbic-acid-modified chitosan was fabricated via a low-temperature solution process and was successfully employed in perovskite solar cells as the bottom electrode.

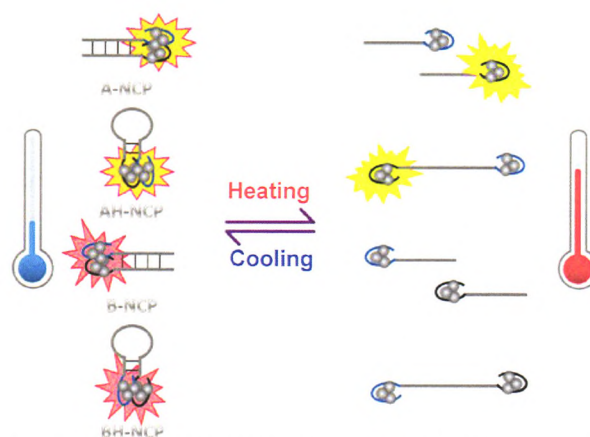
Novel dual fluorescence temperature-sensitive chameleon DNA-templated silver nanocluster pair for intracellular thermometry

Weijun Zhou^{1,2}, Jinbo Zhu¹, Ye Teng¹, Baoji Du^{1,2}, Xu Han¹, and Shaojun Dong^{1,2,*}

¹ Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, China

² University of Chinese Academy of Sciences, China

2012–2023



A series of dual fluorescence temperature-sensitive silver nanocluster (AgNC) pairs were reported. The AgNC pairs achieved sensitive fluorescence variations responding to temperature change from 15 to 45 °C and succeed in indicating temperature in living cells.

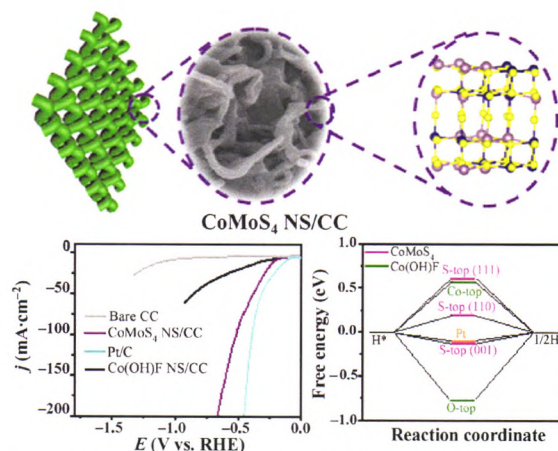
Self-supported CoMoS₄ nanosheet array as an efficient catalyst for hydrogen evolution reaction at neutral pH

Xiang Ren¹, Dan Wu¹, Ruixiang Ge², Xu Sun¹, Hongmin Ma¹, Tao Yan¹, Yong Zhang¹, Bin Du¹, Qin Wei^{1,*}, and Liang Chen^{2,*}

¹ University of Jinan, China

² Ningbo Institute of Materials Technology and Engineering, Chinese Academy of Sciences, China

2024–2033



As a durable catalyst, the CoMoS₄ nanosheet array on carbon cloth shows high activity for hydrogen evolution reaction in neutral media, achieving a geometrical catalytic current density of 10 mA·cm⁻² at an overpotential of 183 mV.

Dual-mode emission of single-layered graphene quantum dots in confined nanospace: Anti-counterfeiting and sensor applications

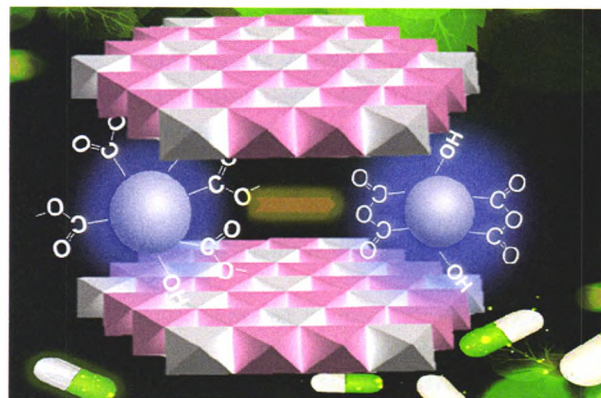
Liqian Bai¹, Ning Xue¹, Yufei Zhao², Xinrui Wang³, Chao Lu¹, and Wenying Shi^{1,*}

¹ Beijing University of Chemical Technology, China

² Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, China

³ Beijing Technology and Business University, China

2034–2045



Graphene quantum dots-layered double hydroxide (GQDs-LDH) composites show dual-emission property. This originates from synergistic effects of confinement and rich O-containing functional groups owing to the nanospace confinement and catalysis property of LDHs. GQDs-LDHs can potentially be used as a green anti-counterfeiting material.

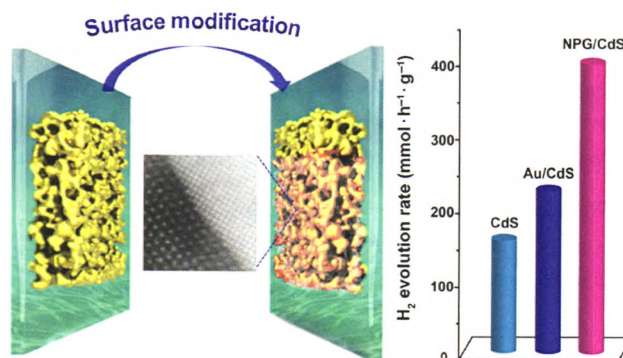
Ultrathin nanoporous metal–semiconductor heterojunction photoanodes for visible light hydrogen evolution

Weiying Zhang¹, Yunfeng Zhao¹, Kai He¹, Jun Luo¹, Guoliang Li¹, Ruirui Liu¹, Siyu Liu¹, Zhen Cao¹, Pengtao Jing², and Yi Ding^{1,*}

¹ Tianjin University of Technology, China

² Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences, China

2046–2057



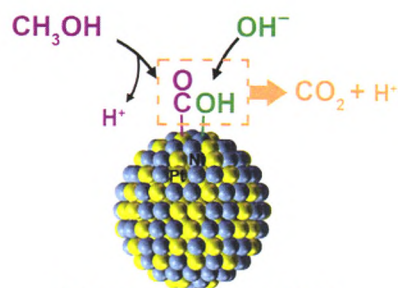
A plasmonic porous metal–semiconductor nano-heterojunction photoelectrode with just ~100 nm overall thickness exhibits impressive hydrogen evolution rate and photostability.

Promoting the methanol oxidation catalytic activity by introducing surface nickel on platinum nanoparticles

Siqi Lu, Huiming Li, Jingyao Sun, and Zhongbin Zhuang*

Beijing University of Chemical Technology, China

2058–2068



Bifunctional catalyst

Using surface controlled PtNi alloy nanoparticles as model catalysts, we propose that the methanol oxidation reaction (MOR) undergoes a Langmuir–Hinshelwood mechanism. Bifunctional catalysts with both CO and OH adsorption sites are beneficial for promoting the MOR in an alkaline electrolyte.

Real-time decay of fluorinated fullerene molecules on Cu(001) surface controlled by initial coverage

Andrey I. Oreshkin^{1,*}, Dmitry A. Muzychenko^{1,*}, Sergey I. Oreshkin¹, Vladimir A. Yakovlev², Palanichamy Murugan³, S. Selva Chandrasekaran³, Vijay Kumar^{4,5}, and Rauf Z. Bakhtizin⁶

¹ Lomonosov Moscow State University, Russia

² Institute of Petrochemical Synthesis, Russian Academy of Sciences, Russia

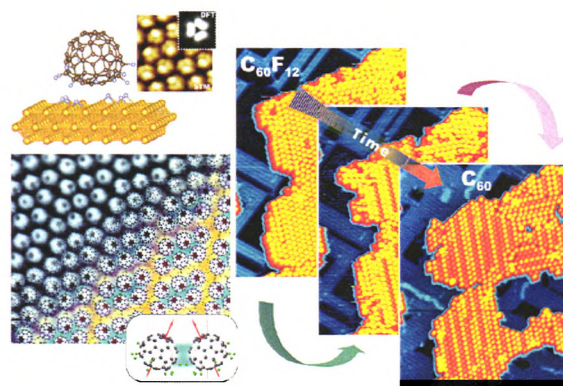
³ CSIR Central Electrochemical Research Institute, India

⁴ Dr. Vijay Kumar Foundation, India

⁵ Shiv Nadar University, India

⁶ Bashkir State University, Russia

2069–2082



The real-time evolution of $C_{60}F_{18}$ molecules on a Cu(001) surface was studied by means of scanning tunneling microscopy and *ab initio* calculations. The results showed that the life-time of fluorinated fullerenes is determined by the density of the two-dimensional (2D) gas phase formed by their decay on a Cu(001) surface occurring as a result of a step-by-step detachment of F atoms from the C_{60} cage.

MoS₂/MnO₂ heterostructured nanodevices for electrochemical energy storage

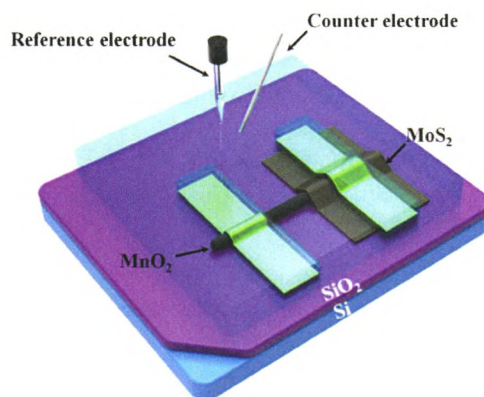
Xiaobin Liao¹, Yunlong Zhao^{1,2}, Junhui Wang¹, Wei Yang¹, Lin Xu¹, Xiaocong Tian¹, Yi Shuang¹, Kwadwo Asare Owusu¹, Mengyu Yan^{1,*}, and Liqiang Mai^{1,3,*}

¹ Wuhan University of Technology, China

² Harvard University, USA

³ University of California, Berkeley, USA

2083–2092



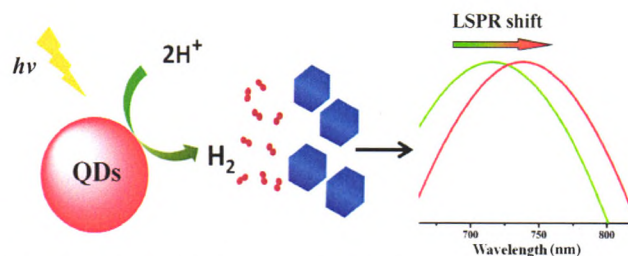
In this work, an electrochemical energy storage device based on a MoS₂ nanosheet/MnO₂ nanowire heterostructure was fabricated to study the effect of the heterogeneous interface on the energy storage performances.

Pd/Ag nanosheet as a plasmonic sensing platform for sensitive assessment of hydrogen evolution reaction in colloid solutions

Minmin Wang^{1,2}, Ping Wang¹, Jie Zhang¹, Hui Hou^{1,2},
Chuanping Li^{1,2}, and Yongdong Jin^{1,*}

¹ Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, China

² University of Chinese Academy of Sciences, China



The photocatalytically generated H_2 from a quantum dot (QD) nanosystem will adsorb and react with palladium/silver nanosheets (Pd/Ag NSs), resulting in a gradual red-shift of localized surface plasmon resonance (LSPR), which in turn can be used to assess the hydrogen evolution reaction (HER) efficiency of an H_2 -generating QD system in colloid solutions.

2093–2103

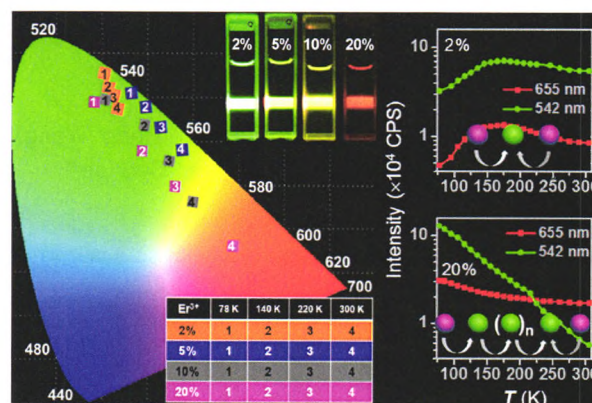
Temperature modulation of concentration quenching in lanthanide-doped nanoparticles for enhanced upconversion luminescence

Luoyuan Li¹, Ningjiu Zhao^{1,2}, Limin Fu^{1,*}, Jing Zhou³,
Xicheng Ai¹, and Jianping Zhang¹

¹ Renmin University of China, China

² Dalian Institute of Chemical Physics, Chinese Academy of Sciences, China

³ Capital Normal University, China



The temperature-switchable concentration quenching mechanism may shed light on improving the upconversion luminescence properties and their practical applications.

2104–2115

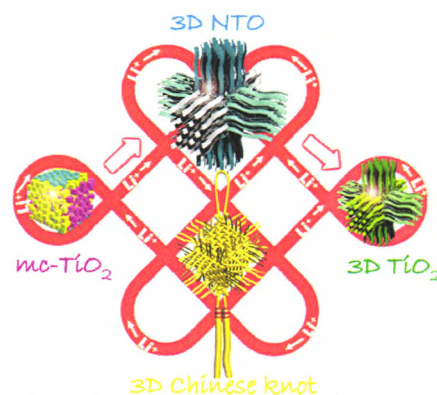
Ultrathin nanobelts-assembled Chinese knot-like 3D TiO₂ for fast and stable lithium storage

Qili Wu¹, Shiman He¹, Xianfeng Yang², Jingling Yang¹,
Gaoren Li¹, Yuying Meng¹, Shengfu Tong^{1,*}, Liqiang Mai^{3,*},
and Mingmei Wu^{1,*}

¹ Sun Yat-Sen University, China

² South China University of Technology, China

³ Wuhan University of Technology, China



Chinese knot-like three-dimensional (3D) TiO_2 nanoarchitectures assembled with well-oriented ultrathin nanobelts are rationally synthesized based on epitaxial growth-combined topotactic conversion. The as-prepared 3D TiO_2 can be utilized as an anode material for long lifespan and fast-charge lithium ion batteries.

2116–2128

Building 2D quasicrystals from 5-fold symmetric corannulene molecules

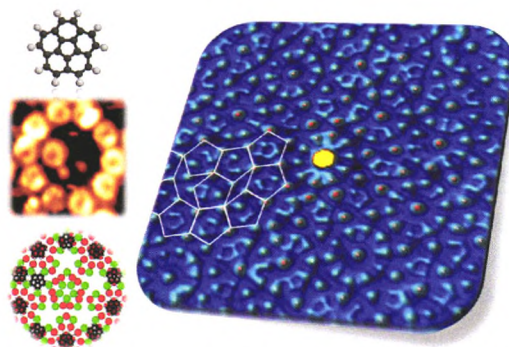
Nataliya Kalashnyk¹, Julian Ledieu¹, Émilie Gaudry¹,
Can Cui², An-Pang Tsai³, and Vincent Fournée^{1,*}

¹ Université de Lorraine, France

² Zhejiang Sci-Tech University, China

³ Tohoku University, Japan

2129–2138



A two-dimensional quasicrystal has been grown from 5-fold symmetric corannulene molecules, via a method that uses the templating effect of the icosahedral Ag-In-Yb substrate through a rational selection of molecular moiety leading to the preferential adsorption of $C_{20}H_{10}$ molecules with their convex sides down at 5-fold symmetric sites, and hence enforcing long-range quasiperiodic order in the film.

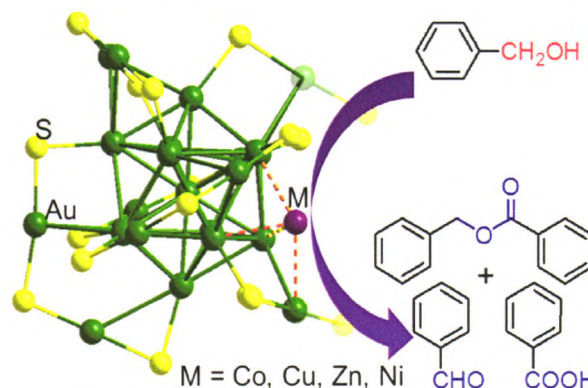
Transition metal-mediated catalytic properties of gold nanoclusters in aerobic alcohol oxidation

Chaolei Zhang^{1,2}, Yongdong Chen^{1,*}, Hong Wang¹,
Zhimin Li², Kai Zheng², Shujun Li¹, and Gao Li^{2,*}

¹ Southwest Petroleum University, China

² Dalian Institute of Chemical Physics, Chinese Academy of Sciences, China

2139–2148



In this study, we found that the catalytic performance of gold nanoclusters is greatly tuned by heteroatom dopants in aerobic alcohol oxidation.

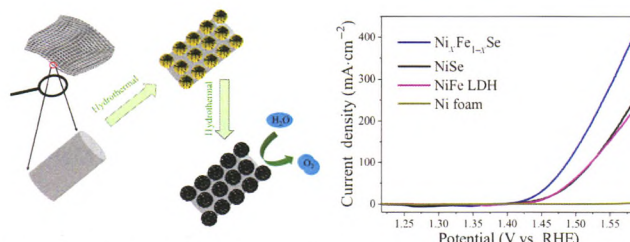
3D mesoporous rose-like nickel-iron selenide microspheres as advanced electrocatalysts for the oxygen evolution reaction

Jiahao Yu¹, Gongzhen Cheng¹, and Wei Luo^{1,2,*}

¹ Wuhan University, China

² Nankai University, China

2149–2158



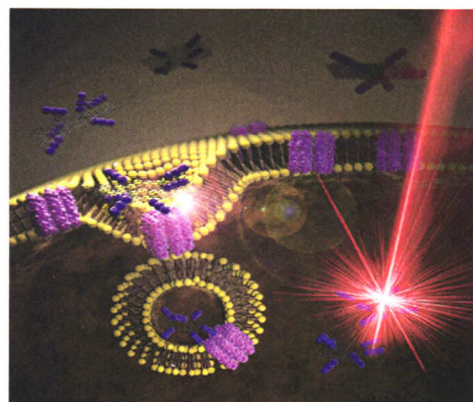
3D mesoporous nickel iron selenide with rose-like microsphere architecture was directly synthesized on Ni foam via a successive two-step hydrothermal method. This system exhibits superior oxygen evolution reaction (OER) electrocatalytic activity, with an ultralow overpotential of 197 mV required to produce a current density of $10 \text{ mA} \cdot \text{cm}^{-2}$ in 1 M KOH.

Chemokine-mimetic plerixafor derivative for tumor-specific delivery of nanomaterials

Seungbeom Ko, Gayong Shim, Jinyoung Kim, and Yu-Kyoung Oh*

Seoul National University, Republic of Korea

2159–2172



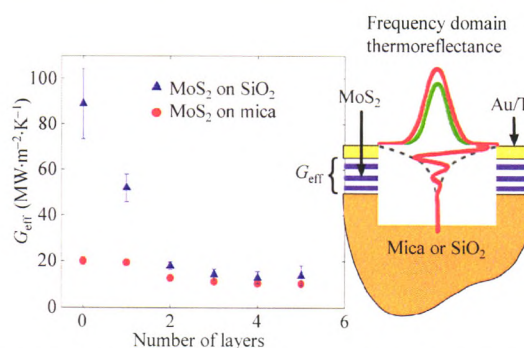
Chemokine-mimetic plerixafor derivatives were designed for tumor-specific delivery and functional effects of nanomaterials.

Enhanced thermal transport across monolayer MoS₂

Miguel Goni, Jia Yang, and Aaron J. Schmidt*

Boston University, USA

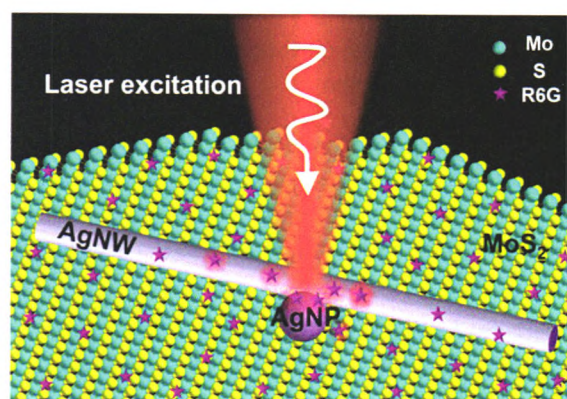
2173–2180



This work describes measurements of thermal transport across single- and few-layer exfoliated MoS₂ on SiO₂ and muscovite mica substrates. On the SiO₂ substrate a significant improvement in heat transport was observed for monolayer MoS₂ compared to few layer MoS₂, while on the mica substrate the MoS₂ had a minimal impact on heat transport.

Ag nanowire/nanoparticle-decorated MoS₂ monolayers for surface-enhanced Raman scattering applicationsJuan Li^{1,2}, Weina Zhang^{1,2}, Hongxiang Lei^{1,*}, and Baojun Li^{2,*}¹ Sun Yat-Sen University, China² Jinan University, China

2181–2189



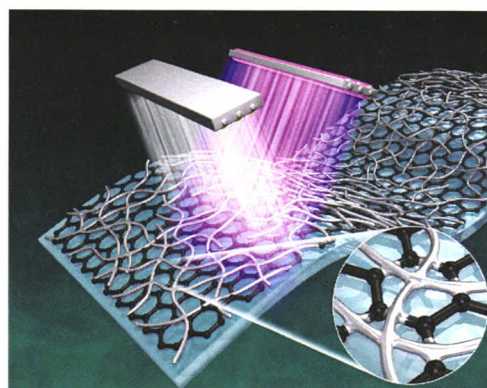
A surface-enhanced Raman scattering (SERS)-active substrate is fabricated by decorating a MoS₂ monolayer with Ag nanowire and nanoparticle structures using a spin-coating method. The fabricated SERS substrate exhibits ultrasensitive detection capabilities, reliable reproducibility, and good stability.

UV-assisted flash light welding process to fabricate silver nanowire/graphene on a PET substrate for transparent electrodes

Wan-Ho Chung, Sung-Hyeon Park, Sung-Jun Joo, and Hak-Sung Kim*

Hanyang University, Republic of Korea

2190–2203



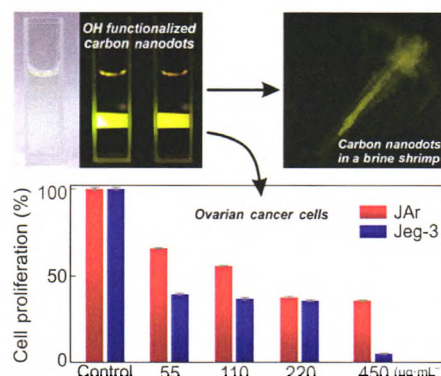
The flexible transparent electrode films with silver nanowire and mixed graphene (SMG) coated on polyethylene terephthalate (PET) substrate can be fabricated via ultraviolet (UV)-assisted flash light welding process.

Selective toxicity of hydroxyl-rich carbon nanodots for cancer research

Tak H. Kim, Joseph P. Sirdaarta, Qian Zhang, Ehsan Eftekhari, James St. John, Derek Kennedy, Ian E. Cock, and Qin Li*

Griffith University, Australia

2204–2216



Highly biocompatible, yellow-emitting carbon nanodots, which are abundant in hydroxyl functional groups, were synthesized. Interestingly, the nanoparticles display divergent antiproliferative activities against two ovarian choriocarcinoma cell lines, which may be further explored for cancer drug discovery.

In situ trapped high-density single metal atoms within graphene: Iron-containing hybrids as representatives for efficient oxygen reduction

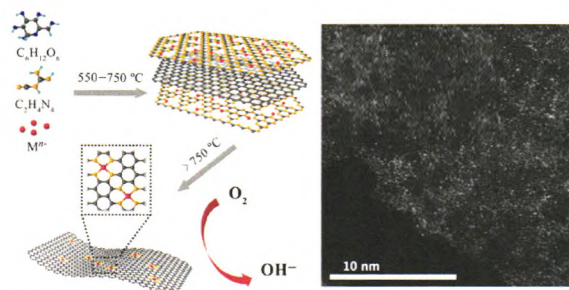
Daobin Liu¹, Chuanqiang Wu¹, Shuangming Chen¹, Shiqing Ding¹, Yaofeng Xie¹, Changda Wang¹, Tao Wang¹, Yasir A. Haleem¹, Zia ur Rehman¹, Yuan Sang¹, Qin Liu¹, Xusheng Zheng¹, Yu Wang², Binghui Ge³, Hangxun Xu¹, and Li Song^{1,*}

¹ University of Science and Technology of China, China

² Shanghai Institute of Applied Physics, Chinese Academy of Sciences, China

³ Institute of Physics, Chinese Academy of Sciences, China

2217–2228



Highly doped single atom catalyst was prepared via a single-step pyrolysis of glucose, dicyandiamide, and inorganic metal salts (Fe, Co, Ni, Cu, and Pt). High-angle annular dark field-scanning transmission electron microscopy (HAADF-STEM) and X-ray absorption fine structure spectroscopy (XAFS) techniques revealed that nitrogen atoms doped into the graphene matrix were pivotal to the stabilization of metal atoms by generating a metal-N_x coordination structure. Single iron-doped hybrid (Fe@N-doped graphene), as a representative, showed an excellent electrocatalytic performance for oxygen reduction reaction. This work provided a feasible approach for the design and fabrication of highly doped isolated metal catalysts with practical applications.

Ion separation and water purification by applying external electric field on porous graphene membrane

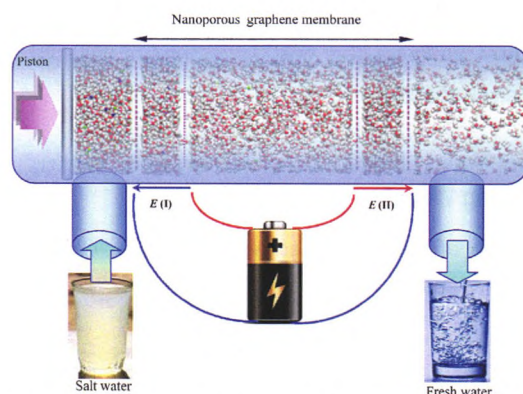
Amir Lohrasebi^{1,2,*} and Samaneh Rikhtehgaran³

¹ University of Isfahan, Iran

² Institute for Research in Fundamental Sciences (IPM), Iran

³ Florida Atlantic University, USA

2229–2236



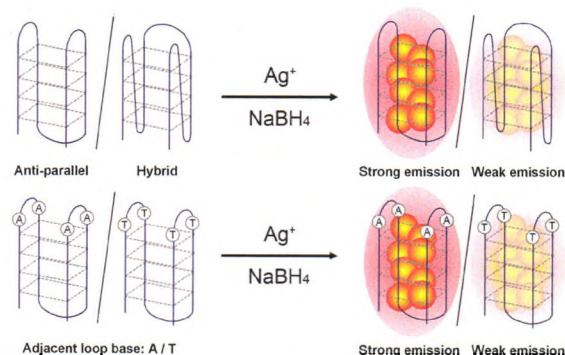
A system including two bilayer graphene membranes, which are exposed to two opposite directions external electric fields, was designed to produce fresh water. It is found that when the system is exposed to the electric field of $10 \text{ mV/\AA}$ and higher, the ion rejection is more than 93%.

How G-quadruplex topology and loop sequences affect optical properties of DNA-templated silver nanoclusters

Guangyu Tao, Yang Chen, Ruoyun Lin, Jiang Zhou, Xiaojing Pei, Feng Liu, and Na Li*

Peking University, China

2237–2247



The optical properties of G-quadruplex-templated silver nanoclusters are affected by G-quadruplex topology and loop sequences. An anti-parallel topology is beneficial to stronger fluorescence, while thymines adjacent to the G-tetrad are detrimental.

Nontoxic engineered virus nanofibers as an efficient agent for the prevention and detection of fungal infection

Yicun Wang², Hongxi Shi¹, Shuai Dong¹, Yan Li¹, Meng Wang³, Yanyan Huai¹, Xintong Zhang¹, Xi Chen¹, Chuanbin Mao^{4,5}, Xiang Gao^{1,*}, and Li Wang^{1,*}

¹ Northeast Normal University, China

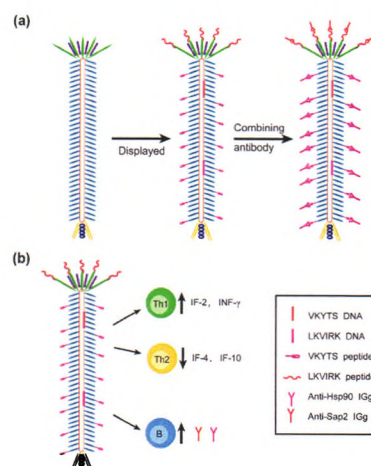
² The Second Hospital of Jilin University, China

³ Harbin Medical University Cancer Hospital, China

⁴ Zhejiang University, China

⁵ University of Oklahoma, USA

2248–2255



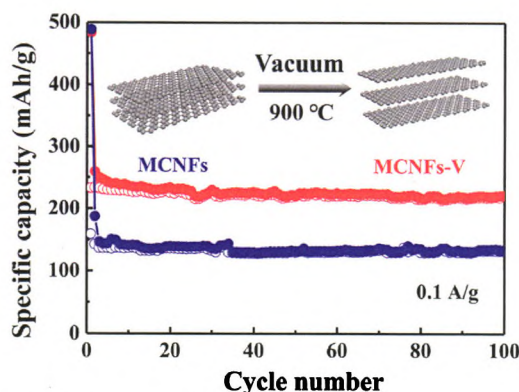
The dual-displayed viral nanofibers could be used as a diagnosis agent for candidemia patients with higher sensitivity, and it could also be served as an excellent vaccine candidate for the prevention of fungal infection. (a) Displayed peptides on the phage, pVIII and pIII, which could recognize fungal antibodies; (b) host immune response to hybrid phage nanofibers.

Enhanced sodium storage performance in flexible free-standing multichannel carbon nanofibers with enlarged interlayer spacing

Beibei Yuan, Linchao Zeng, Xizhen Sun, Yan Yu*, and Qingsong Wang*

University of Science and Technology of China, China

2256–2264



A flexible and free-standing multichannel carbon nanofibers film electrode with enlarged interlayer spacing was fabricated through a facile high-temperature vacuum process and exhibited superior sodium storage performance.

Flow behavior of liquid metal in the connected fascial space: Intervaginal space injection in the rat wrist and mice with tumor

Nan Hu^{1,2,3}, Yupeng Cao^{1,2}, Zhuo Ao¹, Xinxiao Han^{1,2}, Qiang Zhang^{1,2}, Wentao Liu¹, Sidi Liu¹, Fulong Liao^{1,4}, and Dong Han^{1,2,*}

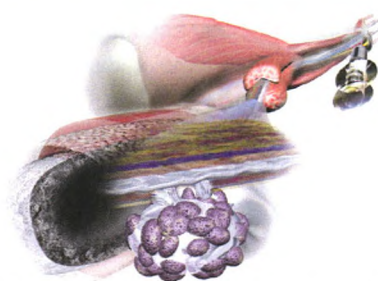
¹ National Center for Nanoscience and Technology, China

² University of Chinese Academy of Sciences, China

³ Chengde Medical University, China

⁴ China Academy of Chinese Medical Sciences, China

2265–2276



After the injection of liquid metal into the wrist intervaginal space comprising tendons, vessels, and nerves, the liquid metal wrapped around the fascial space and finally reached the fingertip downstream and armpit upstream in addition to the neurovascular bundle without vessels or lymph nodes. During the invasion of the tumor along the route, the integrity of the fascia is destroyed. The liquid metal may enter the tumor through the damaged spot, finally reach the inside of the tumor through the fascia fiber network, and wrap the tumor cells. As a result, tumor growth is obstructed and the tumor experiences partial necrosis and becomes hollow inside.

Highly delocalized endohedral metal in Gd@C_{2v}(9)-C₈₂ metallofullerenes co-crystallized with α-S₈

Cheng Li^{1,2}, Xuejiao J. Gao⁴, Huanli Yao^{1,2}, Huan Huang^{1,2}, Rongli Cui^{1,2}, Xihong Guo^{1,2}, Lele Zhang¹, Bing Liu^{1,2}, Binggang Xu¹, Weiqun Shi^{1,2}, Jinquan Dong¹, Lai Feng^{3,*}, Xingfa Gao^{4,*}, and Baoyun Sun^{1,2,*}

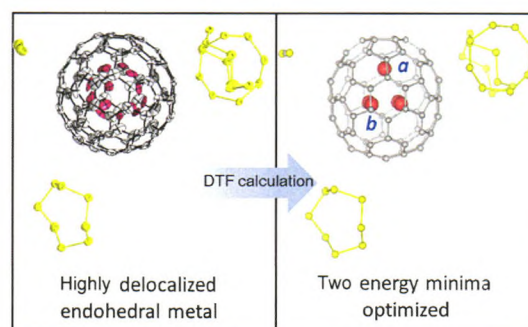
¹ Institute of High Energy Physics, Chinese Academy of Sciences, China

² University of Chinese Academy of Sciences, China

³ Soochow University, China

⁴ Jiangxi Normal University, China

2277–2284



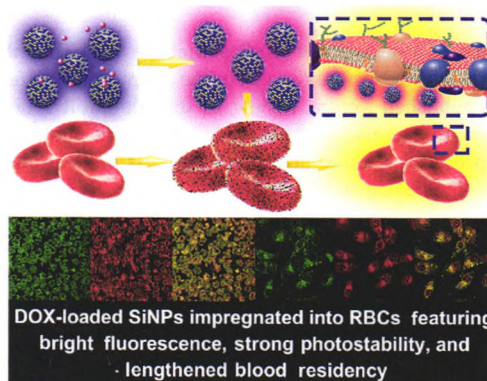
A new Gd@C_{2v}(9)-C₈₂ metallofullerene co-crystallized with α-S₈ was prepared and characterized by single-crystal X-ray diffraction (XRD), and a highly delocalized endohedral Gd atom was identified in the co-crystal for the first time. Density functional theory (DFT) calculations were employed to inspect and rationalize the unique endohedral metal distribution in this system.

Doxorubicin-loaded silicon nanoparticles impregnated into red blood cells featuring bright fluorescence, strong photostability, and lengthened blood residency

Airui Jiang, Bin Song, Xiaoyuan Ji, Fei Peng, Houyu Wang, Yuanyuan Su, and Yao He*

Soochow University, China

2285–2294



We herein present doxorubicin-loaded fluorescent silicon nanoparticles impregnated into red blood cells, which simultaneously exhibit bright fluorescence, robust photostability, and significantly lengthened blood residency.

Sodium-doped carbon nitride nanotubes for efficient visible light-driven hydrogen production

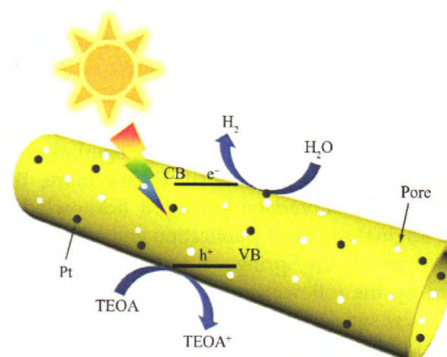
Longshuai Zhang^{1,3}, Ning Ding^{1,3}, Muneaki Hashimoto², Koudai Iwasaki², Noriyasu Chikamori², Kazuya Nakata², Yuzhuan Xu^{1,3}, Jiangjian Shi^{1,3}, Huijue Wu^{1,3}, Yanhong Luo^{1,3}, Dongmei Li^{1,3,*}, Akira Fujishima^{2,*}, and Qingbo Meng^{1,3,*}

¹ Institute of Physics, Chinese Academy of Sciences, China

² Tokyo University of Science, Japan

³ University of Chinese Academy of Sciences, China

2295–2309



Sodium-doped carbon nitride nanotubes ($\text{Na}_x\text{-CNNTs}$) for photocatalytic water splitting have been prepared via a green and simple two-step method involving hydrothermal and thermopolymerization processes. The synergistic effect of the porous tubular structure and the Na^+ doping enhances the hydrogen evolution rate under visible light ($\lambda > 420 \text{ nm}$) irradiation.

Plasmon resonant amplification of a hot electron-driven photodiode

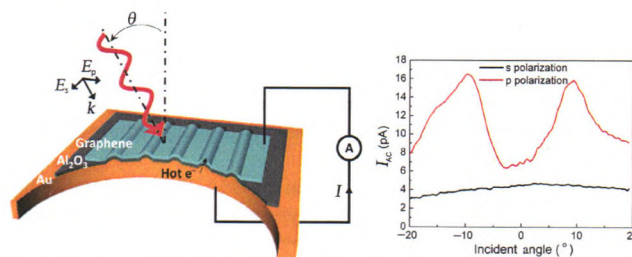
Lang Shen¹, Nirakar Poudel¹, George N. Gibson^{2,3}, Bingya Hou¹, Jihan Chen¹, Haotian Shi¹, Ernest Guignon³, William D. Page³, Arturo Pilar³, and Stephen B. Cronin^{1,*}

¹ University of Southern California, USA

² University of Connecticut, USA

³ Ciencia Inc., USA

2310–2314



Plasmon-enhanced photocurrent is realized in a plasmon resonant grating structure with a pitch of 500 nm. An amplification factor of 4.6 $\times$ is obtained under resonant conditions.

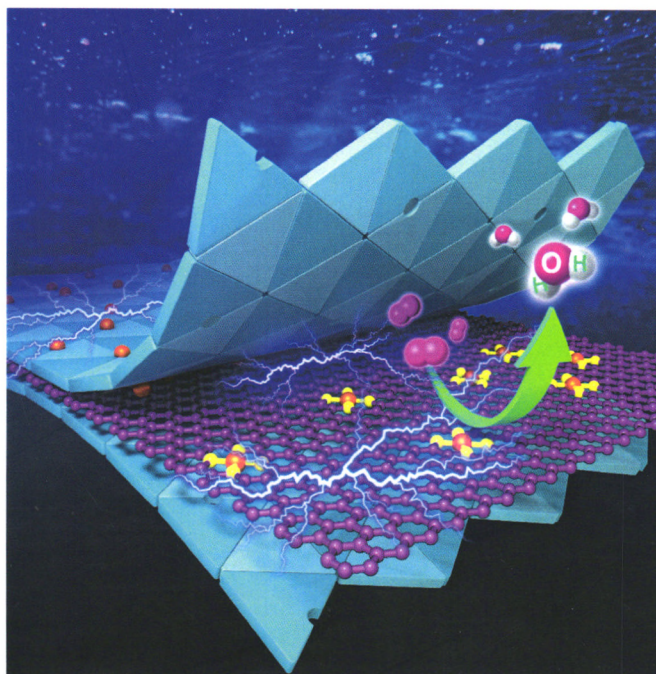
ISSN 1998-0124

CN 11-5974/O4

Nano Research

Volume 11 · Number 4 · April 2018

(Monthly, started in 2008)



纳米研究 (英文版) (月刊, 2008年创刊) 第11卷 第4期 2018年4月出版

Editors-in-Chief Hongjie Dai, Yadong Li

Sponsored by Tsinghua University & Chinese Chemical Society

Edited by Nano Research Editorial Office

Published by Tsinghua University Press

Address Xueyan Building,
Tsinghua University,
Beijing 100084, China

Website www.theNanoResearch.com & www.springer.com/journal/12274

Online Manuscript Submission, Review and Tracking System www.editorialmanager.com/nare

主管单位 中华人民共和国教育部

主办单位 清华大学

中国化学会

主 编 戴宏杰 李亚栋

编 辑 《纳米研究》编辑部

出版发行 清华大学出版社有限公司

印刷单位 北京中献拓方科技发展有限公司

ISSN 1998-0124



万方数据