

Nano Research

February · 2017

Volume 10 · Number 2

Visualizing fast growth of large single-crystalline graphene by tunable isotopic carbon source

Thermally stable $\text{Ir/Ce}_{0.9}\text{La}_{0.1}\text{O}_2$ catalyst for high temperature methane dry reforming reaction

Rambutan-like hierarchically heterostructured $\text{CeO}_2\text{-CuO}$ hollow microspheres:
Facile hydrothermal synthesis and applications



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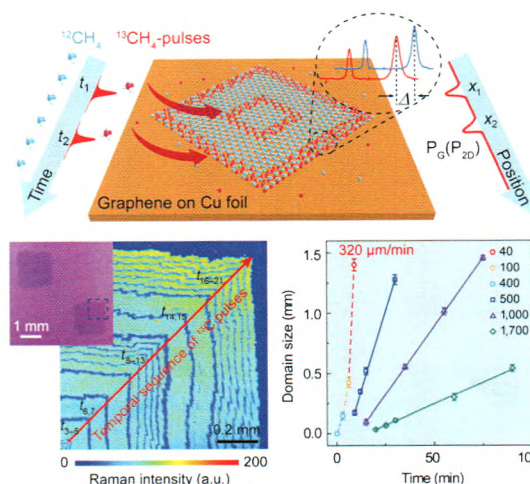
Contents

Research Articles

Visualizing fast growth of large single-crystalline graphene by tunable isotopic carbon source

Luzhao Sun, Li Lin, Jincan Zhang, Huan Wang, Hailin Peng*, and Zhongfan Liu*

Peking University, China



By using an isotopic-pulse labeling technique in conjunction with micro-Raman spectroscopy identification, we visualized the growth dynamics regarding the nucleation, growth, and coalescence during the fast growth of large single-crystalline graphene domains. A high growth rate of 320 $\mu\text{m}/\text{min}$ for the growth of millimeter-sized graphene on Cu foil was realized by tuning the carbon-source supply.

355–363

Thermally stable Ir/Ce_{0.9}La_{0.1}O₂ catalyst for high temperature methane dry reforming reaction

Fagen Wang^{1,2,*}, Leilei Xu³, Weidong Shi², Jian Zhang⁴, Kai Wu⁵, Yu Zhao⁶, Hui Li⁶, He Xing Li⁶, Guo Qin Xu^{1,4,*}, and Wei Chen^{1,4,7,*}

¹ National University of Singapore Suzhou Research Institute, China

² Jiangsu University, China

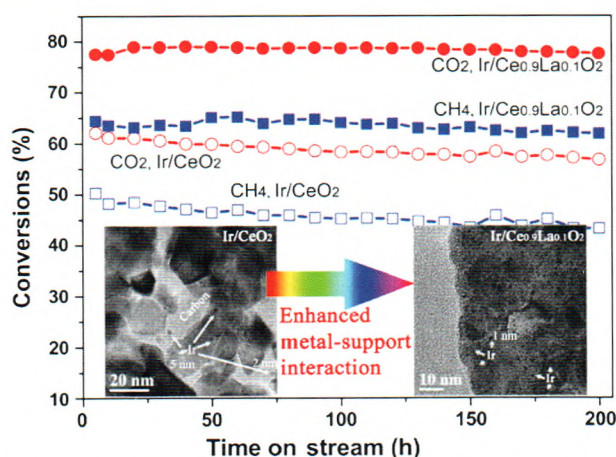
³ Nanjing University of Information Science & Technology, China

⁴ National University of Singapore, Singapore

⁵ Peking University, China

⁶ Shanghai Normal University, China

⁷ Singapore-Peking University Research Center for a Sustainable Low-Carbon Future, Singapore



In this study, an Ir/Ce_{0.9}La_{0.1}O₂ catalyst showed higher activity and stabler performance for methane dry reforming reaction than the Ir/CeO₂ catalyst. The observation was attributed to the stronger metal-support interaction in the Ir/Ce_{0.9}La_{0.1}O₂ catalyst stabilizing the catalyst structure and improving the oxygen storage capacity, leading to negligible aggregation of Ir nanoparticles and the Ce_{0.9}La_{0.1}O₂ support at high temperatures, as well as the rapid removal of carbon deposits at the Ir-Ce_{0.9}La_{0.1}O₂ boundaries.

364–380

Rambutan-like hierarchically heterostructured CeO_2 -CuO hollow microspheres: Facile hydrothermal synthesis and applications

Yongjun Ji^{1,*}, Zheyang Jin¹, Jing Li^{1,2}, Yu Zhang^{1,2}, Hezhi Liu¹, Laishun Shi³, Ziyi Zhong^{4,5}, and Fabing Su^{1,*}

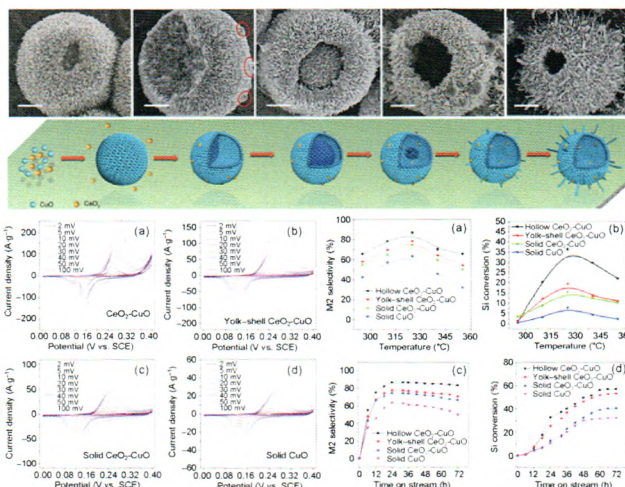
¹ Institute of Process Engineering, Chinese Academy of Sciences, China

² University of Chinese Academy of Sciences, China

³ Shandong University, China

⁴ Institute of Chemical Engineering and Sciences, Singapore

⁵ Nanyang Technological University (NTU), Singapore



Rambutan-like hierarchically heterostructured CeO_2 -CuO hollow microspheres synthesized by a facile one-pot template-free hydrothermal approach exhibit superior performance, both as electrode materials for supercapacitors and as Cu-based catalysts for dimethyldichlorosilane (M2) synthesis via the Rochow reaction.

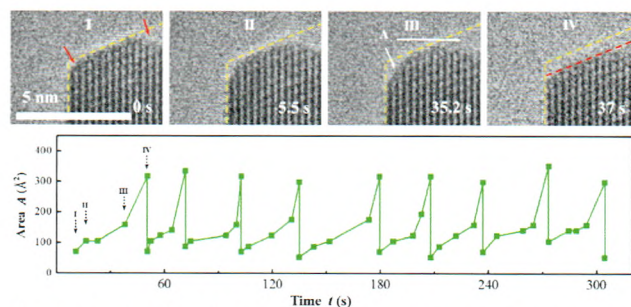
381–396

In situ TEM observation of dissolution and regrowth dynamics of MoO_3 nanowires under oxygen

Wentao Yuan¹, Jian Yu¹, Hengbo Li¹, Ze Zhang¹, Chenghua Sun^{2,*}, and Yong Wang^{1,*}

¹ Zhejiang University, China

² Monash University, Australia



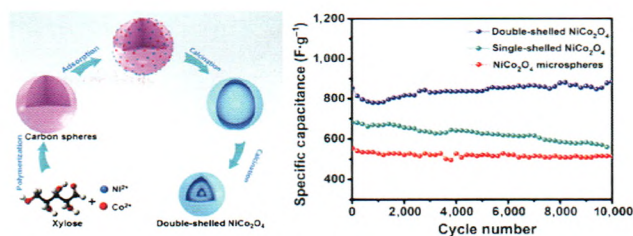
The gas-involved oscillatory dissolution and layer-by-layer regrowth of oxide nanowires is revealed by environmental transmission electron microscopy on an atomic scale.

397–404

Facile one-pot synthesis of NiCo_2O_4 hollow spheres with controllable number of shells for high-performance supercapacitors

Jing Guo, Zhihui Yin, Xiaoxian Zang, Ziyang Dai, Yizhou Zhang, Wei Huang*, and Xiaochen Dong*

Nanjing Tech University (NanjingTech), China



We report the *in situ* synthesis of single- and double-shelled NiCo_2O_4 hollow spheres through a one-pot solvothermal method assisted by xylose. The present hollow spheres lead to superior specific capacitance and cycling stability in supercapacitor electrodes.

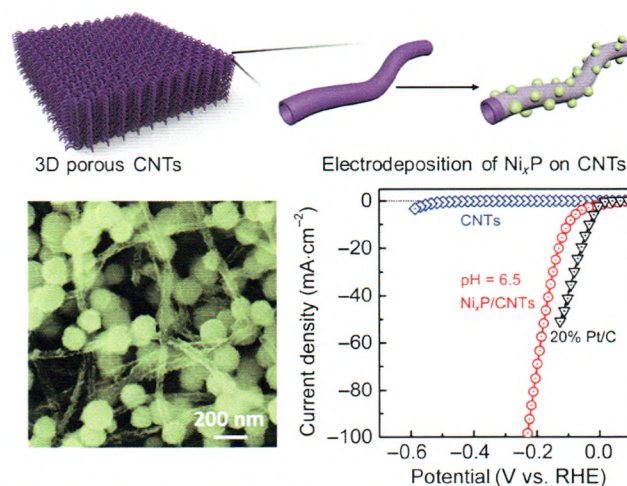
405–414

Sponge-like nickel phosphide–carbon nanotube hybrid electrodes for efficient hydrogen evolution over a wide pH range

Shuying Wang^{1,2,*}, Li Zhang^{2,*}, Xiao Li², Changli Li², Rujing Zhang², Yingjiu Zhang^{1,*}, and Hongwei Zhu^{2,*}

¹ Zhengzhou University, China

² Tsinghua University, China



Sponge-like nickel phosphide–carbon nanotube ($\text{Ni}_x\text{P/CNT}$) hybrid electrodes were prepared by facile cyclic voltammetric deposition of amorphous Ni_xP catalysts onto three-dimensional (3D) porous CNT supports. $\text{Ni}_x\text{P/CNT}$ s exhibit superior catalytic activity for sustained hydrogen evolution in acidic, neutral, and basic media.

415–425

Boron-doped microporous nano carbon as cathode material for high-performance Li-S batteries

Feng Wu^{1,2}, Ji Qian¹, Weiping Wu³, Yusheng Ye¹, Zhiguo Sun¹, Bin Xu⁴, Xiaoguang Yang⁵, Yuhong Xu⁶, Jiatao Zhang¹, and Renjie Chen^{1,2,*}

¹ Beijing Institute of Technology, China

² Collaborative Innovation Center of Electric Vehicles in Beijing, China

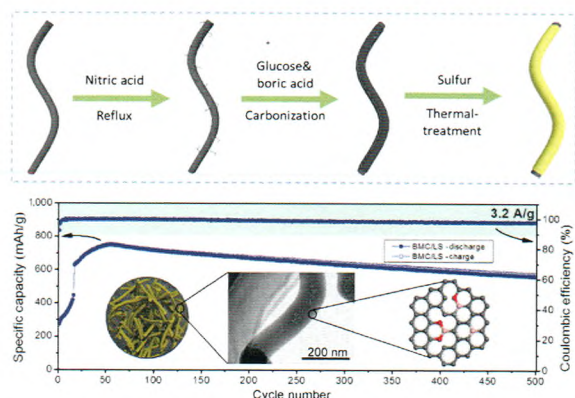
³ City, University of London, UK

⁴ Beijing University of Chemical Technology, China

⁵ Ford Motor Company, USA

⁶ Ford Motor Research and Engineering (Nanjing) Co., Ltd., China

426–436



A boron-doped microporous carbon (BMC)/sulfur composite is synthesized and applied successfully as a novel cathode material for advanced Li-S batteries.

Flexible highly-effective energy harvester via crystallographic and computational control of nanointerfacial morphotropic piezoelectric thin film

Chang Kyu Jeong^{1,2,†}, Sung Beom Cho³, Jae Hyun Han¹, Dae Yong Park¹, Suyoung Yang², Kwi-Il Park⁴, Jung-ho Ryu⁵, Hoon Sohn^{2,*}, Yong-Chae Chung^{3,*}, and Keon Jae Lee^{1,*}

¹ Korea Advanced Institute of Science and Technology (KAIST), Republic of Korea

² KAIST Institute for the NanoCentury (KINC), Republic of Korea

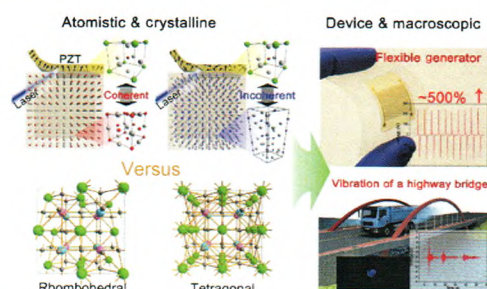
³ Hanyang University, Republic of Korea

⁴ Gyeongnam National University of Science and Technology, Republic of Korea

⁵ Korea Institute of Materials Science (KIMS), Republic of Korea

[†] Present address: The Pennsylvania State University, USA

437–455



Crystallographic behaviors of $\text{PbZr}_{1-x}\text{Ti}_x\text{O}_3$ (PZT) thin film caused by modified interfacial effects are thoroughly studied by integrated perspectives from *ab initio* physical modeling to experimental demonstration; these behaviors can significantly increase the performance of flexible energy harvesters by ~500%, compared to single crystal slaps. Phase balance and crystallinity, as well as the crystal orientation of PZT film at morphotropic phase boundary (MPB), can be clearly modulated by nanointerfacial structure and polarization.

In situ grazing-incidence small-angle X-ray scattering observation of block-copolymer templated formation of magnetic nanodot arrays and their magnetic properties

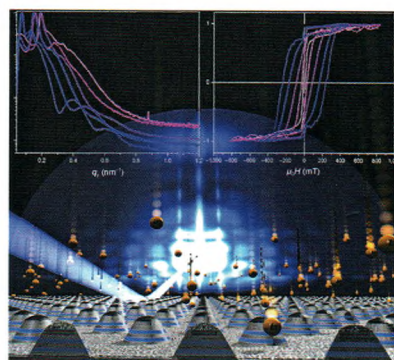
Andreas Meyer^{1,*}, Norbert Franz¹, Hans Peter Oepen¹, Jan Perlich², Gerardina Carbone³, and Till Hartmut Metzger³

¹ Universität Hamburg, Germany

² HASYLAB/Deutsches Elektronen Synchrotron, Germany

³ European Synchrotron Radiation Facility, France

456–471



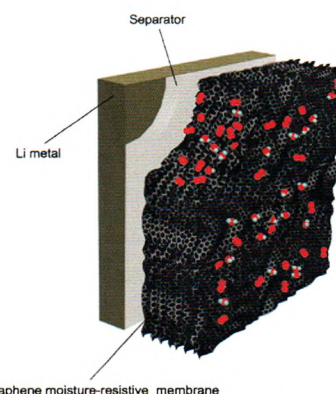
The formation of two-dimensional magnetic nanodot arrays was observed by *in situ* grazing-incidence small-angle X-ray scattering to reveal structural information during nanosphere lithography. We found that the dot shape changed from cylindrical to conical during the etching process and that the magnetic properties showed a proportional dependency of the coercivity on the dot size.

Three-dimensional graphene membrane cathode for high energy density rechargeable lithium-air batteries in ambient conditions

Xing Zhong, Benjamin Papandrea, Yuxi Xu, Zhaoyang Lin, Hua Zhang, Yuan Liu, Yu Huang, and Xiangfeng Duan*

University of California, Los Angeles, USA

472–482



A graphene membrane Li-air battery with high performance has been demonstrated in ambient conditions. The battery's high storage capacity and unique O_2/H_2O selectivity are attributed to its large specific surface area and network of highly tortuous hydrophobic channels.

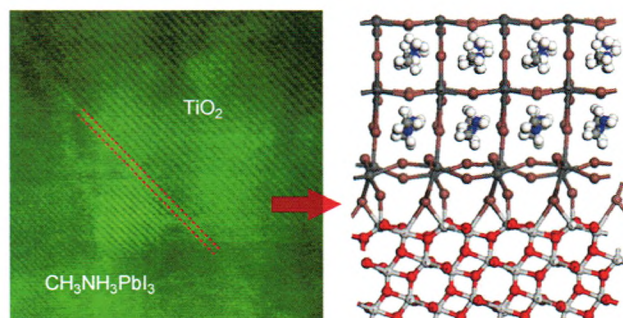
Methylammonium cation deficient surface for enhanced binding stability at $TiO_2/CH_3NH_3PbI_3$ interface

Xin Xu¹, Kai Li², Zhenzhong Yang¹, Jiangjian Shi¹, Dongmei Li¹, Lin Gu^{1,*}, Zhijian Wu^{2,*}, and Qingbo Meng^{1,*}

¹ Institute of Physics, Chinese Academy of Sciences, China

² Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, China

483–490



The $TiO_2/CH_3NH_3PbI_3$ interface is found to have a heavy atomic layer attributed to the vacancies of methylammonium cation groups.

Tunable Rashba spin splitting in quantum-spin Hall-insulator AsF bilayers

Jun Zhao^{1,3}, Wanlin Guo², and Jing Ma^{1,*}

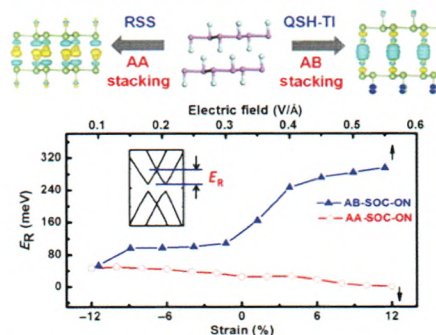
¹ Nanjing University, China

² Nanjing University of Aeronautics and Astronautics, China

³ Yangtze University, China

491–502

AsF bilayer with RSS and nontrivial topology



Tunable Rashba spin splitting (RSS) and nontrivial topological electronic states can be simultaneously aroused in bilayered fluorinated arsenene, according to comprehensive first-principle calculations.

Highly efficient gene silencing and bioimaging based on fluorescent carbon dots *in vitro* and *in vivo*

Seongchan Kim¹, Yuri Choi², Ginam Park³, Cheolhee Won³, Young-Joon Park⁴, Younghoon Lee^{5,*}, Byeong-Su Kim^{2,*}, and Dal-Hee Min^{1,3,*}

¹ Seoul National University, Republic of Korea

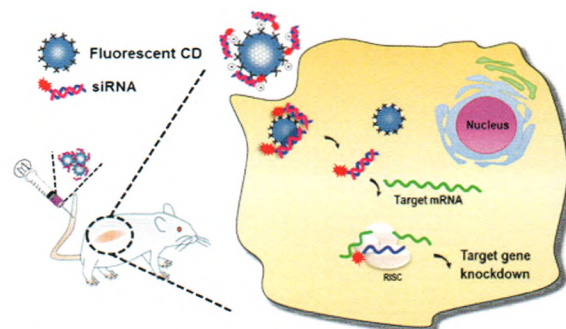
² Ulsan National Institute of Science and Technology (UNIST), Republic of Korea

³ Lemonex Inc., Republic of Korea

⁴ Ajou University, Republic of Korea

⁵ Korea Advanced Institute of Science and Technology (KAIST), Republic of Korea

503–519



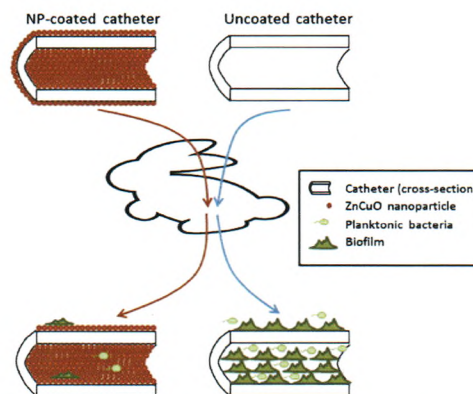
In this work, a strategy for therapeutic RNA interference (RNAi) based on highly biocompatible and fluorescent carbon nanoparticles is demonstrated, in which small interfering RNAs (siRNAs) are protected from ribonuclease (RNase)-mediated degradation and have a longer half-life *in vivo*. Our strategy allows simultaneous bioimaging and efficient downregulation of gene expression, showing high potential for gene therapy *in vitro* and *in vivo*.

Catheters coated with Zn-doped CuO nanoparticles delay the onset of catheter-associated urinary tract infections

Yakov Shalom, Ilana Perelshtein, Nina Perkash, Aharon Gedanken*, and Ehud Banin*

Bar-Ilan University, Israel

520–533

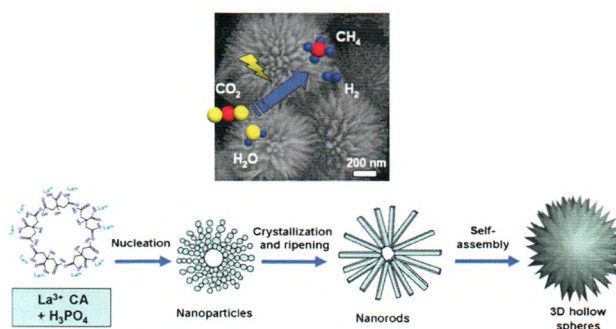


Urinary catheters sonochemically coated with Zn-doped CuO nanoparticles inhibit biofilm formation, delay the onset of catheter-associated urinary tract infection, and show high biocompatibility *in vivo*.

Self-assembly synthesis of LaPO₄ hierarchical hollow spheres with enhanced photocatalytic CO₂-reduction performance

Bao Pan, Yangen Zhou, Wenye Su*, and Xuxu Wang*

Fuzhou University, China



Urchin-like LaPO₄ hollow spheres were successfully prepared by a facile one-pot route. They showed a 6.8-fold enhancement of photocatalytic activity for CO₂ reduction compared with mono-dispersed one-dimensional LaPO₄ nanorods.

534–545

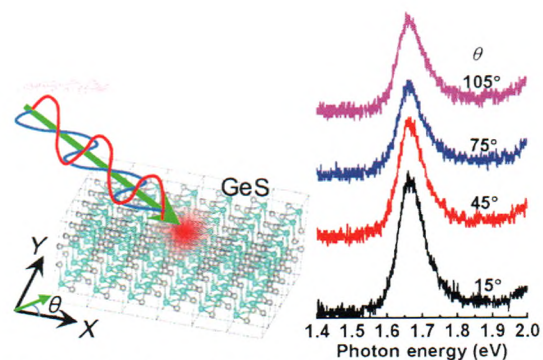
Anisotropic optical and electronic properties of two-dimensional layered germanium sulfide

Dezhi Tan^{1,*}, Hong En Lim¹, Feijiu Wang¹, Nur Baizura Mohamed¹, Shinichiro Mouri¹, Wenjin Zhang¹, Yuhei Miyauchi¹, Mari Ohfuchi², and Kazunari Matsuda^{1,*}

¹ Kyoto University, Japan

² Fujitsu Laboratories Ltd., Japan

546–555



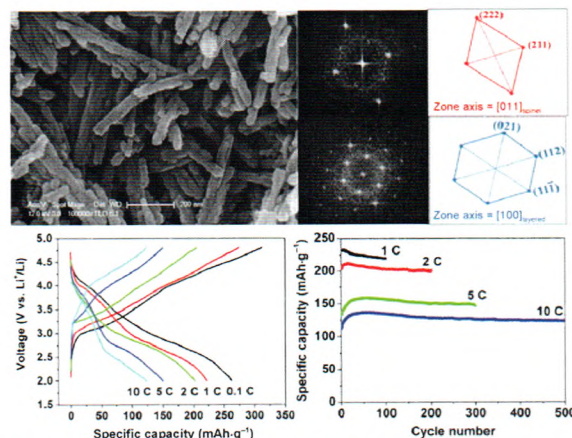
Layered GeS exhibits significantly anisotropic optical and electronic properties, which are revealed by using polarization-dependent Raman-scattering, absorption, and PL spectroscopies.

Spinel-layered integrate structured nanorods with both high capacity and superior high-rate capability as cathode material for lithium-ion batteries

Huibing He, Hengjiang Cong, Ya Sun, Ling Zan, and Youxiang Zhang*

Wuhan University, China

556–569



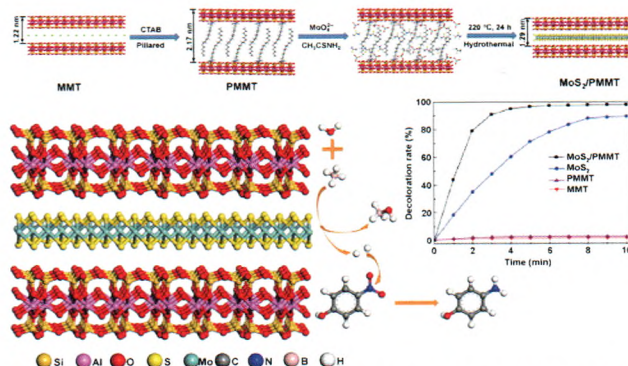
Spinel-layered integrate structured Li_2MnO_3 nanorods were synthesized and showed high capacities and superior high-rate capabilities as a cathode material for lithium batteries.

Hierarchical MoS_2 intercalated clay hybrid nanosheets with enhanced catalytic activity

Kang Peng, Liangjie Fu, Huaming Yang*, Jing Ouyang, and Aidong Tang*

Central South University, China

570–583



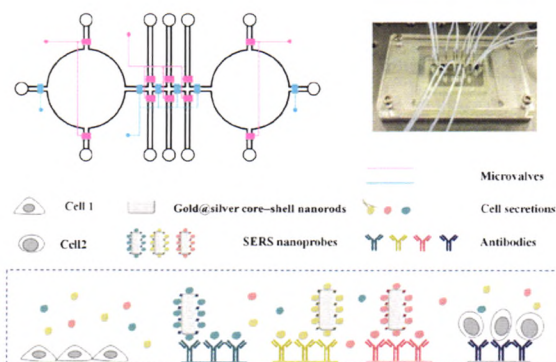
Hierarchical MoS_2 /pillared-montmorillonite (MoS_2 /PMMT) hybrid nanosheets were successfully prepared through facile *in-situ* hydrothermal synthesis of MoS_2 within the interlayer of cetyltrimethylammonium bromide PMMT. The MoS_2 /PMMT exhibited excellent catalytic activity and stability for the reduction reaction of 4-nitrophenol.

In situ probing of cell–cell communications with surface-enhanced Raman scattering (SERS) nanoprobe and microfluidic networks for screening of immunotherapeutic drugs

Lei Wu, Zhuyuan Wang*, Yizhi Zhang, Jiayuan Fei, Hui Chen, Shenfei Zong, and Yiping Cui*

Southeast University, China

584–594



A fully integrated and highly automated surface-enhanced Raman scattering (SERS)-microfluidic chip was developed for *in situ* probing of cancer secretion-mediated cell-cell communications. The platform combines SERS nanoprobe with microfluidics for monitoring cancer-immune system communication and screening of immunotherapeutic drugs.

Monolithically integrated CoP nanowire array: An on/off switch for effective on-demand hydrogen generation via hydrolysis of NaBH_4 and NH_3BH_3

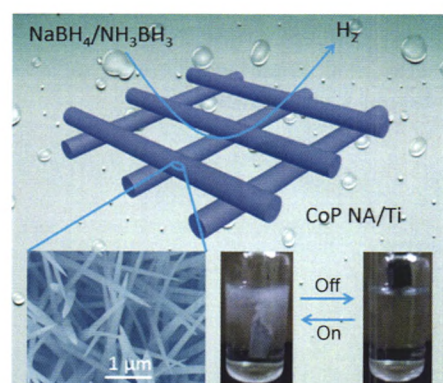
Liang Cui^{1,2}, Yuanhong Xu², Li Niu¹, Wenrong Yang³, and Jingquan Liu^{1,2,*}

¹ Linyi University, China

² Qingdao University, China

³ Deakin University, Australia

595–604



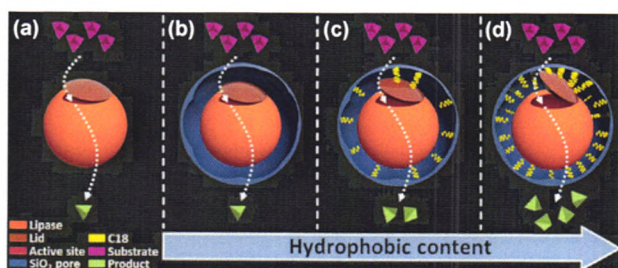
As a highly active and robust catalyst, a monolithically integrated CoP nanowire array on Ti mesh (CoP NA/Ti) behaves as an effective on/off switch for on-demand hydrogen generation via hydrolysis of NaBH_4 and NH_3BH_3 .

Tailoring mesoporous-silica nanoparticles for robust immobilization of lipase and biocatalysis

Mohammad Kalantari, Meihua Yu, Yannan Yang, Ekaterina Strounina, Zhengying Gu, Xiaodan Huang, Jun Zhang, Hao Song, and Chengzhong Yu*

The University of Queensland, Australia

605–617



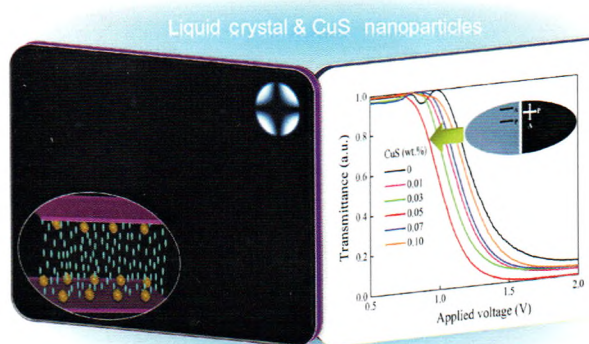
We propose a rational design of mesoporous-silica nanoparticles with outstanding performance for the immobilization of lipase. It is demonstrated that a high content of hydrophobic-surface modification and an optimized pore size of mesoporous-silica nanoparticles are essential for improving the catalytic activity and cyclability of immobilized lipase.

Effects of morphology and concentration of CuS nanoparticles on alignment and electro-optic properties of nematic liquid crystal

Bin Liu, Yiran Ma, Dongyu Zhao*, Lihong Xu, Fashun Liu, Wei Zhou*, and Lin Guo*

Beihang University, China

618–625



The perfect homeotropic alignment and remarkable enhancement of the electro-optic properties of a nematic liquid crystal were realized by doping with CuS nanoparticles.

Magnetic iron oxide nanoparticles accelerate osteogenic differentiation of mesenchymal stem cells via modulation of long noncoding RNA *INZEB2*

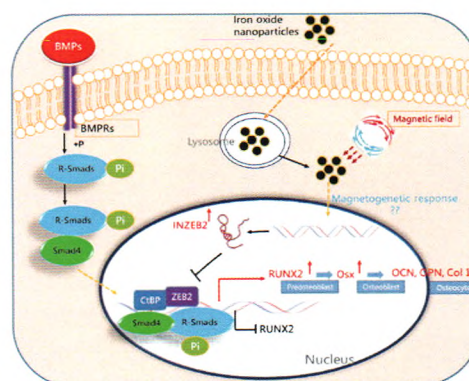
Qiwei Wang^{1,2}, Bo Chen^{1,2}, Fang Ma¹, Shikang Lin³, Meng Cao², Yan Li¹, and Ning Gu^{1,2,*}

¹ Southeast University, China

² Collaborative Innovation Center of Suzhou Nano Science and Technology, China

³ Signalway Antibody LLC, USA

626–642



LncRNA *INZEB2* is upregulated during treatment of mesenchymal stem cells (MSCs) with magnetic iron oxide nanoparticles (IONPs) and is necessary for maintaining the promotion of osteogenic differentiation by IONPs via activation of the BMP/Smad pathway.

Role of the carrier gas flow rate in monolayer MoS₂ growth by modified chemical vapor deposition

Hengchang Liu^{1,2,3,4}, Yuanhu Zhu^{2,*}, Qinglong Meng², Xiaowei Lu², Shuang Kong², Zhiwei Huang², Peng Jiang², and Xinhe Bao^{1,2}

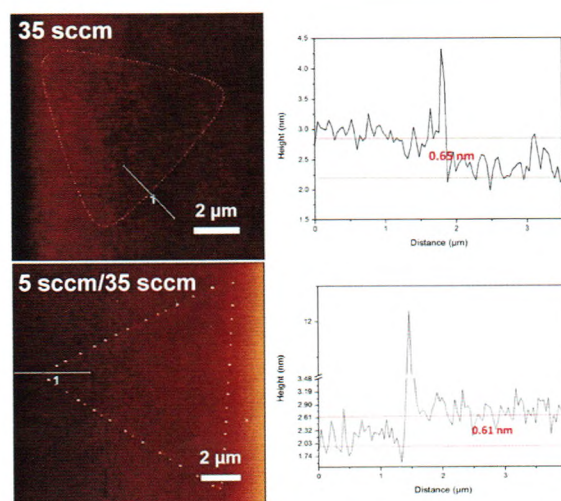
¹ Shanghai Advanced Research Institute, Chinese Academy of Sciences, China

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

³ University of Chinese Academy of Sciences, China

⁴ ShanghaiTech University, China

643–651



The variation of carrier gas flow rate could overcome the low density, the inhomogeneous thickness and morphology of MoS₂. By adjusting the carrier gas flow rate, sharp triangular MoS₂ monolayers could be prepared in a controlled way.

C_{60} fullerene enhances cisplatin anticancer activity and overcomes tumor cell drug resistance

Svitlana Prylutska¹, Rostyslav Panchuk², Grzegorz Gołuński³, Larysa Skivka¹, Yuriy Prylutskyi^{1,*}, Vasyl Hurmach¹, Nadya Skorohyd², Agnieszka Borowik³, Anna Woźniowska³, Jacek Piosik^{3,*}, Olena Kyzyma^{1,4}, Vasil Garamus⁵, Leonid Bulavin¹, Maxim Evstigneiev^{6,*}, Anatoly Buchelnikov⁶, Rostyslav Stoika², Walter Berger⁷, Uwe Ritter⁸, and Peter Scharff⁸

¹ Taras Shevchenko National University of Kyiv, Ukraine

² Institute of Cell Biology, Ukraine

³ Intercollegiate Faculty of Biotechnology UG-MUG, Poland

⁴ Joint Institute for Nuclear Research, Russia

⁵ Helmholtz-Zentrum Geesthacht: Centre for Materials and Coastal Research, Germany

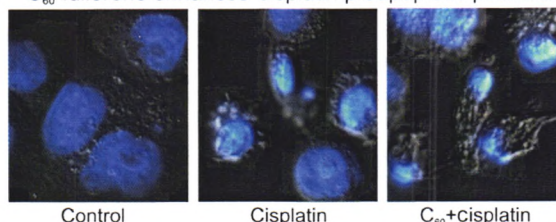
⁶ Belgorod State University, Russia

⁷ Medical University Vienna, Austria

⁸ Technical University of Ilmenau, Germany

652–671

C_{60} fullerene enhances cisplatin proapoptotic potential



Control

Cisplatin

C_{60} +cisplatin

We formulated and prepared novel complex of a fullerene C_{60} and cisplatin. The complex effectively increased anticancer activity of cisplatin two-fold both *in vitro* and *in vivo*.

Growth and optical properties of $In_xGa_{1-x}P$ nanowires synthesized by selective-area epitaxy

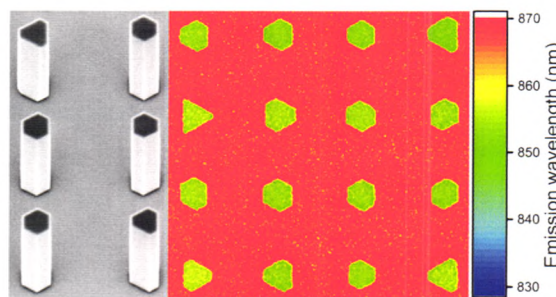
Alexander Berg^{1,*}, Philippe Caroff^{2,*}, Naeem Shahid², Mark N. Lockrey², Xiaoming Yuan^{2,†}, Magnus T. Borgström¹, Hark Hoe Tan², and Chennupati Jagadish²

¹ Lund University, Sweden

² The Australian National University, Australia

[†] Present address: Central South University, China

672–682



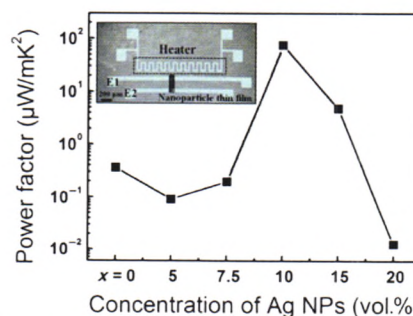
We present a correlated study of $In_xGa_{1-x}P$ nanowires grown by selective-area epitaxy and their optical properties.

Thermoelectric characteristics of nanocomposites made of HgSe and Ag nanoparticles for flexible thermoelectric devices

Junggwon Yun, Kyoungah Cho*, Yoonbeom Park, Seunggen Yang, Jinyong Choi, and Sangsig Kim*

Korea University, Republic of Korea

683–689



We demonstrate enhancements in the thermoelectric properties of HgSe nanoparticles (NPs) when Ag NPs are mixed in a solution phase.

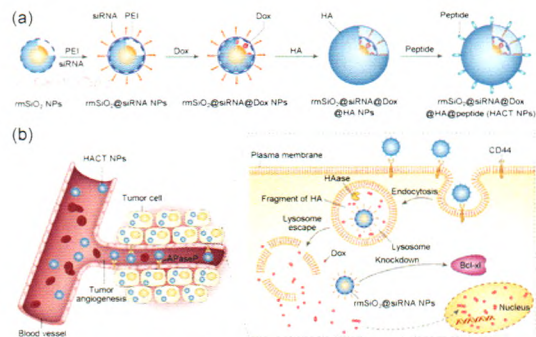
Hyaluronidase-triggered anticancer drug and siRNA delivery from cascaded targeting nanoparticles for drug-resistant breast cancer therapy

Jie Ding^{1,2}, Tingxizi Liang¹, Ying Zhou¹, Zhiwei He², Qianhao Min^{1,*}, Liping Jiang^{1,*}, and Junjie Zhu^{1,*}

¹ Nanjing University, China

² Guangdong Medical University, China

690–703



In this study, we prepared activatable hyaluronidase (HAase) and cascaded targeting nanoparticles (HACT NPs) for the pinpoint delivery of anticancer drugs and siRNAs to overcome the drug resistance of connective tissue growth factor (CTGF)-overexpressing breast cancer *in vivo*.

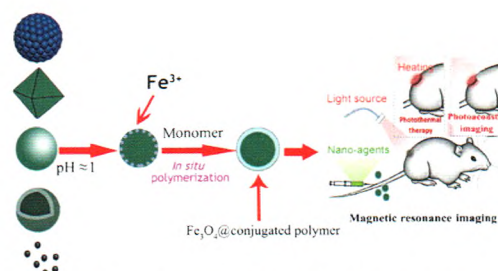
General synthesis of high-performing magneto-conjugated polymer core-shell nanoparticles for multifunctional theranostics

Hao Yan^{1,2}, Lingyun Zhao¹, Wenting Shang², Zhongqun Liu¹, Wensheng Xie¹, Cai Qiang¹, Zhiyuan Xiong¹, Ranran Zhang¹, Baohua Li¹, Xiaodan Sun^{1,*}, and Feiyu Kang^{1,*}

¹ Tsinghua University, China

² Institute of Automation, Chinese Academy of Sciences, China

704–717



A new *in situ* surface polymerization method free of extra surfactants and oxidizing agents was developed for the controlled synthesis of iron oxide@conjugated polymer nanoparticles (NPs) with an adjustable size, shape, and shell thickness. The obtained iron oxide@poly(3,4-ethylenedioxythiophene):poly(4-styrenesulfonate) (PEDOT:PSS) NPs had balanced, prominent magneto-optical properties and exhibited an excellent hyperthermal therapeutic effect under multimodal imaging-guiding *in vivo*.

Large edge magnetism in oxidized few-layer black phosphorus nanomeshes

Yudai Nakanishi¹, Ayumi Ishi¹, Chika Ohata¹, David Soriano², Ryo Iwaki¹, Kyoko Nomura¹, Miki Hasegawa¹, Taketomo Nakamura⁴, Shingo Katsumoto⁴, Stephan Roche^{2,3}, and Junji Haruyama^{1,*}

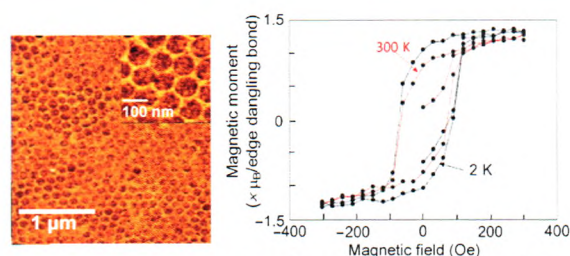
¹ Aoyama Gakuin University, Japan

² Campus UAB, Spain

³ Institució Catalana de Recerca i Estudis Avançats (ICREA), Spain

⁴ The University of Tokyo, Japan

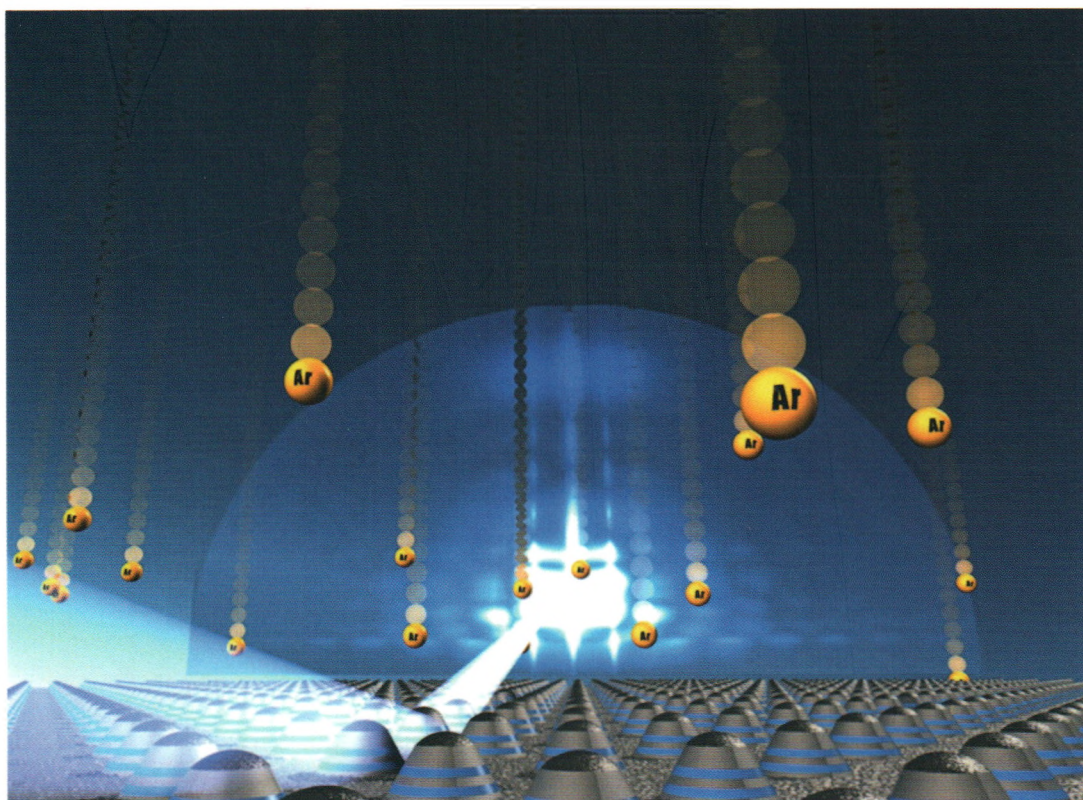
718–728



Room-temperature large edge ferromagnetism arises from O-terminated zigzag pore edges of few-layer black P nanomeshes (BPNMs), which consist of a honeycomb-like array of hexagonal nanopores formed by a non-lithographic method. The observed magnetization values (per unit area) are ~ 100 times larger than those reported for H-terminated graphene NMs, while the magnetism disappears for H-terminated BPNMs. Ferromagnetic spin coupling of the edge P=O bond and interlayer spin interaction cause large magnetism.

Erratum to: Strategies to obtain pattern fidelity in nanowire growth from large-area surfaces patterned using nanoimprint lithography (DOI 10.1007/s12274-016-1165-z)

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纳米研究 (英文版) (月刊, 2008年创刊) 第10卷 第2期 2017年2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

