

Nano Research

September · 2017

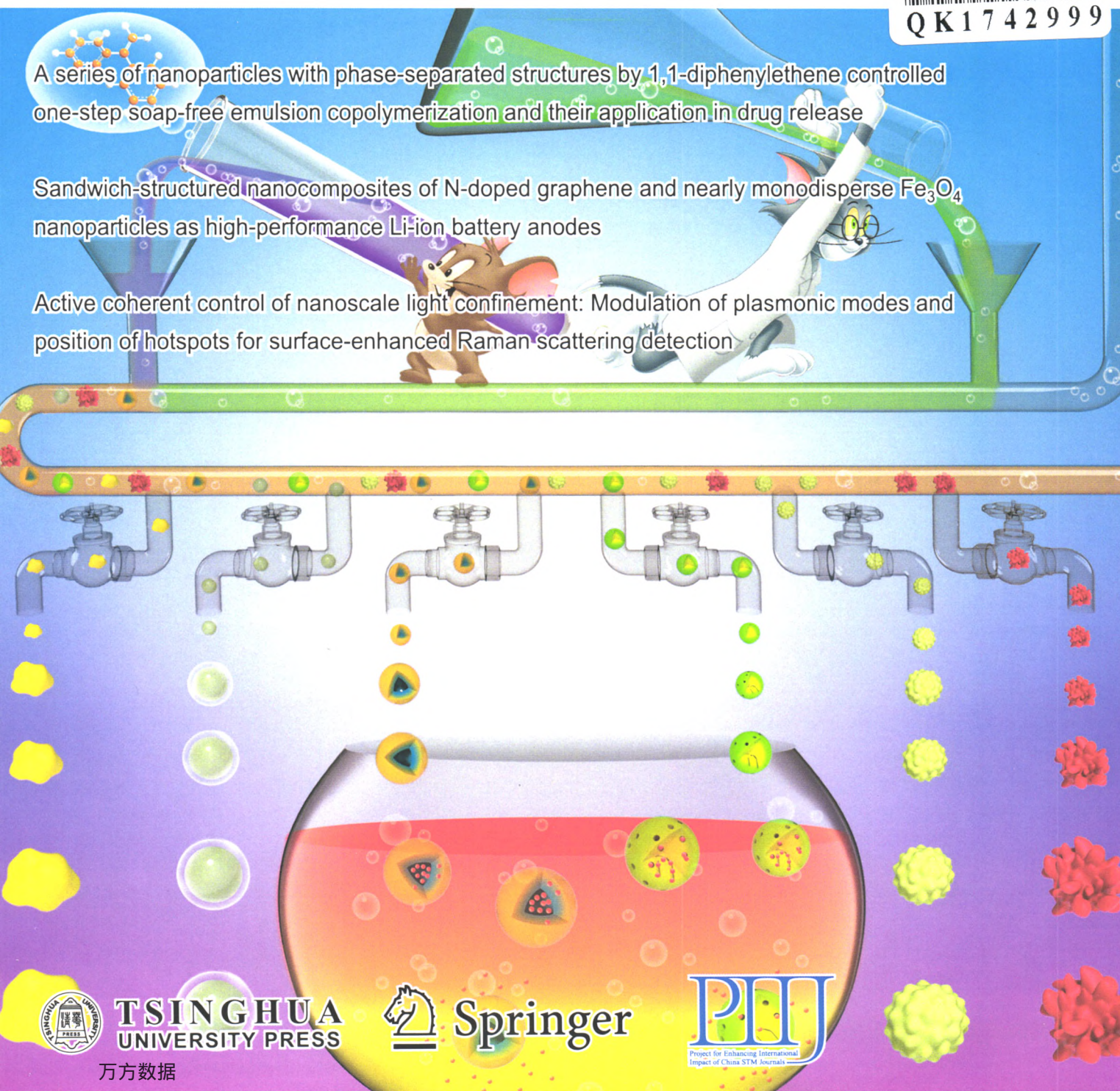
Volume 10 · Number 9



A series of nanoparticles with phase-separated structures by 1,1-diphenylethene controlled one-step soap-free emulsion copolymerization and their application in drug release

Sandwich-structured nanocomposites of N-doped graphene and nearly monodisperse Fe_3O_4 nanoparticles as high-performance Li-ion battery anodes

Active coherent control of nanoscale light confinement: Modulation of plasmonic modes and position of hotspots for surface-enhanced Raman scattering detection



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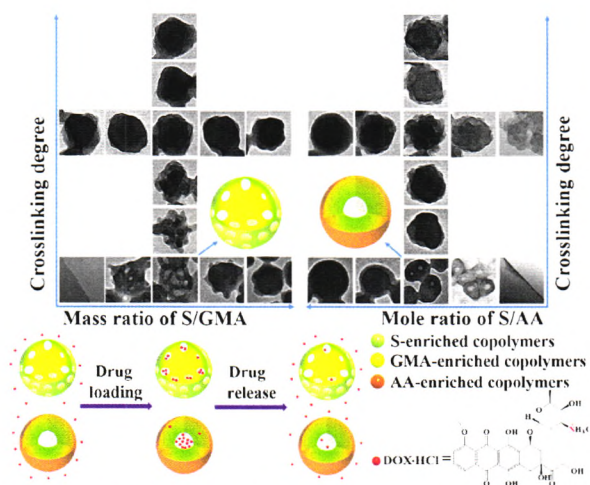
Contents

Research Articles

A series of nanoparticles with phase-separated structures by 1,1-diphenylethene controlled one-step soap-free emulsion copolymerization and their application in drug release

Xinlong Fan, Jin Liu, Xiangkun Jia, Yin Liu, Hao Zhang, Shenqiang Wang, Baoliang Zhang, Hepeng Zhang, and Qiuyu Zhang*

Northwestern Polytechnical University, China



A series of phase-separated porous, raspberry-, flower-like, core-shell, anomalous nanoparticles and nanocapsules are prepared by a facile one-step 1,1-diphenylethene controlled soap-free emulsion copolymerization, where the unpolymerized monomer resulted from low conversion due to 1,1-diphenylethene functions as an *in situ* porogen to produce porous particles and nanocapsules. The drug loading and release behaviors of the porous particles and nanocapsules are investigated.

2905–2922

Sandwich-structured nanocomposites of N-doped graphene and nearly monodisperse Fe_3O_4 nanoparticles as high-performance Li-ion battery anodes

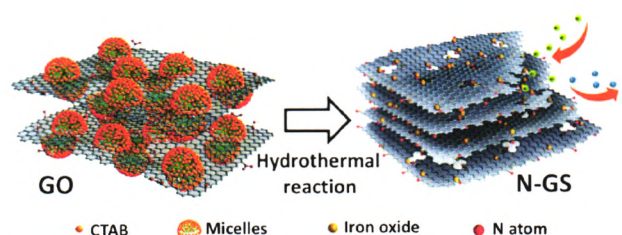
Wen Qi¹, Xuan Li², Hui Li³, Weikang Wu³, Pei Li², Ying Wu¹, Chunjiang Kuang¹, Shaoxiong Zhou^{1,*}, and Xiaolin Li^{4,*}

¹ China Iron & Steel Research Institute Group, China

² Tianjin University, China

³ Shandong University, China

⁴ Pacific Northwest National Laboratory, USA



A sandwich-structured nanocomposite of N-doped graphene and nearly monodisperse Fe_3O_4 nanoparticles were developed as Li-ion battery anode. With N-doped graphene as the framework that controls Fe_3O_4 nucleation, it exhibits good electron conductivity and Li-ion accessibility and can accommodate a large volume change, thereby delivering a capacity of $\sim 1,227 \text{ mA} \cdot \text{h} \cdot \text{g}^{-1}$ and 96.8% retention over 1,000 cycles.

2923–2933

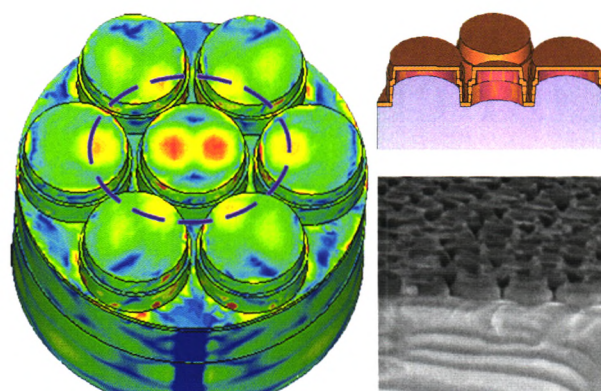
Active coherent control of nanoscale light confinement: Modulation of plasmonic modes and position of hotspots for surface-enhanced Raman scattering detection

Zhendong Zhu^{1,2}, Qixia Wang², Fa Zeng^{2,3}, Oubo You², Sitian Gao^{1,*}, Benfeng Bai², Qiaofeng Tan^{2,*}, Guofan Jin², Qunqing Li^{2,*}, Shoushan Fan², Wei Li¹, Yushu Shi¹, and Xueshen Wang¹

¹ National Institute of Metrology, China

² Tsinghua University, China

³ China Academic of Engineering Physics, China



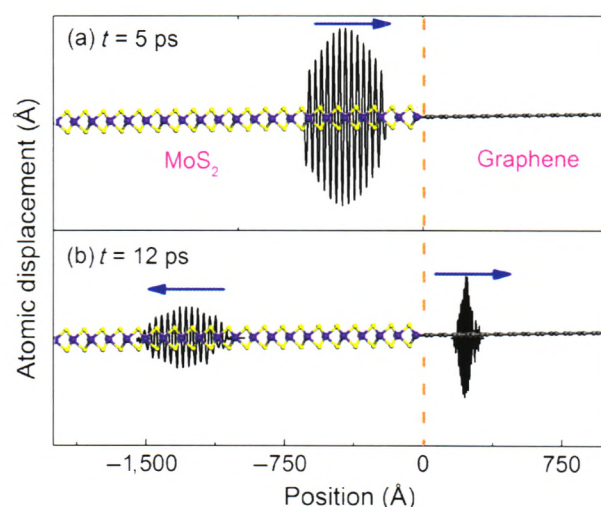
A three-dimensional plasmonic double-stacked nanocone nanostructure is controllably fabricated via mask reconfiguration. This multiscale nanostructure exhibits significant plasmonic properties of active light modulation on the nanoscale and the ability to position the hottest spots on the top surface, along with good performance in surface-enhanced Raman scattering.

2934–2943

MoS₂-graphene in-plane contact for high interfacial thermal conduction

Xiangjun Liu, Junfeng Gao, Gang Zhang*, and Yong-Wei Zhang

A*STAR, Singapore



Snapshot of a wave packet traveling across the MoS₂-graphene interface. The blue arrows indicate the direction in which the wave packet is traveling.

2944–2953

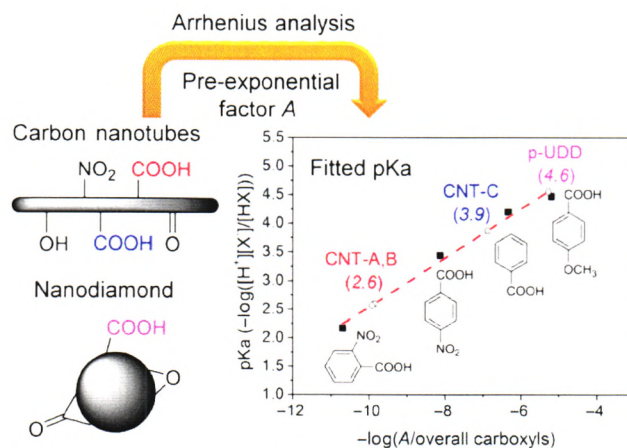
Determination of the acidic properties of carboxylated carbocatalysts in an acid-catalyzed ring-opening reaction using kinetic profiling

Bolun Wang^{1,2}, Guodong Wen¹, and Dangsheng Su^{1,3,*}

¹ Institute of Metal Research, Chinese Academy of Sciences, China

² University of Science and Technology of China, China

³ Fritz Haber Institute of the Max Planck Society, Germany



The average catalytic activities of the carboxyl groups attached to the carbocatalysts differed. These differences were attributed to variations in the pK_a values of the carboxyl groups induced by the electronic effects of the nitro groups.

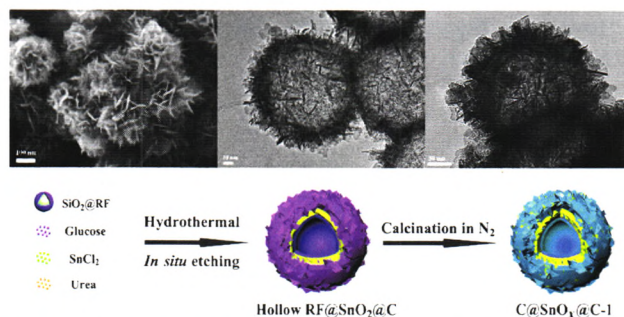
2954–2965

Flower-like C@SnO_x@C hollow nanostructures with enhanced electrochemical properties for lithium storage

Yijia Wang¹, Zheng Jiao¹, Minghong Wu¹, Kun Zheng², Hongwei Zhang², Jin Zou², Chengzhong Yu^{2,*}, and Haijiao Zhang^{1,*}

¹ Shanghai University, China

² The University of Queensland, Australia



A novel kind of flower-like C@SnO_x@C hollow nanostructure was synthesized through a facile and economical hydrothermal process. Owing to its unique architecture, the product exhibited an excellent lithium-storage performance.

2966–2976

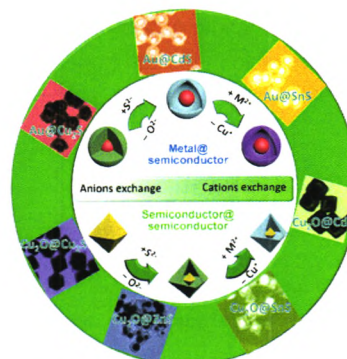
Versatile synthesis of yolk/shell hybrid nanocrystals via ion-exchange reactions for novel metal/semiconductor and semiconductor/semiconductor conformations

Muwei Ji^{1,2}, Xinyuan Li¹, Hongzhi Wang¹, Liu Huang¹, Meng Xu¹, Jia Liu¹, Jiajia Liu¹, Jin Wang², and Jiatao Zhang^{1,*}

¹ Beijing Institute of Technology, China

² Tsinghua University, China

2977–2987



A versatile strategy involving the careful sulfuration of as-prepared cavity-free core/shell nanocrystals (NCs) or metal-oxide NCs followed by phosphine-initialized cation-exchange reactions was demonstrated for preparing novel metal@semiconductor and metal oxide@semiconductor (II-VI) yolk/shell (Y-S) NCs. The geometry, size, and conformations of the core and shell were independently considered. These new Y-S NCs may have unforeseen applications in confined nanoreactors, heterogeneous catalysis, and energy conversion and storage technologies.

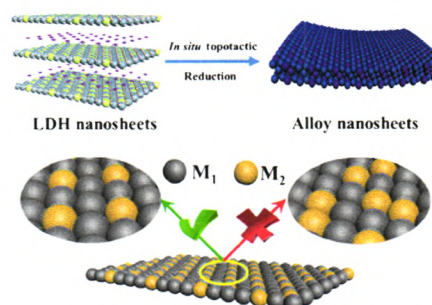
Topotactic reduction of layered double hydroxides for atomically thick two-dimensional non-noble-metal alloy

Pengsong Li¹, Qixian Xie¹, Lirong Zheng², Guang Feng¹, Yingjie Li¹, Zhao Cai¹, Yongmin Bi¹, Yaping Li¹, Yun Kuang^{1,*}, Xiaoming Sun^{1,*}, and Xue Duan¹

¹ Beijing University of Chemical Technology, China

² Institute of High Energy Physics, Chinese Academy of Sciences, China

2988–2997



Atomic-thickness two-dimensional (2D) multi-metallic single crystalline alloy nanosheets with highly tunable metallic compositions could be synthesized through *in situ* topotactic reduction of layered double hydroxides (LDHs). The as-obtained alloy nanosheets not only maintained the ultrathin 2D structure, but also inherited the atomic dispersion of the metallic compositions of the LDH precursors.

High performance metal oxide based sensing device using an electrode with a solid/liquid/air triphase interface

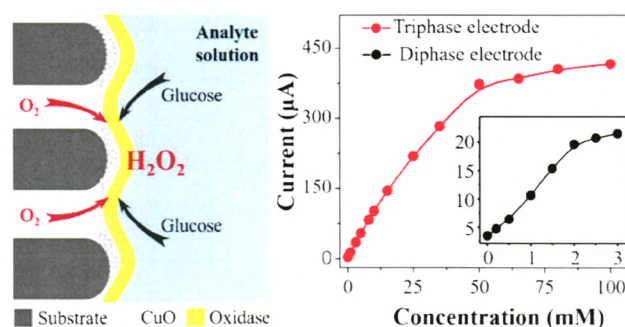
Jun Zhang^{1,2}, Xia Sheng¹, Jian Jin², Xinjian Feng^{1,*}, and Lei Jiang³

¹ Soochow University, China

² Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Sciences, China

³ Beihang University, China

2998–3004



An enzyme electrode with a solid/liquid/air triphase interface allows sufficient oxygen to diffuse directly from the air phase to the oxidase reaction zone, which means that the oxidase kinetics is no longer limited by the oxygen level and ensures that large amounts of H_2O_2 are produced for analyte level measurements. The achieved linear detection upper limit is about 25 times higher than that obtained using traditional enzyme electrodes with a solid/liquid diphasic interface.

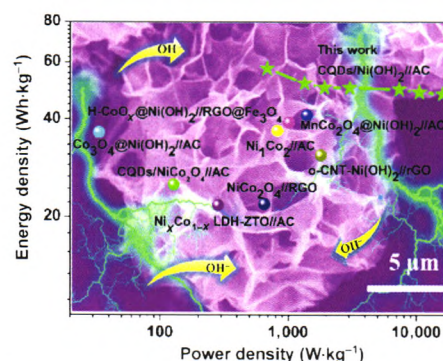
Carbon quantum dot-induced self-assembly of ultrathin $\text{Ni}(\text{OH})_2$ nanosheets: A facile method for fabricating three-dimensional porous hierarchical composite micro-nanostructures with excellent supercapacitor performance

Guijuan Wei¹, Kun Du¹, Xixia Zhao¹, Zhaojie Wang¹, Ming Liu¹, Chuang Li¹, Hui Wang², Changhua An^{1,2,*}, and Wei Xing^{1,*}

¹ China University of Petroleum, China

² Tianjin University of Technology, China

3005–3017



A three-dimensional porous hierarchical carbon quantum dots (CQDs)/ $\text{Ni}(\text{OH})_2$ nanocomposite was synthesized via the CQD-induced assembly of two-dimensional ultrathin $\text{Ni}(\text{OH})_2$ nanosheets. The CQDs functioned as a new type of structure-directing agent. The as-achieved micro-nanostructured CQDs/ $\text{Ni}(\text{OH})_2$ exhibited excellent electrochemical performance with a high energy density of $57.4 \text{ Wh} \cdot \text{kg}^{-1}$ owing to its multilevel hierarchical structures.

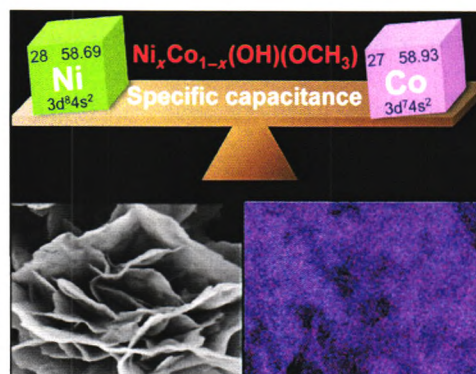
New class of two-dimensional bimetallic nanoplatelets for high energy density and electrochemically stable hybrid supercapacitors

Zhiting Liu^{1,2}, Peng Ma¹, Jens Ulstrup², Qijin Chi^{2,*}, Kake Zhu^{1,*}, and Xinggui Zhou¹

¹ East China University of Science and Technology, China

² Technical University of Denmark, Denmark

3018–3034



A new family of two-dimensional nanoplatelets composed of $\text{Ni}_x\text{Co}_{1-x}(\text{OH})(\text{OCH}_3)$ is synthesized and used in the design and fabrication of hybrid supercapacitors (SCs). The metallic composition is tunable over the entire molar-fraction range (0–1.0), allowing us to optimize their electrochemical performances for high-energy density SCs.

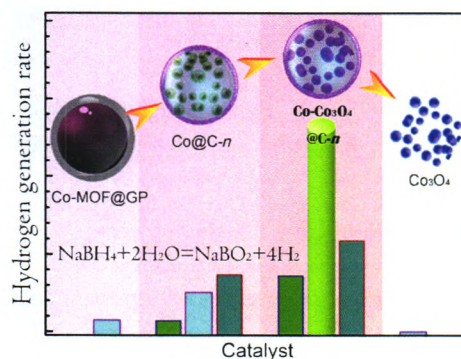
$\text{Co-Co}_3\text{O}_4$ @carbon core–shells derived from metal–organic framework nanocrystals as efficient hydrogen evolution catalysts

Yanyan Liu¹, Guosheng Han¹, Xiaoyu Zhang¹, Congcong Xing¹, Chenxia Du^{1,*}, Huaqiang Cao², and Baojun Li^{1,*}

¹ Zhengzhou University, China

² Tsinghua University, China

3035–3048



$\text{Co-Co}_3\text{O}_4$ @carbon composites were synthesized via pyrolysis of Co-metal-organic frameworks (MOFs)@glucose polymer (GP) following partial oxidation of Co nanoparticles. $\text{Co-Co}_3\text{O}_4$ @C-II provided a maximum H_2 generation rate of $5,360 \text{ mL} \cdot \text{min}^{-1} \cdot \text{g}_{\text{Co}}^{-1}$ and excellent stability during NaBH_4 hydrolysis at room temperature.

Biodegradable nanocarriers for small interfering ribonucleic acid (siRNA) co-delivery strategy increase the chemosensitivity of pancreatic cancer cells to gemcitabine

Chengbin Yang¹, Kok Ken Chan¹, Wen-Jen Lin², Alana Mauluidy Soehartono¹, Guimiao Lin³, Huiting Toh¹, Ho Sup Yoon^{1,4}, Chih-Kuang Chen^{2,*}, and Ken-Tye Yong^{1,*}

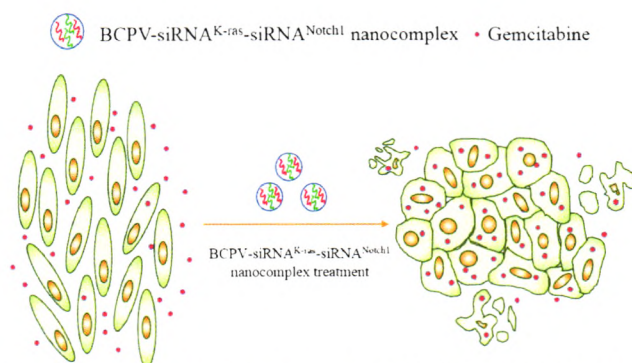
¹ Nanyang Technological University, Singapore

² Feng Chia University, Taiwan, China

³ Shenzhen University, China

⁴ Kyung Hee University, Republic of Korea

3049–3067



The treatment of pancreatic cancer cells with biodegradable charged polyester-based vector (BCPV)-small interfering ribonucleic acid^{K-ras} (siRNA^{K-ras})-siRNA^{Notch1} shows a clear reversal of epithelial-mesenchymal transition (EMT), resulting in increased cell sensitivity to gemcitabine.

An intelligent near-infrared light activatable nanosystem for accurate regulation of zinc signaling in living cells

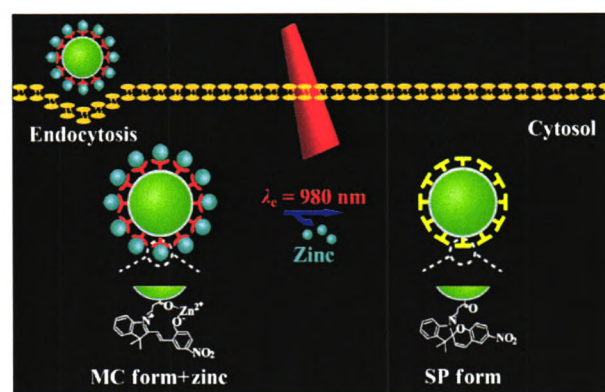
Wei Li^{1,2}, Zhen Liu¹, Zhaowei Chen^{1,2}, Lihua Kang^{3,*}, Yijia Guan^{1,2}, Jinsong Ren^{1,*}, and Xiaogang Qu^{1,*}

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

² University of Chinese Academy of Sciences, China

³ Jilin University, China

3068–3076



Accurate cellular manipulation of zinc levels was achieved by a spiropyran-upconversion-based near-infrared light activatable nanosystem. This system enabled the precise regulation of zinc release while minimizing cellular damage, thus facilitating the future study of complex zinc signaling.

Curved copper nanowires-based robust flexible transparent electrodes via all-solution approach

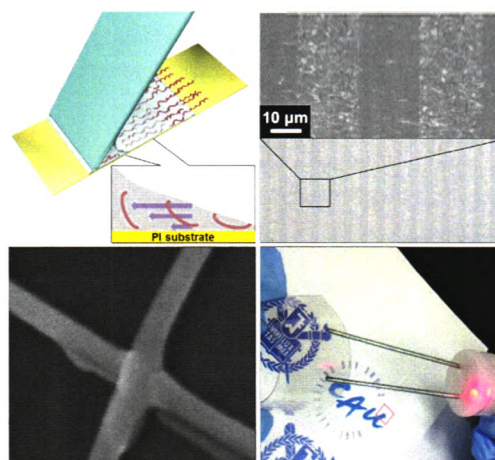
Zhenxing Yin¹, Seung Keun Song², Sanghun Cho¹, Duck-Jae You¹, Jeeyoung Yoo¹, Suk Tai Chang^{2,*}, and Youn Sang Kim^{1,3,*}

¹ Seoul National University, Republic of Korea

² Chung-Ang University, Republic of Korea

³ Advanced Institutes of Convergence Technology, Republic of Korea

3077–3091



Curved Cu nanowire-based flexible transparent conductive electrodes are fabricated via a fully solution-processed approach using various self-designed innovative techniques.

Nanocomposite quasi-solid-state electrolyte for high-safety lithium batteries

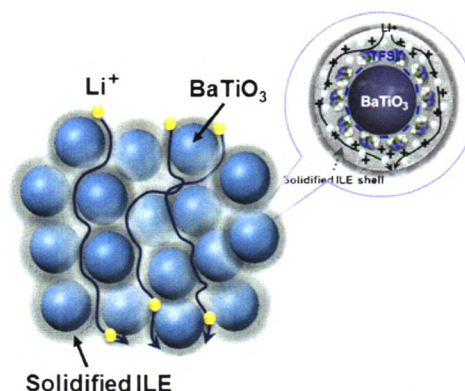
Hyunji Choi¹, Hyun Woo Kim¹, Jae-Kwang Kim^{2,*}, Young Jun Lim¹, Youngsik Kim^{1,*}, and Jou-Hyeon Ahn^{3,*}

¹ Ulsan National Institute of Science and Technology (UNIST), Republic of Korea

² Cheongju University, Republic of Korea

³ Gyeongsang National University, Republic of Korea

3092–3102



A unique hybrid solid-state electrolyte composed of an ionic liquid electrolyte (LiTFSI/Pyr₁₄TFSI) and BaTiO₃ nanosize ceramic particles was prepared without a polymer. The semi-solid electrolyte exhibited high thermal stability, a wide electrochemical window, good ionic conductivity, and remarkable electrochemical properties.

Au/Ni₁₂P₅ core/shell single-crystal nanoparticles as oxygen evolution reaction catalyst

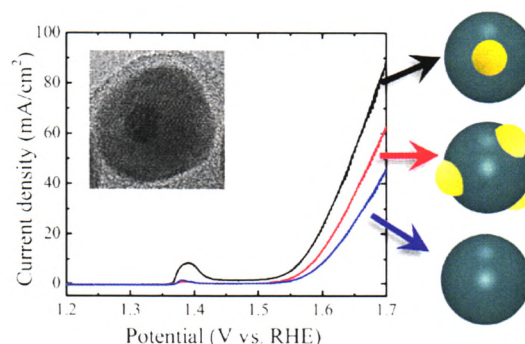
Yingying Xu¹, Sibin Duan¹, Haoyi Li², Ming Yang³, Shijie Wang³, Xun Wang², and Rongming Wang^{1,*}

¹ University of Science and Technology Beijing, China

² Tsinghua University, China

³ A*STAR, Singapore

3103–3112



Oxygen evolution reaction (OER) catalytic activity has been found in Au/nickel phosphide (Ni₁₂P₅) core/shell nanoparticles (NPs), which may relate to the interfacial coupling between the single-crystal core and shell.

Two-photon-excited near-infrared emissive carbon dots as multifunctional agents for fluorescence imaging and photothermal therapy

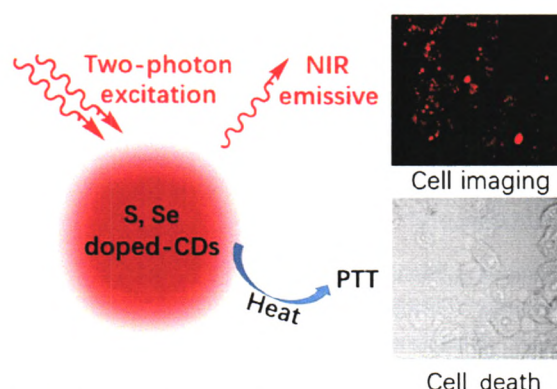
Minhuan Lan¹, Shaojing Zhao¹, Zhenyu Zhang¹, Li Yan¹, Liang Guo², Guangle Niu², Jinfeng Zhang¹, Junfang Zhao², Hongyan Zhang², Pengfei Wang^{2,3,*}, Guangyu Zhu¹, Chun-Sing Lee¹, and Wenjun Zhang^{1,*}

¹ City University of Hong Kong, Hong Kong, China

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

³ University of Chinese Academy of Sciences, China

3113–3123



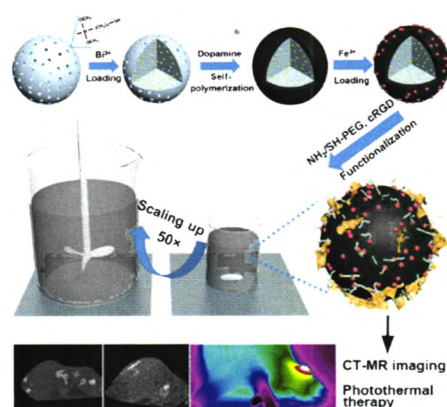
S and Se co-doping leads to excitation wavelength-independent near-infrared emission, a large two-photon absorption cross section, and a high efficiency for the photothermal conversion of C dots (CDs). Thus, the CDs are promising phototheranostic agents for two-photon-excited fluorescence imaging and the photothermal therapy of cancer cells.

Gram-scale synthesis of nanotherapeutic agents for CT/T₁-weighted MRI bimodal imaging guided photothermal therapy

Xianguang Ding¹, Xiaoxia Hao¹, Dongdong Fu¹, Mengxin Zhang¹, Tian Lan¹, Chunyan Li¹, Renjun Huang², Zhijun Zhang¹, Yonggang Li², Qiangbin Wang¹, and Jiang Jiang^{1,*}

¹ Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Sciences, China

² The First Affiliated Hospital of Soochow University, China



Gram-scale nanotheranostic agents based on biocompatible polydopamine-coated mesoporous silica have been developed. These materials are excellent X-ray CT and T₁-weighted magnetic resonance imaging (MRI) contrast enhancing agents, and can be used for photothermal therapy.

3124–3135

Unexpected elastic isotropy in a black phosphorene/TiC₂ van der Waals heterostructure with flexible Li-ion battery anode applications

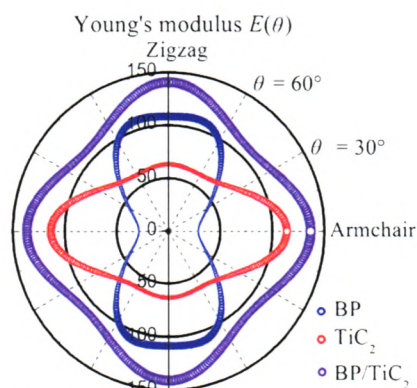
Qiong Peng^{1,2}, Kangming Hu^{1,2}, Baisheng Sa^{1,2,3,*}, Jian Zhou³, Bo Wu^{1,2,*}, Xianhua Hou⁴, and Zhimei Sun^{3,*}

¹ Fuzhou University, China

² Fujian Province University, China

³ Beihang University, China

⁴ South China Normal University, China



A BP/TiC₂ van der Waals (vdW) heterostructure exhibits superior electrical conductivity, mechanical stability, omnidirectional flexibility, and a high Li (Na) storage capacity, demonstrating its great promise as a flexible anode for highly efficient battery equipment.

3136–3150

Fluorination of suspended graphene

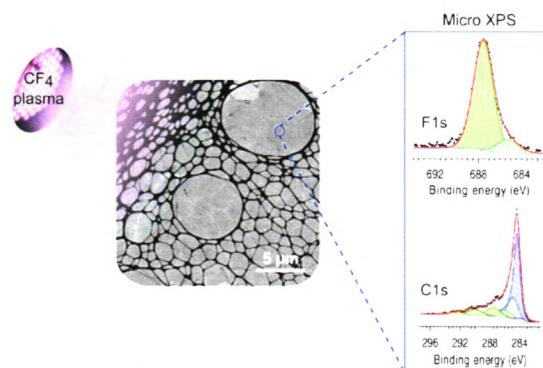
Claudia Struzzi^{1,*}, Mattia Scardamaglia¹, Nicolas Reckinger², Jean-François Colomer², Hikmet Sezen³, Matteo Amati³, Luca Gregoratti³, Rony Snyders^{1,4}, and Carla Bittencourt¹

¹ University of Mons, Belgium

² University of Namur, Belgium

³ Elettra - Sincrotrone Trieste S.C.p.A. di interesse nazionale, Italy

⁴ Materia Nova Research Center, Belgium



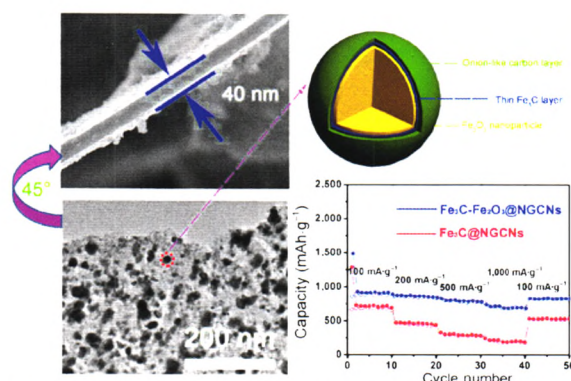
Fluorination of suspended graphene is studied by investigating two different kinetic energies for the ions striking the graphene sheets. The modifications of the electronic and structural properties are examined via spectroscopy and microscopy: Micro-X-ray photoelectron spectroscopy and micro-Raman analysis results are discussed together with scanning photoelectron and scanning electron microscopy results.

3151–3163

Proline-derived *in situ* synthesis of nitrogen-doped porous carbon nanosheets with encaged $\text{Fe}_2\text{O}_3@/\text{Fe}_3\text{C}$ nanoparticles for lithium-ion battery anodes

Jingfei Zhang, Lijuan Qi, Xiaoshu Zhu, Xiaohong Yan, Yufeng Jia, Lin Xu, Dongmei Sun*, and Yawen Tang*

Nanjing Normal University, China



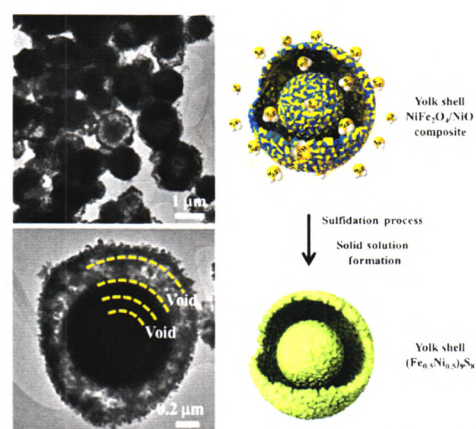
Scalable *in situ* synthesis of two-dimensional (2D) N-doped C nanosheet, assembled together with embedded double-shelled and well-separated Fe_2O_3 nanoparticles, using natural and cheap amino acid proline as C precursor by a facile inert salt-template approach, composed of $\text{Fe}_2\text{O}_3@/\text{Fe}_3\text{C}$ -NGCNs, is developed. The hybrids exhibit markedly improved stability of Li storage and excellent rate capability.

3164–3177

Yolk-shell-structured $(\text{Fe}_{0.5}\text{Ni}_{0.5})_9\text{S}_8$ solid-solution powders: Synthesis and application as anode materials for Na-ion batteries

Jung Hyun Kim and Yun Chan Kang*

Korea University, Republic of Korea



In this study, multicomponent metal sulfide materials with a yolk-shell structure and a single phase were studied for the first time as anode materials for sodium-ion batteries.

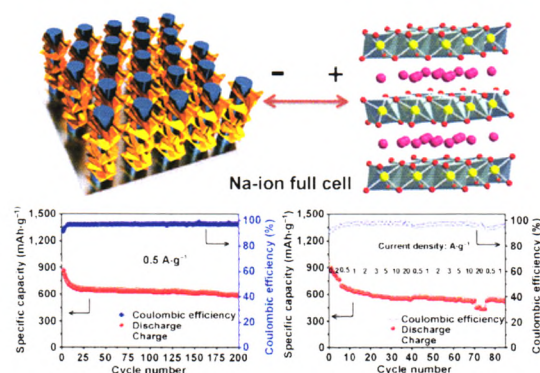
3178–3188

Hierarchical Sb-Ni nanoarrays as robust binder-free anodes for high-performance sodium-ion half and full cells

Liyang Liang¹, Yang Xu¹, Liaoyong Wen¹, Yueliang Li², Min Zhou¹, Chengliang Wang¹, Huaping Zhao¹, Ute Kaiser², and Yong Lei^{1,*}

¹ Ilmenau University of Technology, Germany

² Ulm University, Germany



Hierarchical electrode material composed of Sb nanoplates on Ni nanorod arrays is fabricated and its capacitive behavior is verified through kinetics analysis. When used as a binder-free sodium-ion battery (SIB) anode, it exhibits high capacity, long cycling life, and excellent rate capability not only in Na-ion half cells but also in full cells.

3189–3201

FeSe₂ clusters with excellent cyclability and rate capability for sodium-ion batteries

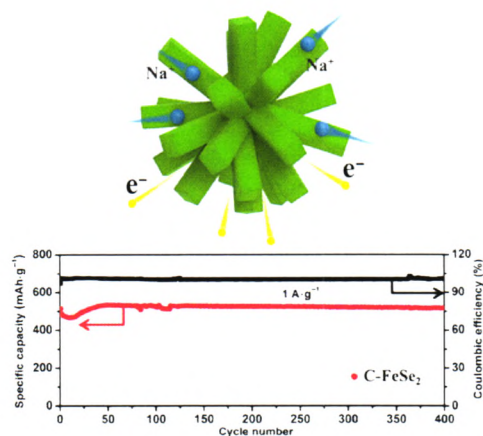
Xiujuan Wei¹, Chunjuan Tang^{1,2}, Qinyou An^{1,*}, Mengyu Yan¹, Xuanpeng Wang¹, Ping Hu¹, Xinyin Cai¹, and Liqiang Mai^{1,3,*}

¹ Wuhan University of Technology, China

² Luoyang Institute of Science and Technology, China

³ University of California, Berkeley, USA

3202–3211



A gold immunochromatographic sensor (GICS) was developed for the rapid detection of twenty-six sulfonamides in honey samples.

Folate targeted coated SPIONs as efficient tool for MRI

Cinzia Scialabba¹, Roberto Puleio², Davide Peddis³, Gaspare Varvaro³, Pietro Calandra⁴, Giovanni Cassata², Luca Cicero², Mariano Licciardi^{1,5,*}, and Gaetano Giammona^{1,5}

¹ University of Palermo, Italy

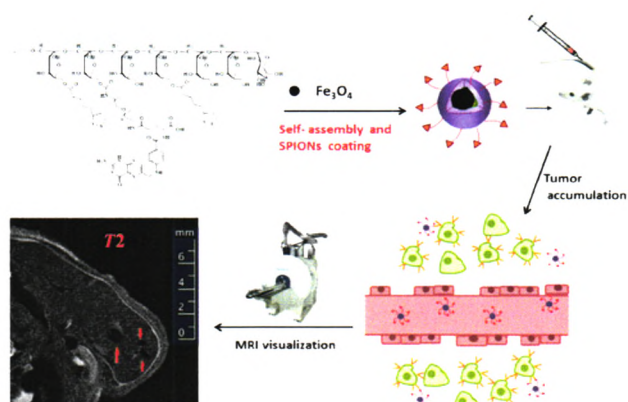
² Istituto Zooprofilattico Sperimentale della Sicilia "A. Mirri", Italy

³ Institute of Structure of Matter National Research Council (CNR), Italy

⁴ Istituto per lo Studio dei Materiali Nanostrutturati Consiglio Nazionale delle Ricerche, Italy

⁵ University of Palermo, Italy

3212–3227



The new amphiphilic inulin-based graft copolymer was successfully used as coating material for the production of magnetic nanoparticles, which were tumor targeted and could be used as excellent magnetic resonance imaging (MRI) contrast agents.

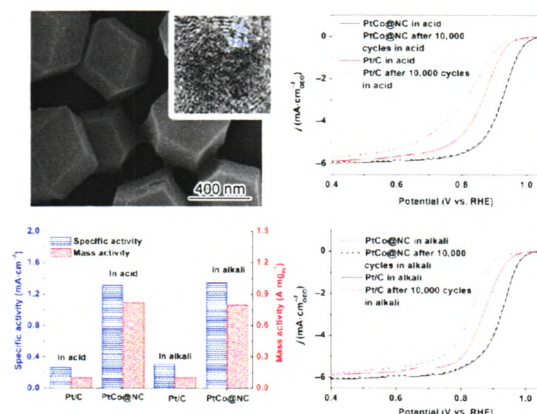
N-doped carbon-stabilized PtCo nanoparticles derived from Pt@ZIF-67: Highly active and durable catalysts for oxygen reduction reaction

Nana Du^{1,2}, Chengming Wang^{1,*}, Ran Long¹, and Yujie Xiong^{1,*}

¹ University of Science and Technology of China, China

² Fuyang Normal College, China

3228–3237



N-doped carbon-stabilized PtCo nanoparticles (PtCo@NC) have been developed via thermal decomposition on a Pt-incorporated Co-based zeolitic imidazolate framework (Pt@ZIF-67). The PtCo@NC catalyst shows a remarkably higher electrocatalytic activity and durability for the oxygen reduction reaction (ORR) in both acidic and alkaline media, as compared with a commercial Pt/C catalyst.

Giant enhancement and anomalous temperature dependence of magnetism in monodispersed NiPt₂ nanoparticles

Aixian Shan^{1,4}, Chinping Chen^{1,*}, Wei Zhang², Daojian Cheng^{2,*}, Xi Shen³, Richeng Yu^{3,*}, and Rongming Wang^{4,*}

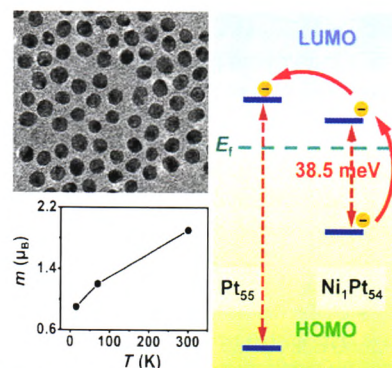
¹ Peking University, China

² Beijing University of Chemical Technology, China

³ Institute of Physics, Chinese Academy of Sciences, China

⁴ University of Science and Technology Beijing, China

3238–3247



Monodispersed single-crystal NiPt₂ nanoparticles are synthesized via a one-step solvothermal method. The observed giant enhancement in the atomic magnetic moments and their anomalous temperature dependence are attributed to the electron transfer, which is caused by thermal activation over the energy gap of the molecular d-band structures. The energy gap is substantially reduced for the PtNi₂ alloying cluster compared with the pure Pt cluster.

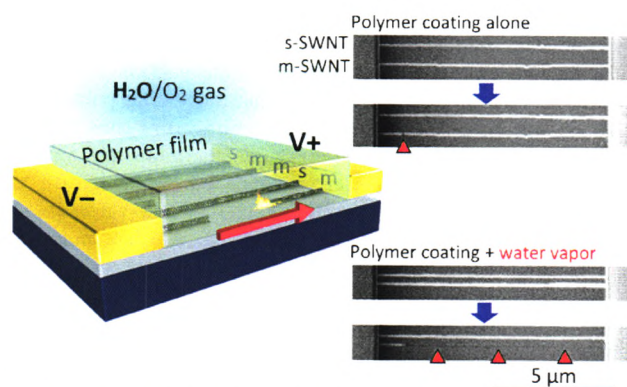
Water-assisted self-sustained burning of metallic single-walled carbon nanotubes for scalable transistor fabrication

Keigo Otsuka¹, Taiki Inoue¹, Yuki Shimomura¹, Shohei Chiashi¹, and Shigeo Maruyama^{1,2,*}

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3248–3260



The burning of on-substrate carbon nanotubes is self-propagated with the assistance of water-vapor exposure and polymer coating. Semiconducting carbon nanotube arrays are obtained by selectively burning metallic tubes.

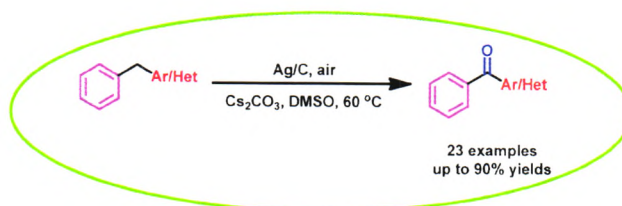
Ag/C nanoparticles catalysed aerobic oxidation of diaryl and aryl(hetero) methylenes into ketones

Shuangxi Guo¹, Qi Zhang¹, Hongbo Li¹, Huifang Guo^{2,*}, and Wei He^{1,*}

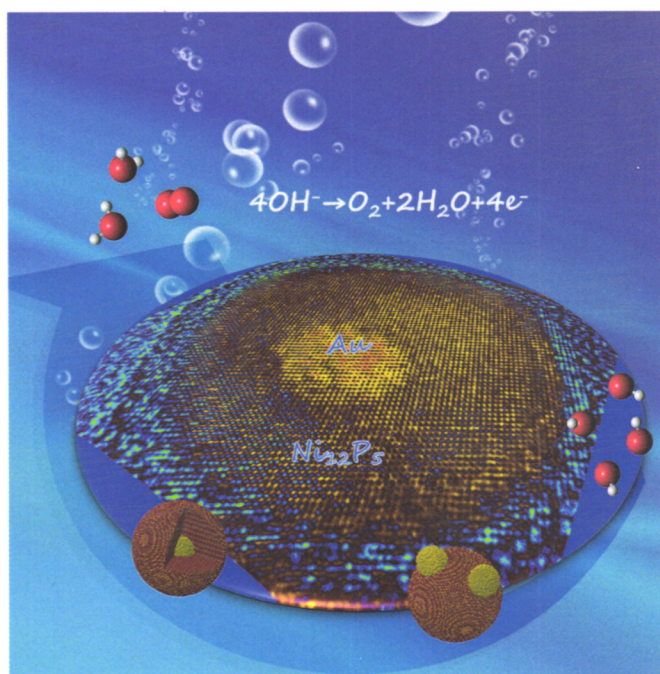
¹ Tsinghua University, China

² Chinese Academy of Medical Sciences & Peking Union Medical College, China

3261–3267



The aerobic oxidation of diaryl and aryl(hetero) methylenes into ketones, catalyzed by Ag/C nanoparticles under mild conditions, was successfully developed. This method features a wide scope of substrates, good yields, and easy recycling of the catalyst.



纳米研究 (英文版) (月刊, 2008年创刊) 第10卷 第9期 2017年9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, ChinaWebsite www.theNanoResearch.com & www.springer.com/journal/12274Online 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



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