## Contents

### Review Articles

**Silicene on non-metallic substrates: Recent theoretical and experimental advances**

Emilio Scalise¹*, Kostantina Iordanidou², Valeri V. Afanas’ev², André Stesmans², and Michel Houssa²*,

¹ Max-Planck-Institut für Eisenforschung, Germany
² University of Leuven, Belgium

A review of recent theoretical and experimental works on the possible growth of silicene on non-metallic surfaces, and a theoretical approach toward the systematic study of the stability of silicene on substrates are presented.

1169–1182

### Research Articles

**Flexible memristors as electronic synapses for neuro-inspired computation based on scotch tape-exfoliated mica substrates**

Xiaobing Yan¹,³*, Zhenyu Zhou¹, Jianhui Zhao¹, Qi Liu²*, Hong Wang¹, Guoliang Yuan³, and Jingsheng Chen⁴

¹ Hebei University, China
² Institute of Microelectronics, Chinese Academy of Sciences, China
³ Nanjing University of Science and Technology, China
⁴ National University of Singapore, Singapore

In this work, we explore the use of mica as a substrate for flexible memristor devices. We employ the scotch tape exfoliation technique to peel the mica, which is made possible due to its perfect cleavage along the basal plane. The mica substrate allows for memristor devices with superior flexibility and thermostability, which may potentially lead to the realization of high-temperature memristors for application in biologically-inspired computing systems.

1183–1192
Aqueous and mechanical exfoliation, unique properties, and theoretical understanding of MoO$_3$ nanosheets made from free-standing $\alpha$-MoO$_3$ crystals: Raman mode softening and absorption edge blue shift

Hongfei Liu*, Yongqing Cai, Mingyong Han, Shifeng Guo, Ming Lin, Meng Zhao, Yongwei Zhang, and Dongzhi Chi
A*STAR (Agency for Science, Technology and Research), Singapore

1193–1203

Multivalent interacting glycodendrimer to prevent amyloid-peptide fibril formation induced by Cu(II): A multidisciplinary approach

Anna Janaszewska¹, Barbara Klajnert-Maculewicz¹,*, Monika Marcinkowska¹, Piotr Duchnowicz¹, Dietmar Appelhans², Gianvito Grasso³, Marco A. Deriu³, Andrea Danani³,*, Michela Cangiotti⁴, and Maria Francesca Ottaviani⁴,¹,*
¹ University of Lodz, Poland
² Leibniz Institute of Polymer Research, Germany
³ SUPSI-DTI IDSIA-Dalle Molle Institute for Artificial Intelligence, Switzerland
⁴ University of Urbino, Italy

1204–1226

High-performance enhancement-mode thin-film transistors based on Mg-doped In$_2$O$_3$ nanofiber networks

Hongchao Zhang¹, You Meng¹, Longfei Song¹, Linqu Luo¹, Yuanbin Qin², Ning Han³, Zaixing Yang⁴, Lei Liu¹, Johnny C. Ho⁵,*, and Fengyun Wang¹,*
¹ Qingdao University, China
² Xi’an Jiaotong University, China
³ Institute of Process Engineering, Chinese Academy of Sciences, China
⁴ Shandong University, China
⁵ City University of Hong Kong, Hong Kong, China

1227–1237
### Hollow carbon nanofibers with dynamic adjustable pore sizes and closed ends as hosts for high-rate lithium-sulfur battery cathodes

Xiang-Qian Zhang, Bin He, Wen-Cui Li, and An-Hui Lu*
Dalian University of Technology, China

Hollow carbon nanofibers (HCFs) that combine the features of adjustable pore sizes, closed ends, and thin carbon shells are prepared for the first time as hosts for Li-S battery cathodes. The unique structures lead to high rate capacities (e.g., 860 mA·h·g⁻¹ at 4.0 C (1 C = 1.675 A·g⁻¹)) and stable cyclability over 500 cycles for S@HCF.

### Ligand density-dependent influence of arginine–glycine–aspartate functionalized gold nanoparticles on osteogenic and adipogenic differentiation of mesenchymal stem cells

Jingchao Li¹,², Ying Chen¹,², Naoki Kawazoe¹, and Guoping Chen¹,²,*
¹ National Institute for Materials Science, Japan
² University of Tsukuba, Japan

Biomimetic gold nanoparticles with tunable surface arginine–glycine–aspartate (RGD) density were prepared for the regulation of osteogenic and adipogenic differentiation of human mesenchymal stem cells.

### Multimodal bioimaging based on gold nanorod and carbon dot nanohybrids as a novel tool for atherosclerosis detection

Xiaojing Liu¹, Luting Liu¹, Xiujie Hu¹, Shuyun Zhou¹, Rinat Ankri², Dror Fixler²,* and Zheng Xie¹,*
¹ Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, China
² Bar-Ilan University, Israel

A multimodal contrast agent achieves diffusion reflection and fluorescence lifetime imaging microscopy multimodal imaging of macrophages in vitro. The new contrast agent is based on gold nanorods@silica@carbon dots core–shell. This system will potentially enhance detection sensitivity compared to the current far-field imaging technique, and will also establish a new method to quantitatively and noninvasively detect targeted nanoparticles in vivo, affording a promising theranostics tool.
Lotus root-like porous carbon nanofiber anchored with CoP nanoparticles as all-pH hydrogen evolution electrocatalysts

Hengyi Lu\textsuperscript{1}, Wei Fan\textsuperscript{2,*}, Yunpeng Huang\textsuperscript{1}, and Tianxi Liu\textsuperscript{1,2,*}

\textsuperscript{1} Fudan University, China
\textsuperscript{2} Donghua University, China

Self-standing lotus root-like porous carbon nanofibers (PCNFs) are developed and utilized as supporting materials for anchoring electroactive CoP nanoparticles. These unique PCNFs have longitudinal channels and mesopores on the outer and inner carbon walls, which enhances the contact between the electrolyte and catalyst. This endows the CoP/PCNF composites with excellent hydrogen evolution reaction (HER) performance at an all-pH range.

Graphene oxide-decorated Fe\textsubscript{2}(MoO\textsubscript{4})\textsubscript{3} microflowers as a promising anode for lithium and sodium storage

Chunhua Han\textsuperscript{1,*}, Xiaoji Ren\textsuperscript{1}, Qidong Li\textsuperscript{1}, Wen Luo\textsuperscript{1,2}, Lei Huang\textsuperscript{1}, Liang Zhou\textsuperscript{1}, and Liqiang Mai\textsuperscript{1,1,*}

\textsuperscript{1} Wuhan University of Technology, China
\textsuperscript{2} Université de Lorraine, France
\textsuperscript{1} Present address: University of California, Berkeley, USA

Graphene oxide-decorated Fe\textsubscript{2}(MoO\textsubscript{4})\textsubscript{3} microflower composite was fabricated via a facile one-step water-bath method, in which the Fe\textsubscript{2}(MoO\textsubscript{4})\textsubscript{3} was constructed by numerous nanosheets. The composite demonstrates a high specific capacity, excellent rate capability, and stable cycling performance when used as the anode for lithium and sodium storage.

Three-dimensional interconnected Ni(Fe)O\textsubscript{x}H\textsubscript{y} nanosheets on stainless steel mesh as a robust integrated oxygen evolution electrode

Qi Zhang\textsuperscript{1,2}, Haixia Zhong\textsuperscript{2}, Fanlu Meng\textsuperscript{2}, Di Bao\textsuperscript{2}, Xinbo Zhang\textsuperscript{2}, and Xiaolin Wei\textsuperscript{1,*}

\textsuperscript{1} Xiangtan University, China
\textsuperscript{2} Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, China

As a robust integrated oxygen evolution reaction (OER) electrode, an interconnected Ni(Fe)O\textsubscript{x}H\textsubscript{y} nanosheet array on stainless steel mesh was prepared by a facile hydrothermal method without using any polymeric binder, and exhibits excellent OER performance with low overpotential, small Tafel slope and long-term durability.
Rational design and synthesis of hierarchically structured SnO$_2$ microspheres assembled from hollow porous nanoplates as superior anode materials for lithium-ion batteries

Gi Dae Park and Yun Chan Kang*
Korea University, Republic of Korea

1301–1312

In this study, hierarchically structured metal oxide microspheres formed from building blocks of hollow nanoplates were designed as efficient anode materials for lithium-ion batteries.

Improved peroxidase-mimic property: Sustainable, high-efficiency interfacial catalysis with H$_2$O$_2$ on the surface of vesicles of hexavanadate-organic hybrid surfactants

Kun Chen$^{1,2}$, Aruuhan Bayaguud$^1$, Hui Li$^2$, Yang Chu$^2$, Haochen Zhang$^3$, Hongli Jia$^1$, Baofang Zhang$^2$, Zicheng Xiao$^3$, Pingfan Wu$^{3,*}$, Tianbo Liu$^{2,*}$, and Yongge Wei$^{1,4,*}$
$^1$ Tsinghua University, China
$^2$ University of Akron, USA
$^3$ Hubei University of Technology, China
$^4$ Peking University, China

1313–1321

We demonstrate that bilayer vesicles formed by a hexavanadate cluster functionalized with two alkyl chains are highly efficient catalysts for the oxidation of 3,3',5,5'-tetramethylbenzidine (TMB) with H$_2$O$_2$ at room temperature, a reaction mimicking the peroxidase activity in biological catalytic oxidation processes.

One-dimension carbon self-doping g-C$_3$N$_4$ nanotubes: Synthesis and application in dye-sensitized solar cells

Xue Li, Kai Pan, Yang Qu*, and Guofeng Wang*
Heilongjiang University, China

1322–1330

One-dimensional carbon self-doping g-C$_3$N$_4$ nanotubes were synthesized for the first time. They boost the light harvesting ability of the photovoltaic devices by enhancing the visible light absorption as well as the charge separation and transfer.
Hierarchical CoNiSe₂ nano-architecture as a high-performance electrocatalyst for water splitting

Tao Chen and Yiwei Tan*
Nanjing Tech University, China

1331–1344

Sulfur nanoparticles encapsulated in reduced graphene oxide nanotubes for flexible lithium-sulfur batteries

Kena Chen, Jun Cao, Qiongqiong Lu, Qingrong Wang, Minjie Yao, Mingming Han, Zhiqiang Niu*, and Jun Chen
Nankai University, China

1345–1357

Effects of redox-active interlayer anions on the oxygen evolution reactivity of NiFe-layered double hydroxide nanosheets

Daojin Zhou¹, Zhao Cai¹, Yongmin Bi¹, Weiliang Tian¹,², Ma Luo¹, Qian Zhang¹, Qian Zhang¹, Qixian Xie¹, Jindi Wang¹, Yaping Li², Yun Kuang¹, Xue Duan¹, Michal Bajdich³, Samira Siahrostami⁴*, and Xiaoming Sun¹,*
¹ Beijing University of Chemical Technology, China
² Tarim University, China
³ SLAC National Accelerator Laboratory, USA
⁴ Stanford University, USA

1358–1368

A new integrated bifunctional catalyst, hierarchical CoNiSe₂ nanorod arrays supported on Ni foam, has been fabricated by a one step solvothermal reaction, showing exquisitely high activity toward the oxygen and hydrogen evolution reactions (OER and HER, respectively) and outstanding long-term stability.

Three-dimensional reduced graphene oxide foams composed of interconnected nanotube-like reduced graphene oxide were fabricated as an efficient scaffold for sulfur. Lithium-sulfur batteries based on flexible reduced graphene oxide nanotubes wrapped sulfur composite film maintain electrochemical stability even when bent.

The reducing ability of anions intercalated in the interlayer of nickel-iron layered double hydroxides (NiFe-LDHs) has an important impact on the catalytic activity of these compounds for the oxygen evolution reaction (OER). Anions with low standard redox potential and strong reducing ability transfer more electrons to the hydroxide layers. The resulting electron-rich metal sites can thus enhance the OER performance of the NiFe-LDHs.
Anomalous enhancement of fluorescence of carbon dots through lanthanum doping and potential application in intracellular imaging of ferric ion

Shenghong Yang¹, Xiaohan Sun¹, Zhaoyan Wang¹, Xiayan Wang²*, Guangsheng Guo², and Qiaosheng Pu¹,*

¹ Lanzhou University, China
² Beijing University of Technology, China

Through La³⁺ doping, the emission band of carbon dots shifted from blue to green with an apparent improvement in the quantum yield and fluorescence lifetime although La³⁺ is non-fluorescent. The as-prepared material can be used to visualize intracellular Fe³⁺ in live HeLa cells.

Efficient defect-controlled photocatalytic hydrogen generation based on near-infrared Cu-In-Zn-S quantum dots

Xiao-Yuan Liu¹,², Guozhen Zhang³, Hao Chen¹, Haowen Li², Jun Jiang³, Yi-Tao Long²,* and Zhijun Ning¹,*

¹ ShanghaiTech University, China
² East China University of Science and Technology, China
³ University of Science and Technology of China (USTC), China

Defect-controlled, stable, and water soluble CuInS₂ and Cu-In-Zn-S quantum dots are synthesized and investigated for highly efficient co-catalyst free photocatalytic hydrogen generation under visible to near-infrared light irradiation.

Graphene as an intermediary for enhancing the electron transfer rate: A free-standing Ni₃S₂@graphene@Co₉S₈ electrocatalytic electrode for oxygen evolution reaction

Qiuchun Dong, Yizhou Zhang, Ziyang Dai, Peng Wang, Min Zhao, Jinjun Shao*, Wei Huang*, and Xiaochen Dong*

Nanjing Tech University, China

Graphene was introduced into three-dimensionally structured composites as an intermediary for enhancing the electron transfer rate and stability. It greatly improves the catalytic performance.
Effects of dielectric stoichiometry on the photoluminescence properties of encapsulated WSe$_2$ monolayers

Javier Martín-Sánchez$^{1,*}$, Antonio Mariscal$^{2}$, Marta De Luca$^{3}$, Altarara Tarazaga Martín-Luengo$^{1}$, Georg Gramse$^{1}$, Alma Halilovic$^{1}$, Rosalia Serna$^{2}$, Alberta Bonanni$^{3}$, Ilaria Zardo$^{3}$, Rinaldo Trotta$^{1,*}$, and Armando Rastelli$^{1}$

$^1$ Johannes Kepler University Linz, Austria
$^2$ CSIC, Spain
$^3$ University of Basel, Switzerland

In this work, the photoluminescence emission of encapsulated WSe$_2$ monolayers with SiO$_x$ and Al$_x$O$_y$ dielectric oxide layers—deposited by means of different physical and chemical deposition techniques—is demonstrated to be strongly influenced by the oxides stoichiometry quality. A nearly unchanged optical emission is found when the encapsulation is carried out with stoichiometric oxides, whereas a strong photoluminescence decrease accompanied by a dominant trion (charged exciton) emission is observed for sub-stoichiometric encapsulating oxides.

Hierarchical Ni-Co-S@Ni-W-O core–shell nanosheet arrays on nickel foam for high-performance asymmetric supercapacitors

Weidong He$^{1}$, Zhifu Liang$^{1}$, Keyu Ji$^{1}$, Qingfeng Sun$^{3,*}$, Tianyou Zhai$^{2,*}$, and Xijin Xu$^{1,*}$

$^1$ University of Jinan, China
$^2$ Huazhong University of Science and Technology (HUST), China
$^3$ Zhejiang A & F University, China

Free-standing, three-dimensional (3D), hierarchical Ni-Co-S@Ni-W-O core–shell hybrid structures on Ni foam were successfully designed and synthesized. Using these 3D-networks as the positive electrode, we further demonstrated the excellent stability, large specific capacitance, and high energy density of asymmetrical supercapacitors.

Confinedly implanted NiFe$_2$O$_4$-rGO: Cluster tailoring and highly tunable electromagnetic properties for selective-frequency microwave absorption

Yanlan Zhang, Xixi Wang, and Maosheng Cao$^*$

Beijing Institute of Technology, China

A facial strategy of confined implantation is demonstrated for small NiFe$_2$O$_4$ clusters-reduced graphene oxide nanohybrids. Properly tailoring the magnetic clusters can realize synergistic effect of dielectric loss and magnetic loss for highly-tunable and selective-frequency microwave absorption.
Hierarchical three-dimensional flower-like Co$_3$O$_4$ architectures with a mesocrystal structure as high capacity anode materials for long-lived lithium-ion batteries

Wenqiang Cao$^1$, Wenzhong Wang$^{1,*}$, Honglong Shi$^1$, Jun Wang$^2$, Maosheng Cao$^3$, Yujie Liang$^1$, and Min Zhu$^1$

$^1$ Minzu University of China, China
$^2$ Ningbo University, China
$^3$ Beijing Institute of Technology, China

We rationally design a high-capacity electrode based on three-dimensional (3D) hierarchical Co$_3$O$_4$ flower-like architectures with a mesocrystal nanostructure. The achieved hierarchical 3D Co$_3$O$_4$ flower-like architectures with a mesocrystal nanostructure exhibit a high reversible capacity of 920 mA·h·g$^{-1}$ after 800 cycles at 1.12 C ($1$ C = 890 mA·h·g$^{-1}$), excellent rate performance, and cycling stability when applied as the anode for lithium storage.

Colloidal CsPbBr$_3$ perovskite nanocrystal films as electrochemiluminescence emitters in aqueous solutions

Zhixiong Cai$^1$, Feiming Li$^1$, Wei Xu$^1$, Shujun Xia$^1$, Jingbin Zeng$^2$, Shaogui He$^3$, and Xi Chen$^1$,*

$^1$ Xiamen University, China
$^2$ China University of Petroleum (East China), China
$^3$ Xiamen Huaxia University, China

A perovskite nanocrystal (NC) film is demonstrated to be a promising electrochemiluminescence (ECL) emitter. Self-assembled films of the CsPbBr$_3$ NCs show relatively stable emission in aqueous solutions due to the cross-linking of oleic acid/oleylamine on the surface of the CsPbBr$_3$ NCs.

Formation of plasmon quenching dips greatly enhances 1O$_2$ generation in a chlorin e6–gold nanorod coupled system

Hui Zhang$^{1,2}$, Haiyun Li$^{1,2}$, Huizhen Fan$^{1,2}$, Jiao Yan$^{1,2}$, Dejing Meng$^{1,2}$, Shuai Hou$^1$, Yinglu Ji$^1$, and Xiaochun Wu$^{1,*}$

$^1$ National Center for Nanoscience and Technology, China
$^2$ University of the Chinese Academy of Sciences, China

Formation of plasmon quenching dips is effective in enhancing singlet oxygen (1O$_2$) generation via the plasmon resonance energy transfer (PRET) effect.
Optical emission spectroscopy diagnosis of energetic Ar ions in synthesis of SiC polytypes by DC arc discharge plasma

Jian Gao, Lei Zhou, Jingshuang Liang, Ziming Wang, Yue Wu, Javid Muhammad, Xinglong Dong*, Shouzhe Li, Hongtao Yu, and Xie Quan*
Dalian University of Technology, China

1470–1481

Cobalt-based hydroxide nanoparticles @ N-doping carbonic frameworks core–shell structures as highly efficient bifunctional electrocatalysts for oxygen evolution and oxygen reduction reactions

Shiqiang Feng, Cheng Liu, Zhigang Chai, Qi Li*, and Dongsheng Xu*
Peking University, China

1482–1489

Gas template-assisted spray pyrolysis: A facile strategy to produce porous hollow Co$_3$O$_4$ with tunable porosity for high-performance lithium-ion battery anode materials

Haoran Du, Kuangfu Huang, Min Li, Yuanyuan Xia, Yixuan Sun, Mengkang Yu, and Baoyou Geng*
Anhui Normal University, China

1490–1499
Application of yolk–shell Fe$_3$O$_4@$N-doped carbon nanochains as highly effective microwave-absorption material

Mingtao Qiao, Xingfeng Lei, Yong Ma, Lidong Tian, Xiaowei He, Kehe Su, and Qiuyu Zhang*
Northwestern Polytechnical University, China

Yolk–shell porous Fe$_3$O$_4@$N-doped carbon nanochains have been developed as novel microwave-absorption materials. Because of the high aspect ratio, the yolk–shell structure, and numerous pores and spaces, Fe$_3$O$_4@$N-doped carbon nanochains offer superior microwave absorption performance. A detailed microwave absorption mechanism has been proposed.

Wafer-level and highly controllable fabricated silicon nanowire transistor arrays on (111) silicon-on-insulator (SOI) wafers for highly sensitive detection in liquid and gaseous environments

Xun Yang$^{1,2}$, Anran Gao$^1$, Yuelin Wang$^1$, and Tie Li$^1$,*
$^1$ Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences, China
$^2$ University of Chinese Academy of Sciences, China

Wafer-level and highly controllable fabrication technology of silicon nanowire arrays is presented in this study. A material with excellent electrical properties for the highly sensitive determination of pH and nitrogen dioxide is shown in this paper.

Tetrafunctional Cu$_2$S thin layers on Cu$_2$O nanowires for efficient photoelectrochemical water splitting

Zhenzhen Li and Zhonghai Zhang*
East China Normal University, China

A tetrafunctional Cu$_2$S thin layer with sensitizing, electron trapping, electrocatalytic, and protecting functions is generated in situ on the surface of Cu$_2$O nanowires on three-dimensional porous copper foam, to fabricate an effective and highly stable photocathode for photoelectrochemical water reduction.
Tunable electron and phonon properties of folded single-layer molybdenum disulfide

Jie Peng¹, Peter W. Chung¹,*, Madan Dubey², and Raju R. Namburu²

¹ University of Maryland, USA
² U.S. Army Research Laboratory, USA

The length of the sheet used to form a folded structure in single-layer MoS₂ has a very different influence on the electronic and thermal properties of these materials.

Dip-coating processed sponge-based electrodes for stretchable Zn-MnO₂ batteries

Hong-Wu Zhu, Jin Ge, Yu-Can Peng, Hao-Yu Zhao, Lu-An Shi, and Shu-Hong Yu*

University of Science and Technology of China, China

A polyurethane (PU) sponge coated with silver nanowires was used as a stretchable current collector and combined with electrode materials via a facile dip-coating method. A stretchable Zn-MnO₂ full battery was prepared, which provided a stable power supply even under 100% strain.

Mesoporous TiO₂ microparticles formed by the oriented attachment of nanocrystals: A super-durable anode material for sodium-ion batteries

Liming Ling¹, Ying Bai¹,²,* Huali Wang¹, Qiao Ni¹, Jiatao Zhang¹, Feng Wu¹,², and Chuan Wu¹,²,*

¹ Beijing Institute of Technology, China
² Collaborative Innovation Center of Electric Vehicles in Beijing, China

Mesoporous TiO₂ microparticles with a unique combination of nanocrystals and uniform nanopores were prepared and applied as a super-durable anode material for advanced sodium-ion batteries.
Device performance and light characteristics stability of quantum-dot-based white-light-emitting diodes

Bruno Clasen Hames, Iván Mora-Seró, and Rafael S. Sánchez†,*

Universitat Jaume I, Spain
† Present address: University of Liverpool, UK

Preparation and electro-optical characterization of quantum-dot-based light-emitting diodes are described, and the evolution of their white light characteristics is studied.

1575–1588

Size contrast of Pt nanoparticles formed on neighboring domains within suspended and supported graphene

Dario Roccella1, Matteo Amati2, Hikmet Sezen2,†, Rosaria Brescia3, and Luca Gregoratti2,*

1 Università degli Studi di Genova - Facoltà di Scienze Matematiche, Italy
2 Elettra - Sincrotrone Trieste S.C.p.A. in Area Science Park, Italy
3 Istituto Italiano di Tecnologia (IIT), Italy
† Present address: Helmholtz-Zentrum Berlin GmbH, Germany

Herein, we exploited the capability of spatially resolved photoemission in combination with high resolution transmission electron microscopy to investigate the interactions of thermally evaporated Pt atoms on suspended and supported graphene.

1589–1598

A systematic theoretical study on FeOₓ-supported single-atom catalysts: M₁/FeOₓ for CO oxidation

Jinxia Liang1,2,3, Qi Yu2, Xiaofeng Yang4,*, Tao Zhang4, and Jun Li3,*

1 Guizhou Education University, China
2 Shaanxi University of Technology, China
3 Tsinghua University, China
4 Dalian Institute of Chemical Physics, Chinese Academy of Sciences, China

A comprehensive theoretical investigation of the CO oxidation activity and stability of FeOₓ-supported metal single-atom active sites was conducted with density functional theory (DFT). The metals considered included all of the 3d, 4d, and 5d metals from group VIII to IB. The theoretical analyses revealed the fundamental mechanisms of the interactions between the atomically dispersed single metal atoms on the FeOₓ substrate and aid in the design of highly active FeOₓ-supported single-atom catalysts (SACs).

1599–1611
**Synthesis of nano SnO$_2$-coupled mesoporous molecular sieve titanium phosphate as a recyclable photocatalyst for efficient decomposition of 2,4-dichlorophenol**

Yanduo Liu, Ning Sun, Shuangying Chen, Rui Yan, Peng Li, Yang Qu, Yichun Qu*, and Liqiang Jing*

Heilongjiang University, China

Specific surface, lifetime, and separation of photogenerated charges in molecular sieve titanium phosphate increased after introducing a mesoporous structure and coupling a proper amount of SnO$_2$, greatly improving the photoactivities for 2,4-dichlorophenol degradation and CO oxidation. ·O$_2^-$ is formed by transferring electrons to SnO$_2$ and then by reacting with O$_2$ as the dominant active species to induce the degradation of 2,4-dichlorophenol.

**Cell-assembled (Gd-DOTA)$_i$-triphenylphosphonium (TPP) nanoclusters as a T$_2$ contrast agent reveal in vivo fates of stem cell transplants**

Yanhui Zhang$^{1,2}$, Hongyan Zhang$^{1,2}$, Binbin Li$^{1,3}$, Hailu Zhang$^1$, Bo Tan$^1$*, and Zongwu Deng$^{1,*}$

1 Suzhou Institute of Nano-tech and Nano-bionics, Chinese Academy of Sciences, China
2 Shanghai University, China
3 University of Science and Technology of China, China

Labeling cells with (Gd-DOTA)$_i$-triphenyl phosphonium (TPP) via electroporation results in two distinct cellular distributions of (Gd-DOTA)$_i$-TPP: freely and evenly distributed in the cytosol or cell-assembled nanoclusters in the cytoplasm. The (Gd-DOTA)$_i$-TPP nanoclusters not only promote its intracellular retention time but also induce a significant magnetic resonance imaging (MRI) signal reduction, which act as an excellent T$_2$ contrast agent and allows for unambiguous reporting of in vivo viability and migration of cell transplants under T$_2$-weighted MRIs over a long period.

**A novel method for preparing and characterizing graphene nanoplatelets/aluminum nanocomposites**

Duosheng Li$^{1,*}$, Yin Ye$^1$, Xiaojun Liao$^1$, and Qing H. Qin$^2$

1 Nanchang Hangkong University, China
2 Australian National University, Australia

The mechanical properties of graphene nanoplatelets/aluminum (Al) nanocomposites containing a low volume fraction of GNPs were significantly improved. When 0.5 vol.%, 1.0 vol.%, and 2.0 vol.% GNPs were added to the aluminum matrix, the average compressive strength of the GNPs/Al nanocomposites increased remarkably from 330% to 586%.
High-performance asymmetrical supercapacitor composed of rGO-enveloped nickel phosphite hollow spheres and N/S co-doped rGO aerogel

Deyang Zhang¹, Yihe Zhang¹,*, Yongsong Luo², Yu Zhang¹, Xiaowei Li¹, Xuelian Yu¹, Hao Ding¹, Paul K. Chu³, and Li Sun¹,*

¹ China University of Geosciences, China
² Xinyang Normal University, China
³ City University of Hong Kong, Hong Kong, China

An asymmetrical supercapacitor composed of reduced graphene oxide (rGO)-enveloped nickel phosphate hollow spheres and N/S co-doped rGO aerogel has been fabricated, which exhibits outstanding cycling and rate capability.

1651–1663

Amorphous NiFeB nanoparticles realizing highly active and stable oxygen evolving reaction for water splitting

Guang Liu, Dongying He, Rui Yao, Yong Zhao, and Jinping Li*
Taiyuan University of Technology, China

With the advantages of amorphous characteristics, optimal Fe doping contents, and in situ formation of active borate-enriched NiFeOOH layers during water oxidation, ultrafine amorphous NiFeB nanoparticles proved to be highly efficient oxygen-evolving catalysts for water splitting at a wide range of pH values (7–14).

1664–1675

Van der Waals interfacial bonding and intermixing in GeTe-Sb₂Te₃-based superlattices

Andriy Lotnyk*, Isom Hilmi, Ulrich Ross, and Bernd Rauschenbach
Leibniz Institute of Surface Modification (IOM), Germany

In this work, GeTe-Sb₂Te₃-based superlattices (SLs) are produced by pulsed laser deposition (PLD) and characterized by advanced scanning transmission electron microscopy. The results shed new light on the possible configurations of interfacial phase change memory (iPCM) building units that can be formed during the synthesis of GeTe-Sb₂Te₃-based SLs.

1676–1686
High-metallic-phase-concentration Mo$_{1-x}$W$_x$S$_2$ nanosheets with expanded interlayers as efficient electrocatalysts

Qun He$^1$, Yangyang Wan$^1$, Hongliang Jiang$^1$, Chuanqiang Wu$^1$, Zhongti Sun$^1$, Shuangming Chen$^{1,*}$, Yu Zhou$^1$, Haiping Chen$^1$, Daobin Liu$^1$, Yasir A. Haleem$^1$, Binghui Ge$^2$, Xiaojun Wu$^{1,*}$, and Li Song$^1,*$

$^1$ University of Science and Technology of China, China
$^2$ Institute of Physics, Chinese Academy of Sciences, China

1687–1698

Mechanically robust antireflective coatings

Sadaf Bashir Khan, Hui Wu, Xiaochen Huai, Sumeng Zou, Yuehua Liu, and Zhengjun Zhang$^*$

Tsinghua University, China

1699–1713

Direct imaging and determination of the crystal structure of six-layered graphdiyne

Chao Li$^1$, Xiuli Lu$^1$, Yingying Han$^1$, Shangfeng Tang$^1$, Yi Ding$^1$, Ruirui Liu$^1$, Haihong Bao$^1$, Yuliang Li$^2$, Jun Luo$^{1,*}$, and Tongbu Lu$^1,*$

$^1$ Tianjin University of Technology, China
$^2$ Institute of Chemistry, Chinese Academy of Sciences, China

1714–1721

High-metallic-phase-concentration ultrathin ternary Mo$_{1-x}$W$_x$S$_2$ nanosheets were successfully synthesized for the first time. The metallic phase concentration, together with the enlarged and distinct interlayer spacing, can be regulated by using different Mo/W atomic ratios, and the optimized catalyst shows obvious advantage in the electrochemical water splitting reaction.

We established a simple strategy to fabricate mechanically robust and thermally stable, hierarchically lotus-like super-hydrophobic nanostructures showing omnidirectional antireflective (AR) performance with tunability in the desired wavelength range. This approach is practically applicable in different optic and optoelectronic devices including windshields, display panels, eyeglasses, solar cells, and windows of high rise buildings.

Since its discovery, the direct imaging and determination of the crystal structure of few-layer graphdiyne has proven difficult. In this work, we successfully employed low-voltage transmission electron microscopy with low current density to realize the direct imaging of graphdiyne and confirmed that the structure of an as-synthesized graphdiyne nanosheet is crystalline, with six-layer thickness and ABC stacking.
Novel perovskite/TiO$_2$/Si trilayer heterojunctions for high-performance self-powered ultraviolet-visible-near infrared (UV-Vis-NIR) photodetectors

Fengren Cao$^1$, Qingliang Liao$^2$, Kaimo Deng$^1$, Liang Chen$^1$, Liang Li$^1$,* and Yue Zhang$^2$,*

$^1$ Soochow University, China
$^2$ University of Science and Technology Beijing, China

1722–1730

In situ carbon nanotube clusters grown from three-dimensional porous graphene networks as efficient sulfur hosts for high-rate ultra-stable Li–S batteries

Shizhi Huang, Lingli Zhang, Jingyan Wang, Jinfang Zhu,* and Pei Kang Shen*

Guangxi University, China

1731–1743

Tunable excitonic emission of monolayer WS$_2$ for the optical detection of DNA nucleobases

Shun Feng$^1$, Chunxiao Cong$^2$,* Namphung Peimyoo$^{1,†}$, Yu Chen$^1$, Jingzhi Shang$^1$, Chenji Zou$^1$, Bingchen Cao$^1$, Lishu Wu$^1$, Jing Zhang$^1$, Mustafa Eginligi$^3$, Xingzhi Wang$^1$, Qihua Xiong$^1$, Arundithi Ananthanarayanan$^1$, Peng Chen$^1$, Baile Zhang$^1$, and Ting Yu$^1$,*

$^1$ Nanyang Technological University, Singapore
$^2$ Fudan University, China
$^3$ Nanjing Tech University (NanjingTech), China
$^†$ Present address: University of Exeter, UK

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