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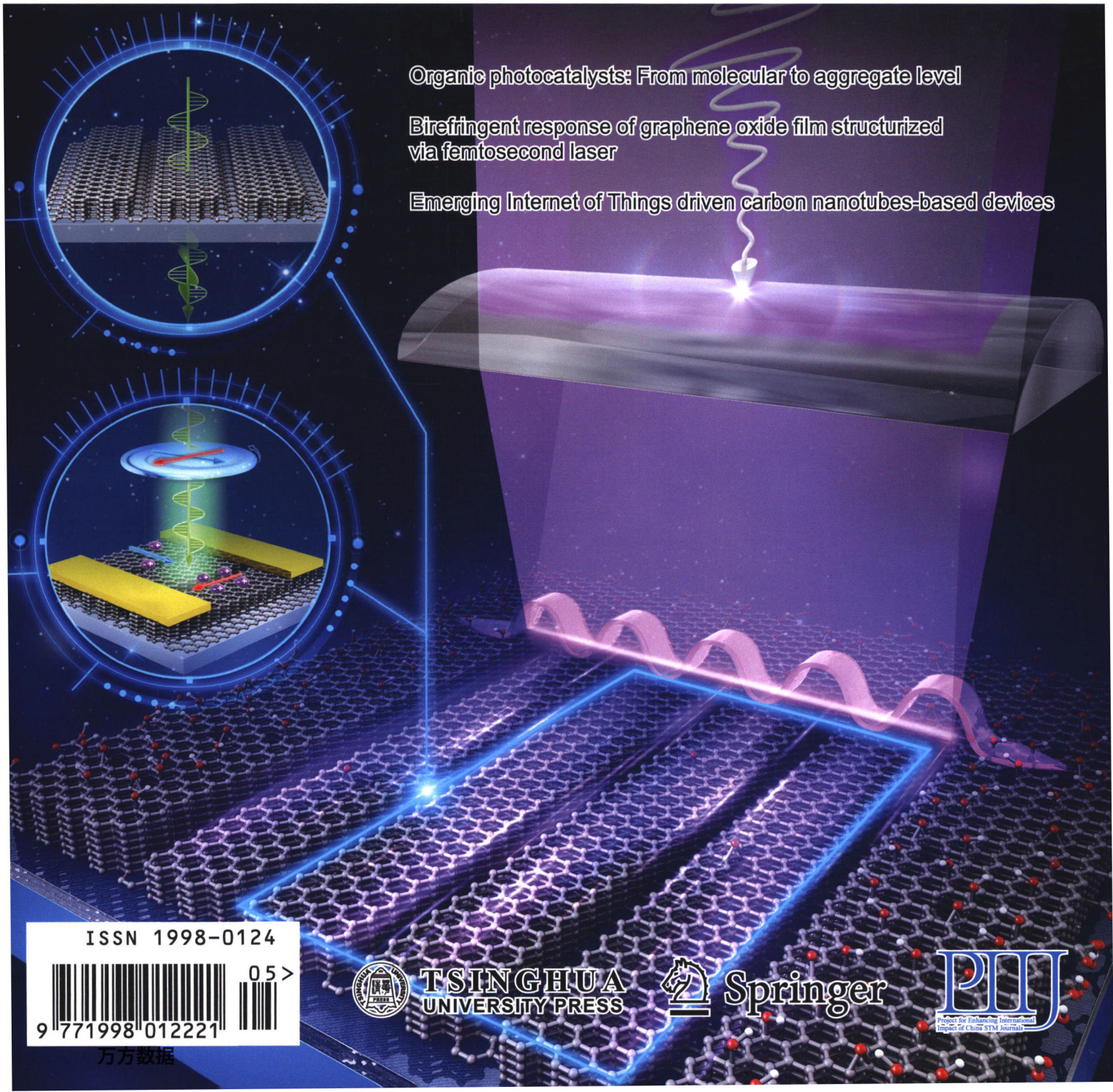

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Contents

Catalytic

Review Article

Organic photocatalysts: From molecular to aggregate level

Chuxuan Yan[1], Jiaqi Dong[1], Yingzhi Chen[1,2,*], Wenjie Zhou[2], Yu Peng[1], Yue Zhang[2], and Lu-ning Wang[1,2,*]

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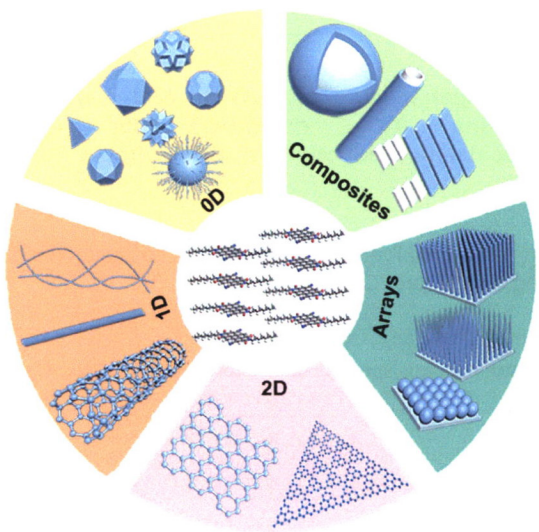
[2] Shunde Graduate School of University of Science and Technology Beijing, China



The ease of molecular modification and crystal/interface engineering allow organic photocatalysts to perform versatilely in both homogeneous and heterogeneous photocatalysis. We review free organic molecules, supported organic molecules, and organic aggregates by discussing the lightabsorption properties, charge carrier behaviors, and configurational stability to achieve careful structure/property control for high-performance photocatalysis.

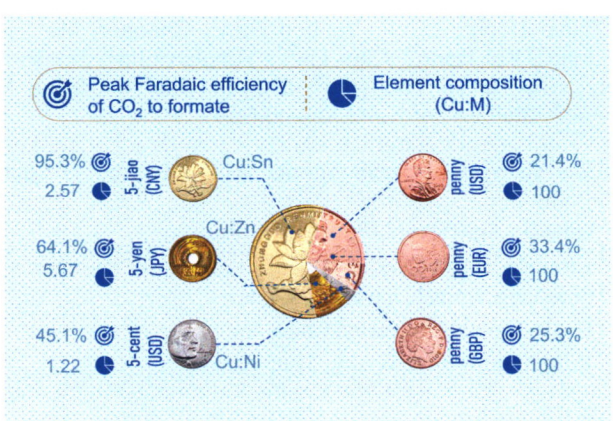
3835–3858

Research Articles

CO_2 reduction with coin catalyst

Taishi Xiao, Can Tang, Hongbin Li, Tong Ye, Kun Ba, Peng Gong, and Zhengzong Sun*

Fudan University, China



We successfully demonstrate the "third side of a coin" as an efficient CO_2 reduction catalyst. A closed-loop lifecycle of formate/formic acid was developed, promising as an industry-compatible commodity chemical.

3859–3865

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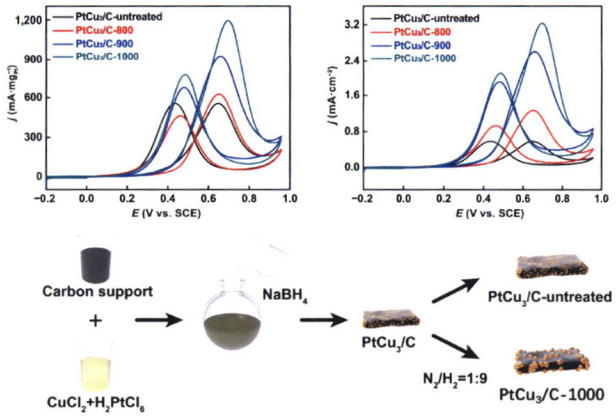
Structure engineering of $PtCu_3$/C catalyst from disordered to ordered intermetallic compound with heat-treatment for the methanol electrooxidation reaction

Zihao Xing[1], Jun Li[1], Shun Wang[1], Chenliang Su[2,*], and Huile Jin[1,*]

[1] Wenzhou University, China
[2] Shenzhen University, China

3866–3871



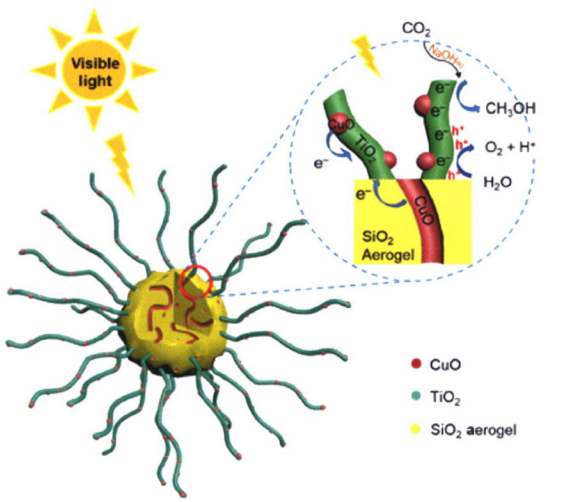
The intermetallic compound of $PtCu_3$/C-1000 exhibited high specific activity of 3.23 $mA \cdot cm^{-1}$ and mass activity of 1,200 $mA \cdot mg_{Pt}^{-1}$ towards the methanol electrooxidation reaction.

Hierarchical loading of CuO on SiO_2 aerogel@high crystalline TiO_2 nanofibers for efficiently photocatalytic reduction of CO_2 without sacrificial agent

Man Wen[1], Beibei Ren[1], Xiangzhi Ye[1], Jianxiong He[2], Hong Jiang[1], and Chunrong Xiong[1,*]

[1] Hainan University, China
[2] Hainan haikong Special Glass Techology Co., Ltd., China

3872–3879



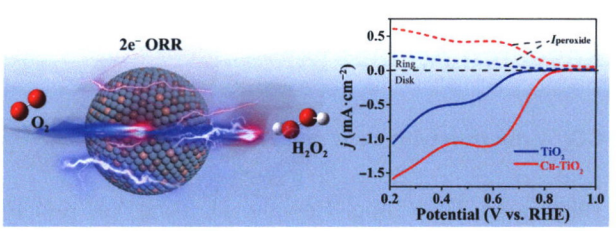
The high crystalline nanofibers and a hierarchical nanocomposite significantly enhanced the density and stability of photoexcited electron–hole pairs. The catalysts combined many advantageous features and exhibited an efficiently photocatalytic reduction of CO_2 without sacrificial agent.

Highly efficient two-electron electroreduction of oxygen into hydrogen peroxide over Cu-doped TiO_2

Zhiqin Deng[1], Li Li[1], Yuchun Ren[1], Chaoqun Ma[2], Jie Liang[1], Kai Dong[1], Qian Liu[3,*], Yonglan Luo[3], Tingshuai Li[1], Bo Tang[4], Yang Liu[5], Shuyan Gao[5], Abdullah M. Asiri[6], Shihai Yan[2,*], and Xuping Sun[1,*]

[1] University of Electronic Science and Technology of China, China
[2] Qingdao Agricultural University, China
[3] Chengdu University, China
[4] Shandong Normal University, China
[5] Henan Normal University, China
[6] King Abdulaziz University, Saudi Arabia

3880–3885



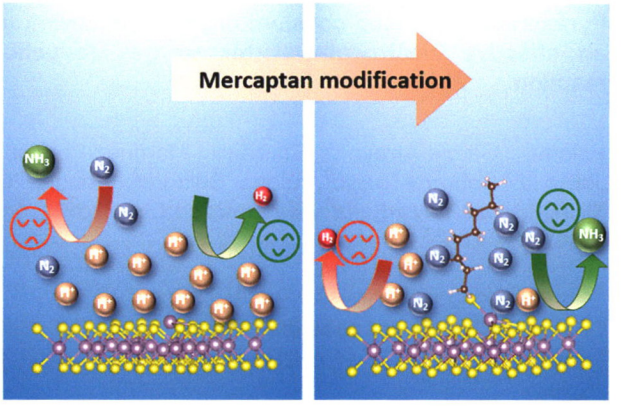
Cu acts as an effective dopant to boost the catalytic activity of TiO_2 for $2e^-$ O_2 reduction reaction. Such Cu-TiO_2 electrocatalyst achieves a high H_2O_2 selectivity of 91.2% and a large Faradaic efficiency (FE) of 98% in an alkaline medium.

Surface hydrophobic modification enhanced catalytic performance of electrochemical nitrogen reduction reaction

Lijuan Niu[1], Ziwen Liu[1], Guohua Liu[1], Mengxuan Li[2], Xupeng Zong[1], Dandan Wang[1], Li An[1,*], Dan Qu[1], Xiaoming Sun[1], Xiayan Wang[1], and Zaicheng Sun[1,*]

[1] Beijing University of Technology, China
[2] Jilin Normal University,China

3886–3893



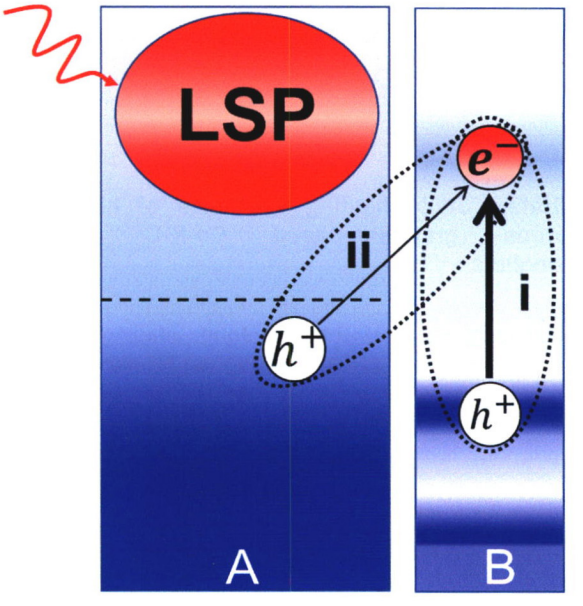
MoS_2 after thiol modification increased the local N_2 concentration, inhibited the hydrogen reduction reaction (HER), and facilitated the adsorption of N_2, which further improved the nitrogen reduction reaction (NRR) activity.

Plasmon-mediated photodecomposition of NH_3 via intramolecular charge transfer

Yimin Zhang[1,2,4], Weite Meng[2,3], Daqiang Chen[1,4], Lili Zhang[2], Shunfang Li[2,*], and Sheng Meng[1,4,*]

[1] Beijing National Laboratory for Condensed Matter Physics and Institute of Physics, Chinese Academy of Sciences, China
[2] Zhengzhou University, China
[3] Anhui University of Science and Technology, China
[4] University of Chinese Academy of Sciences, China

3894–3900



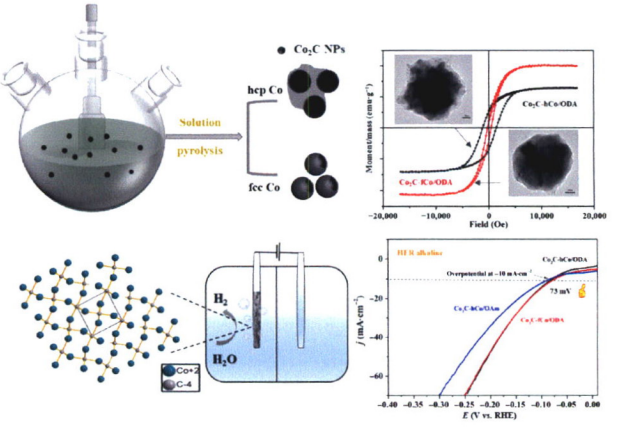
Intramolecular charge transfer induced by localized surface plasmon dominates the plasmon-mediated photolysis of NH_3, accompanying with a secondary direct charge transfer.

High coercivity cobalt carbide nanoparticles as electrocatalysts for hydrogen evolution reaction

Yaqin Qie, Yixuan Liu, Fanqi Kong, Zhilin Yang, and Hua Yang*

Jilin University, China

3901–3906

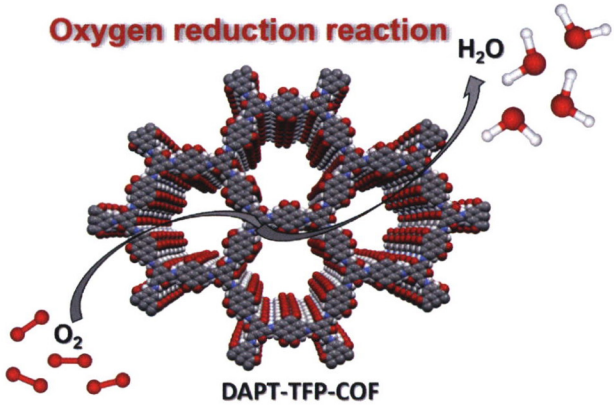


An improved solution pyrolysis route was used to synthesize single-phase cobalt carbides with high coercivity and excellent hydrogen evolution reaction (HER) catalytic activities, in which cobalt nanoparticles (NPs) with different structures were used as raw materials.

Pyrenetetraone-based covalent organic framework as an effective electrocatalyst for oxygen reduction reaction

Paloma García-Arroyo[1], Emiliano Martínez-Periñán[2], Jorge J. Cabrera-Trujillo[1], Elena Salagre[2], Enrique G. Michel[2], José I. Martínez[3], Encarnación Lorenzo[2,4,*], and José L. Segura[1,*]

[1] Universidad Complutense de Madrid, Spain
[2] Universidad Autónoma de Madrid, Spain
[3] Instituto de Ciencia de Materiales de Madrid (ICMM-CSIC), Spain
[4] Instituto Madrileño de Estudios Avanzados en Nanociencia (IMDEA-Nanociencia), Spai



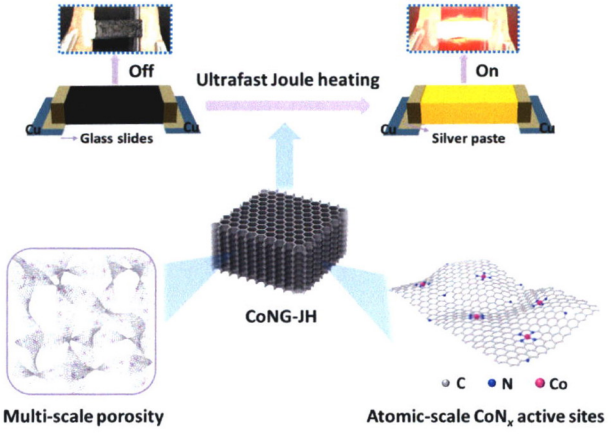
A novel two-dimensional (2D) covalent organic framework (DAPT-TFP-COF) was synthesized by incorporating highly electroactive pyrene-4,5,9,10-tetraone (PTO) units, which was tested as an electrocatalyst towards oxygen reduction reaction.

3907–3912

Ultrafast Joule heating synthesis of hierarchically porous graphene-based Co-N-C single-atom monoliths

Lingli Xing, Rui Liu, Zhichao Gong, Jingjing Liu, Jianbin Liu, Haisheng Gong, Kang Huang, and Huilong Fei*

Hunan University, China



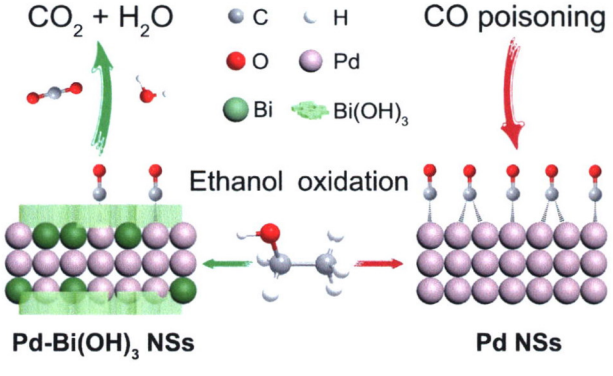
The ultrafast Joule heating process ensures the rapid and stable dispersion of atomic-scale CoN_x active sites in graphene, while the three-dimensional hierarchically porous architecture promotes the mass transfer efficiency during the catalytic process.

3913–3919

Synergistic combination of Pd nanosheets and porous $Bi(OH)_3$ boosts activity and durability for ethanol oxidation reaction

Mingyu Chu[2], Jialu Huang[1], Jin Gong[2], Yi Qu[4], Guoling Chen[4], Hu Yang[1], Xuchun Wang[2,3], Qixuan Zhong[2], Chengwei Deng[4,*], Muhan Cao[2], Jinxing Chen[2], Xiaolei Yuan[1,2,*], and Qiao Zhang[2]

[1] Nantong University, China
[2] Soochow University, China
[3] University of Western Ontario, Canada
[4] Shanghai Institute of Space Power-Sources, China



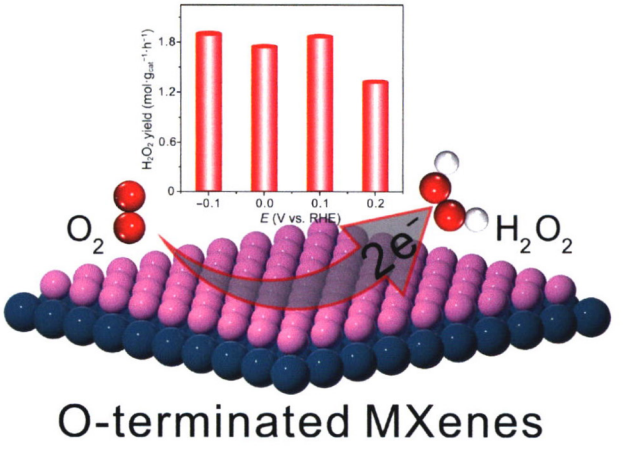
The incorporation of $Bi(OH)_3$ species effectively tunes the electronic (induce Pd into an electron-rich state) and geometric (separate the Pd ensemble) structures of Pd nanosheets, leading to the improved ethanol oxidation reaction (EOR) activity and superior CO tolerance.

3920–3926

Investigation of MXenes as oxygen reduction electrocatalyst for selective H_2O_2 generation

Xiao Huang[1], Min Song[1], Jian Zhang[1,*], Jingjing Zhang[1], Wei Liu[1], Chang Zhang[1], Wang Zhang[2,*], and Deli Wang[1,*]

[1] Huazhong University of Science and Technology, China
[2] Shenzhen University, China



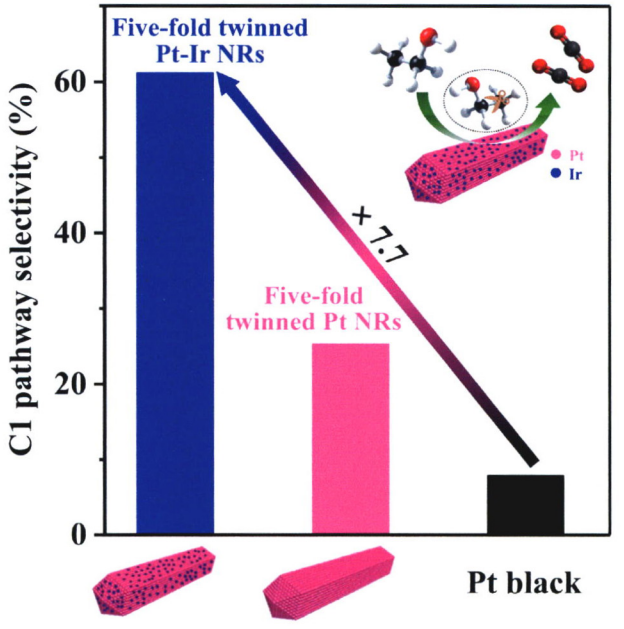
We found here MXenes are inherent two-electron oxygen reduction reaction (ORR) catalysts. Nb_2CT_x shows a high H_2O_2 production rate of 1.95 mol·g_{cat}^{-1}·h^{-1} at 0.1 V (vs. reversible hydrogen electrode (RHE)) and can efficiently decompose organic dyes.

3927–3932

Five-fold twinned Ir-alloyed Pt nanorods with high C1 pathway selectivity for ethanol electrooxidation

Yan Fang[1], Shiyu Guo[1], Dongjie Cao[1], Genlei Zhang[1,*], Qi Wang[1], Yazhong Chen[1], Peng Cui[1], Sheng Cheng[1], and Wansheng Zuo[2]

[1] Hefei University of Technology, China
[2] Wuhu Tus-semiconductor Co., China



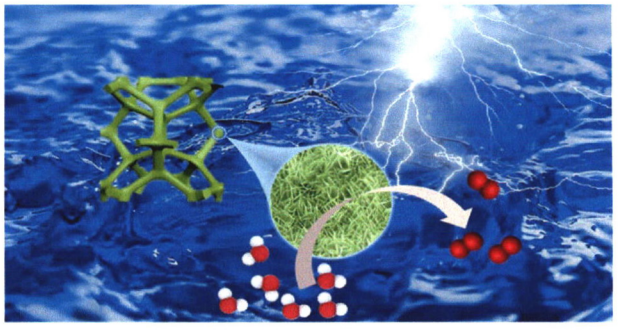
Five-fold twinned (FFT) Pt-Ir nanorods (NRs) are synthesized and exhibit outstanding electrocatalytic performance for ethanol oxidation with a considerable C1 pathway selectivity.

3933–3939

Mn-doping induced electronic modulation and rich oxygen vacancies on vertically grown $NiFe_2O_4$ nanosheet array for synergistically triggering oxygen evolution reaction

Yonghao Gan, Meilin Cui, Xiaoping Dai*, Ying Ye, Fei Nie, Ziteng Ren, Xueli Yin, Baoqiang Wu, Yihua Cao, Run Cai, and Xin Zhang

China University of Petroleum, China



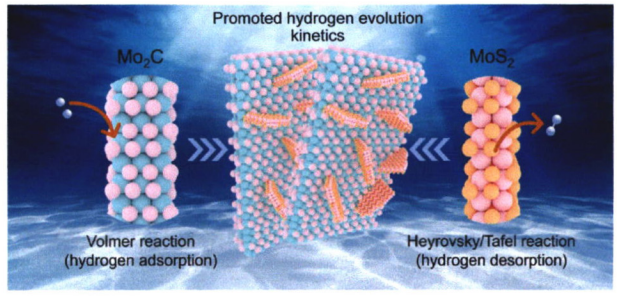
Mn-doped $NiFe_2O_4$ induces the electronic modulation to entitle the hybridization between Ni 3d and O 2p orbitals to facilitate the formation of *OOH, and also creates more oxygen vacancies to reduce the adsorption energy of water molecules for triggering OER process.

3940–3945

Vertically mounting molybdenum disulfide nanosheets on dimolybdenum carbide nanomeshes enables efficient hydrogen evolution

Tingting Wang[1], Pengyan Wang[1], Yajun Pang[2,*], Yitian Wu[2], Jin Yang[2], Hao Chen[2], Xiaorui Gao[3], Shichun Mu[1], and Zongkui Kou[1,*]

[1] Wuhan University of Technology, China
[2] Zhejiang A&F University, China
[3] Changshu Institute of Technology, China



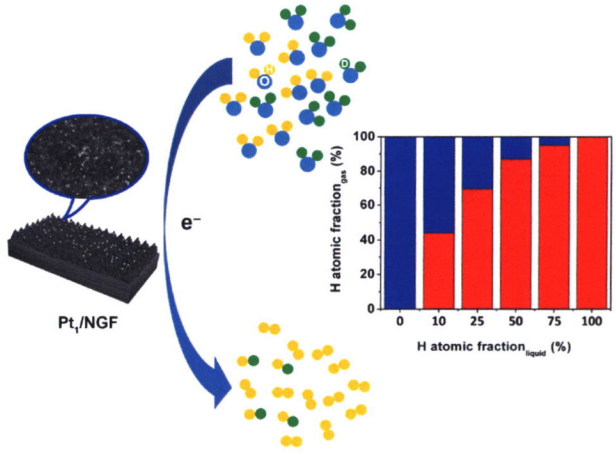
A two-dimensional (2D) layered-nanosheet-on-2D-nonlayered-nanomesh hierarchical heterostructure was fabricated to aim at weakening the strong hydrogen adsorption strength of Mo_2C by introducing the MoS_2 featuring the strong hydrogen intermediate desorption capacity.

3946–3951

Platinum single atom catalysts for hydrogen isotope separation during hydrogen evolution reaction

Jingsong Xu[1], Rui Li[2], Xiayan Yan[2], Qingkai Zhao[2], Rongguang Zeng[2], Jingwen Ba[2], Qifa Pan[1], Xin Xiang[2,*], and Daqiao Meng[1,*]

[1] Science and Technology on Surface Physics and Chemistry Laboratory, China
[2] Institute of Materials, China Academy of Engineering Physics, China



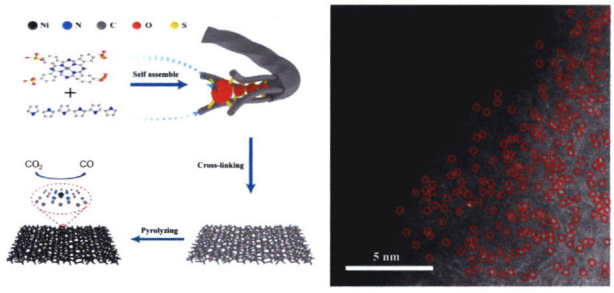
Pt single atom catalysts (SACs) were anchored on nitrogen doped graphite foil by polyol reduction method. The as-prepared Pt SACs exhibited high activity with an overpotential of 0.022 V at 10 mA·cm^{-2} toward hydrogen evolution reaction and a high separation factor of 6.83 toward H/D separation.

3952–3958

Atomically dispersed Ni anchored on polymer-derived mesh-like N-doped carbon nanofibers as an efficient CO_2 electrocatalytic reduction catalyst

Tai Cao[1], Rui Lin[1], Shoujie Liu[2], Weng-Chon (Max) Cheong[3], Zhi Li[1,*], Konglin Wu[2], Youqi Zhu[4], Xiaolu Wang[1], Jian Zhang[1], Qiheng Li[1], Xiao Liang[1], Ninghua Fu[1], Chen Chen[1], Dingsheng Wang[1], Qing Peng[1], and Yadong Li[1,*]

[1] Tsinghua University, China
[2] Anhui Normal University, China
[3] University of Macau, Macao, China
[4] Beijing Institute of Technology, China



A self-assembly strategy was developed to synthesize a highly efficient CO_2 reduction electrocatalyst with atomically dispersed Ni active centers anchored on polymer-derived mesh-like N-doped carbon nanofibers.

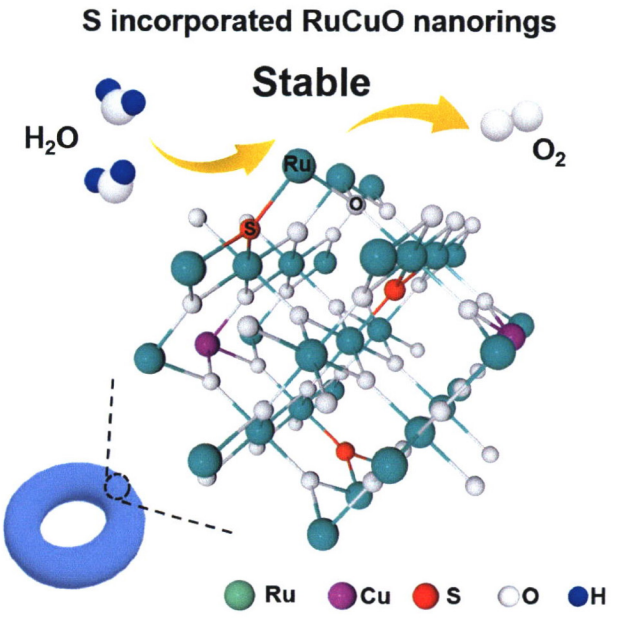
3959–3963

S incorporated RuO_2-based nanorings for active and stable water oxidation in acid

Qing Yao[1,2], Zhiyong Yu[1], Ying-Hao Chu[3], Yu-Hong Lai[3], Ting-Shan Chan[4], Yong Xu[5,*], Qi Shao[1], and Xiaoqing Huang[2,*]

[1] Soochow University, China
[2] Xiamen University, China
[3] "National Yang Ming Chiao Tung University", Taiwan, China
[4] "National Synchrotron Radiation Research Center", Taiwan, China
[5] Guangdong University of Technology, China

3964–3970



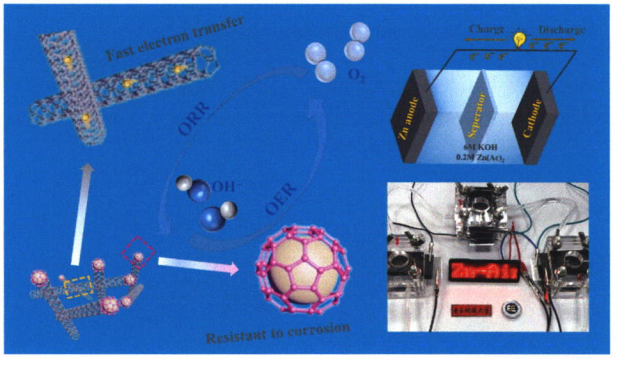
We demonstrate that the incorporation of S into RuCuO nanorings (NRs) can optimize the interaction of Ru and O and significantly suppresses the dissolution of Ru in acidic condition. The optimal catalyst exhibits enhanced stability for 3,000 cycles of cyclic voltammetry test and more than 250 h chronopotentiometry test at 10 $mA \cdot cm^{-2}$ in 0.5 M H_2SO_4.

N-doped CNTs capped with carbon layer armored CoFe alloy as highly stable bifunctional catalyst for oxygen electrocatalysis

Bin Wang[1], Katam Srinivas[1], Yanfang Liu[1], Dawei Liu[1], Xiaojuan Zhang[1], Wanli Zhang[1], and Yuanfu Chen[1,2,*]

[1] University of Electronic Science and Technology of China, China
[2] Tibet University, China

3971–3979



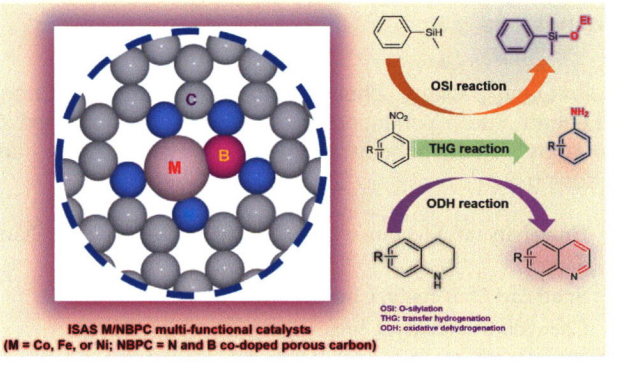
A bifunctional oxygen evolution reaction (OER)/oxygen reduction reaction (ORR) electrocatalyst with exceptional operating stability was designed to meet the practical application for Zn-air batteries.

Biomass-assisted approach for large-scale construction of multi-functional isolated single-atom site catalysts

Tao Wu[1,2,3], Sha Li[4], Shoujie Liu[4], Weng-Chon Cheong[5], Cheng Peng[1], Kai Yao[1], Yingping Li[1], Jieyue Wang[1], Binbin Jiang[6,*], Zheng Chen[3,*], Zhiming Chen[2], Xianwen Wei[1], and Konglin Wu[1,2,*]

[1] Anhui University of Technology, China
[2] Anhui Polytechnic University, China
[3] Anhui Normal University, China
[4] Chemistry and Chemical Engineering of Guangdong Laboratory, China
[5] University of Macau, Macao, China
[6] Anqing Normal University, China

3980–3990

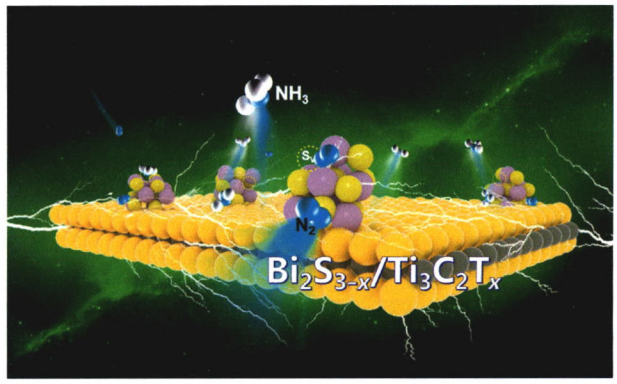


A biomass-assisted pyrolysis-etching-activation (PEA) strategy was developed to construct ISAS metal decorated on N and B co-doped porous carbon (ISAS M/NBPC, M = Co, Fe, or Ni) catalysts with multi-functional features and excellent catalytic activities. They can be used to conduct different types of catalytic reactions, such as O-silylation (OSI), oxidative dehydrogenation (ODH), and transfer hydrogenation (THG).

Sulfur-deficient Bi_2S_{3-x} synergistically coupling $Ti_3C_2T_x$-MXene for boosting electrocatalytic N_2 reduction

Yaojing Luo, Peng Shen, Xingchuan Li, Yali Guo, and Ke Chu*

Lanzhou Jiaotong University, China



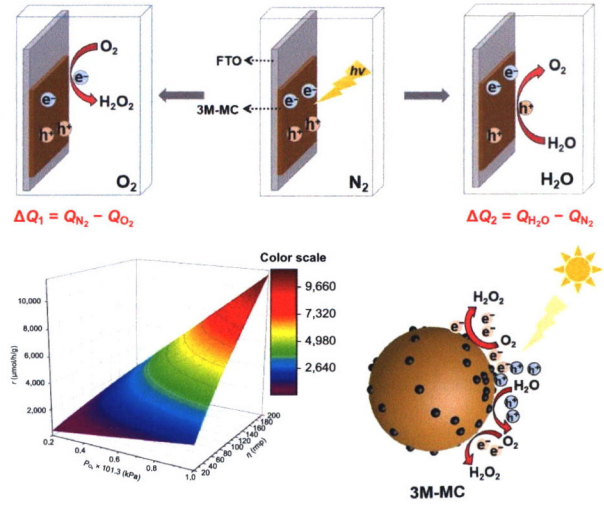
Sulfur-deficient Bi_2S_{3-x} nanoparticles decorated $Ti_3C_2T_x$-MXene exhibited a dramatically boosted electrocatalytic N_2 reduction activity with an NH_3 yield of 68.3 $\mu g \cdot h^{-1} \cdot mg^{-1}$ and a Faradaic efficiency of 22.5%, attributed to the dual-active-centers of S-vacancies and interfacial-Bi sites for strongly boosting N_2 adsorption and $^*N_2H$ formation to result in an energetic-favorable nitrogen reduction reaction (NRR) process.

3991–3999

Highly efficient metal-free catalyst from cellulose for hydrogen peroxide photoproduction instructed by machine learning and transient photovoltage technology

Yan Liu[1], Xiao Wang[1], Yajie Zhao[1], Qingyao Wu[1], Haodong Nie[1], Honglin Si[1], Hui Huang[1,*], Yang Liu[1,*], Mingwang Shao[1,*], and Zhenhui Kang[1,2,*]

[1] Soochow University, China
[2] Macau University of Science and Technology, Macau, China



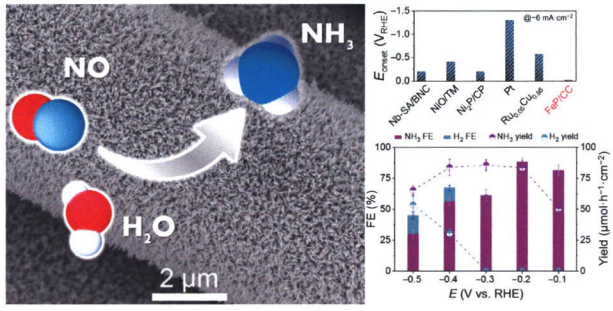
Metal-free photocatalyst from cellulose shows the high photocatalytic activity and anti-poisoning properties for the photoproduction of H_2O_2 instructed by transient photovoltage technology and machine learning.

4000–4007

FeP nanorod array: A high-efficiency catalyst for electroreduction of NO to NH_3 under ambient conditions

Jie Liang[1], Qiang Zhou[2], Ting Mou[1], Hongyu Chen[1], Luchao Yue[1], Yongsong Luo[1], Qian Liu[3], Mohamed S. Hamdy[4], Abdulmohsen Ali Alshehri[5], Feng Gong[2,*], and Xuping Sun[1,*]

[1] University of Electronic Science and Technology of China, China
[2] Southeast University, China
[3] Chengdu University, China
[4] King Khalid University, Saudi Arabia
[5] King Abdulaziz University, Saudi Arabia



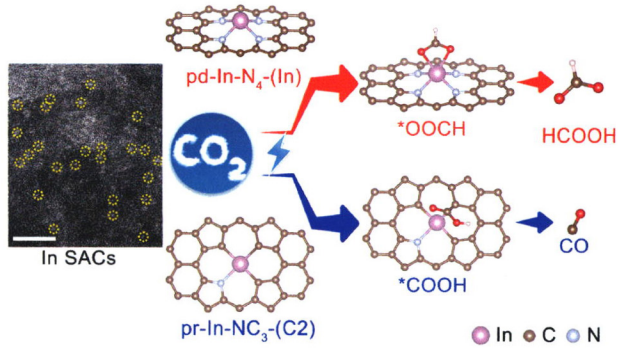
An FeP nanorod array supported on carbon cloth (FeP/CC) behaves as a high-active electrocatalyst with a low onset potential toward NO-to-NH_3 conversion, achieving a remarkable Faradaic efficiency of 88.49% and a large yield of 85.62 $\mu mol \cdot h^{-1} \cdot cm^{-2}$ in 0.2 M phosphate-buffered solution.

4008–4013

Tuning the reaction path of CO_2 electroreduction reaction on indium single-atom catalyst: Insights into the active sites

Jiawei Zhang[1], Gangming Zeng[1], Lanlan Chen[2], Wenchuan Lai[1], Yuliang Yuan[1], Yangfan Lu[3], Chao Ma[1], Wenhua Zhang[2,*], and Hongwen Huang[1,*]

[1] Hunan University, China
[2] University of Science and Technology of China, China
[3] Zhejiang University, China



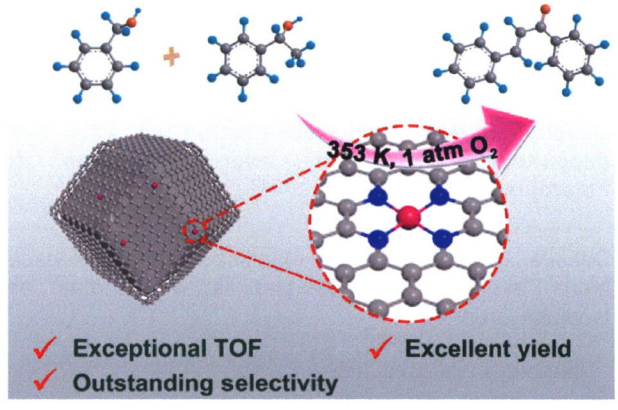
Electrochemical CO_2 reduction (CO_2RR) selectivity switch from HCOOH to CO in In single-atom catalysts (SACs) enabled by active sites shift from indium center to the indium-adjacent carbon atoms.

4014–4022

Synthesis of cobalt single atom catalyst by a solid-state transformation strategy for direct C–C cross-coupling of primary and secondary alcohols

Zhijun Li[1,*], Yuying Chen[1], Xiaowen Lu[1], Honghong Li[1], Leipeng Leng[1], Tinglei zhang[1], and J. Hugh Horton[1,2]

[1] Northeast Petroleum University, China
[2] Queen's University, Canada



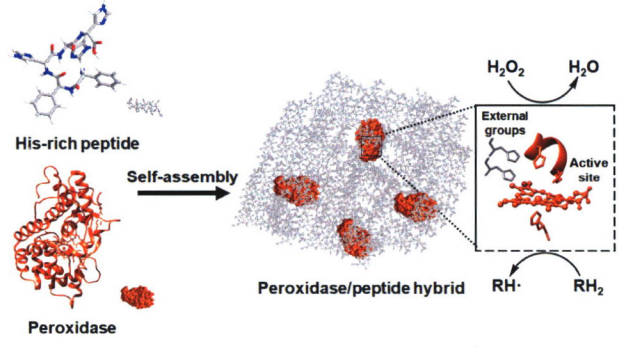
Herein, we report a solid-state transformation strategy to fabricate Co single atom catalysts by introducing Co species from commercial Co_2O_3 powders into nitrogen-doped carbon support. Its exceptional catalytic performance in the direct C–C cross-coupling of primary and secondary alcohols was experimentally validated and further confirmed by density functional theory calculations.

4023–4031

Designed histidine-rich peptide self-assembly for accelerating oxidase-catalyzed reactions

Peidong Du, Siyuan Liu, Hao Sun, Haifeng Wu, and Zhen-Gang Wang*

Beijing University of Chemical Technology, China



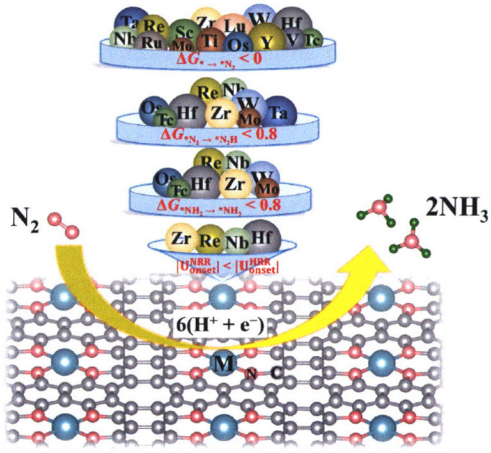
The histidine-rich peptides self-assemble with peroxidases to form biocatalytic hybrids, in which the histidine from the peptides may collaborate with the residues in the heme pocket of the enzyme to accelerate the catalytic rate toward H_2O_2-oxidation of electron donor substrates.

4032–4038

Single-atom catalysts based on two-dimensional metalloporphyrin monolayers for ammonia synthesis under ambient conditions

Chun-Xiang Huang[1,2], Sheng-Yao Lv[1,2], Cong Li[1], Bin Peng[2], Guoliang Li[2,*], and Li-Ming Yang[1,*]

[1] Huazhong University of Science and Technology, China
[2] South China Normal University, China



Four novel metal porphyrin MPP (M = Zr, Nb, Hf and Re) single-atom catalyst candidates with excellent performance for ammonia (NH_3) synthesis from electrocatalytic nitrogen reduction reaction (NRR) have been identified through a combination of four-step high-throughput screening and first-principles calculations on a series of 3d, 4d, and 5d transition metals anchored onto porphyrin substrates.

4039–4047

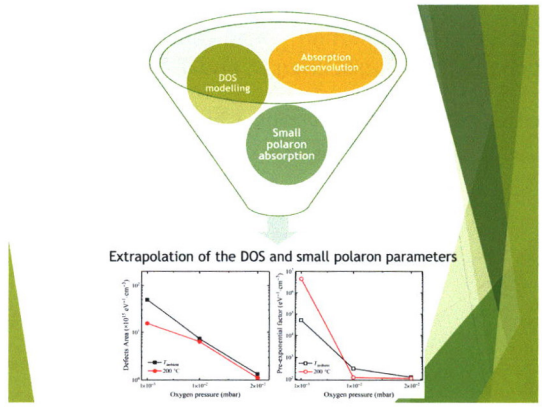
Energy

Research Articles

Density of states characterization of TiO_2 films deposited by pulsed laser deposition for heterojunction solar cells

Daniele Scirè[1,*], Roberto Macaluso[1], Mauro Mosca[1], Maria Pia Casaletto[2], Olindo Isabella[3], Miro Zeman[3], and Isodiana Crupi[1]

[1] University of Palermo, Italy
[2] National Research Council (CNR), Italy
[3] Delft University of Technology, the Netherlands



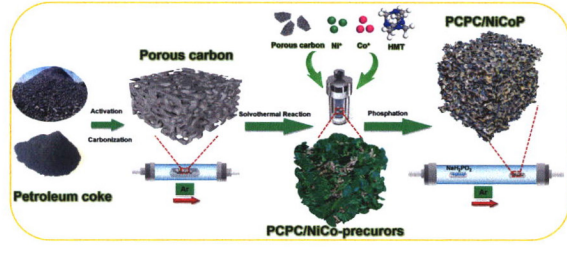
The application of TiO_2 has an important role as electron selective contact in heterojunction technology (HJT), but knowledge of the defect density of states (DOS) is incomplete. We provide the defect density of states and the small polaron parameters after an optical non-destructive characterization.

4048–4057

Petroleum coke derived porous carbon/NiCoP with efficient reviving catalytic and adsorptive activity as sulfur host for high performance lithium–sulfur batteries

Bo Zhang[1], Lu Wang[1], Bin Wang[1], Yanjun Zhai[2], Shuyuan Zeng[2], Meng Zhang[1], Yitai Qian[1], and Liqiang Xu[1,*]

[1] Shandong University, China
[2] Liaocheng University, China



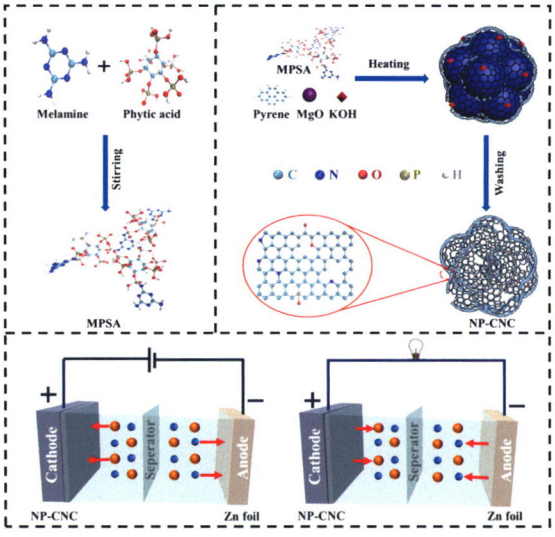
A distinct multifunctional integrated sulfur-host of petroleum coke-based porous carbon/NiCoP composites was prepared for capturing lithium polysulfides (LiPSs) and accelerating the conversion reaction kinetics of LiPSs.

4058–4067

Interconnected N/P co-doped carbon nanocage as high capacitance electrode material for energy storage devices

Lei Yang[1], Xiaojun He[1,*], Yuchen Wei[1], Honghui Bi[1], Feng Wei[1], Hongqiang Li[1], Changzhou Yuan[2,*], and Jieshan Qiu[3,*]

[1] Anhui University of Technology, China
[2] University of Jinan, China
[3] Beijing University of Chemical Technology, China



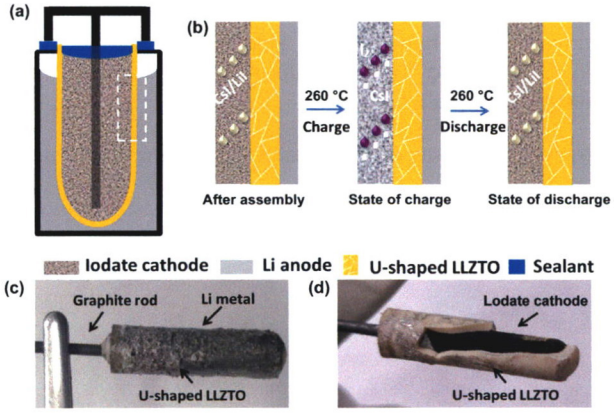
Interconnected N/P co-doped carbon nanocage (NP-CNC) was synthesized from pyrene molecules by using MgO as template and melamine-phytic acid supramolecular aggregate (MPSA) as dopant coupled with KOH activation, presenting outstanding electrochemical properties as electrode material of energy storage devices.

4068–4075

A garnet-electrolyte based molten Li-I_2 battery with high performance

Bin Sun[1], Panpan Wang[1,2], Jing Xu[1], Qianzheng Jin[1,*], Zili Zhang[1], Hui Wu[3,*], and Yang Jin[1,*]

[1] Zhengzhou University, China
[2] Xiangtan university, China
[3] Tsinghua University, Chin



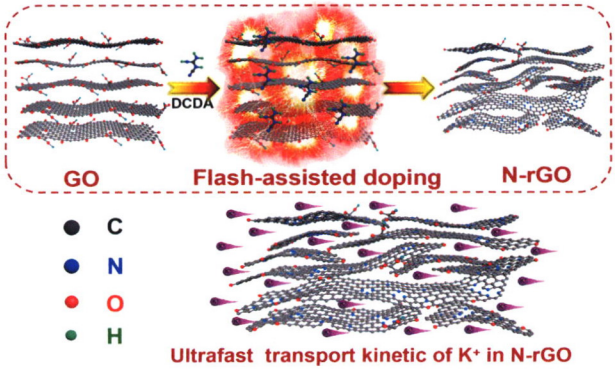
Here, we firstly report a molten Li-I_2 battery (MLIB) based on the U-shaped garnet $Li_{6.4}La_3Zr_{1.4}Ta_{0.6}O_{12}$ (LLZTO) ceramic electrolyte tube at a moderate operating temperature of 260 °C, comprised of a molten lithium anode and a molten CsI/LiI eutectic salt cathode. The high active material LiI loading in a single cell can reach up to 593 mg (~ 173.7 mg·cm^{-2}).

4076–4082

Flash-assisted doping graphene for ultrafast potassium transport

Yongzhi Zhang[1,2], Xianjue Chen[2], Wanglai Cen[1], Wenhao Ren[2], Haocheng Guo[2], Sicheng Wu[2], Yang Xiao[2], Sheng Chen[2], Yong Guo[2], Dan Xiao[1,*], and Chuan Zhao[2,*]

[1] Sichuan University, China
[2] University of New South Wales, Australia



A flash-assisted doping method was proposed to produce nitrogen- and sulfur-doped graphene (N-rGO and S-rGO). Particularly, the as-synthesized N-rGO with a high N content of 12.75 at.% and abundant structure defects used as potassium ion battery anodes exhibits ultrafast transport kinetics of K^+.

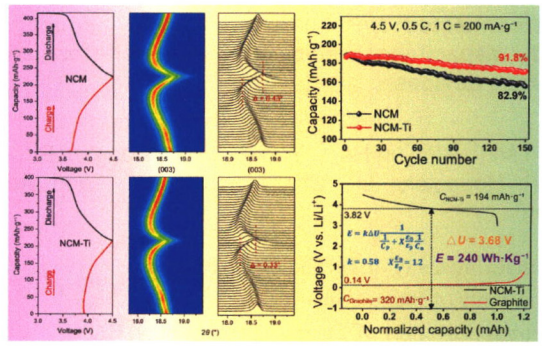
4083–4090

Stabilizing effects of atomic Ti doping on high-voltage high-nickel layered oxide cathode for lithium-ion rechargeable batteries

Yong Cheng[1,2], Yan Sun[3], Changting Chu[1], Limin Chang[1,*], Zhaomin Wang[3], Dongyu Zhang[2], Wanqiang Liu[3,*], Zechao Zhuang[4,*], and Limin Wang[1,2]

[1] Jilin Normal University, China
[2] Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, China
[3] Changchun University of Science and Technology, China
[4] Tsinghua University, China

4091–4099



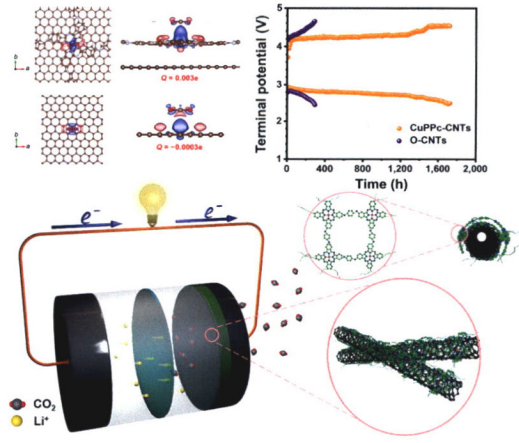
The homogeneous Ti-doped high-voltage high-nickel lithium layered oxide cathode $LiNi_{0.6}Co_{0.2}Mn_{0.18}Ti_{0.02}O_2$ (NCM-Ti) is successfully prepared through a liquid phase physical mixing and high-temperature annealing method. Ti doping inhibits the undesired H_2-H_3 phase transition, minimizing the mechanical degradation due to the strong Ti–O bond and no unpaired electrons for Ti^{4+}, and Ti-doped NCM shows superior cycle stability and an energy density of up to 240 $Wh \cdot Kg^{-1}$.

Single atom site conjugated copper polyphthalocyanine assisted carbon nanotubes as cathode for reversible Li-CO_2 batteries

Yunyun Xu[1], Cheng Jiang[1], Hao Gong[2], Hairong Xue[1], Bin Gao[1], Peng Li[1], Kun Chang[1], Xianli Huang[1], Tao Wang[1,*], and Jianping He[1]

[1] Nanjing University of Aeronautics and Astronautics, China
[2] Nanjing Forestry University,China

4100–4107



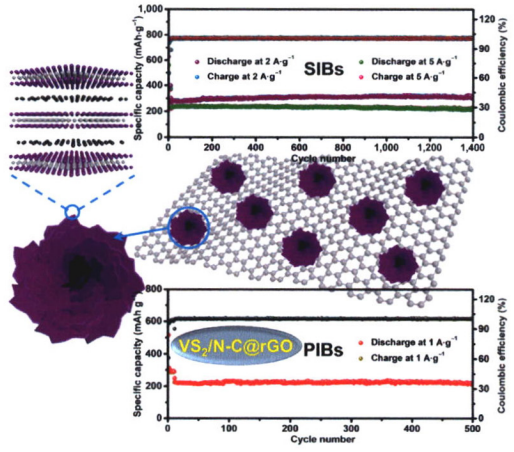
Conjugated copper polyphthalocyanine significantly improved the CO_2 adsorption and carbon nanotubes have excellent electrical conductivity. The composites (CuPPc-CNTs) provide an opportunity for the research of covalent organic polymers (COPs) single-atom catalyst in Li-CO_2 battery field.

Assembly of flower-like VS_2/N-doped porous carbon with expanded (001) plane on rGO for superior Na-ion and K-ion storage

Junwei Sun[1], Gang Lian[1,*], Laiying Jing[2], Di Wu[1], Deliang Cui[1], Qilong Wang[3], Haohai Yu[1,*], Huaijin Zhang[1], and Ching-Ping Wong[4]

[1] Shandong University, China
[2] Qilu University of Technology (Shandong Academy of Sciences), China
[3] Shandong University, China
[4] Georgia Institute of Technology, USA

4108–4116



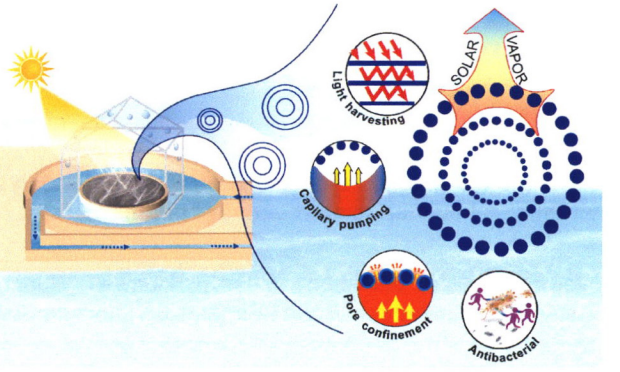
The interlayer-expanded VS_2 nanoflowers via alternated intercalation of N-doped carbon (N-C) monolayers are rationally designed and grown on reduced graphene oxide (rGO). The obtained VS_2/N-C@rGO nanohybrids, as electrode materials for sodium-ion batteries (SIBs) and potassium-ion batteries (PIBs), exhibit excellent electrochemical energy storage performance.

Multishelled CuO/Cu_2O induced fast photo-vapour generation for drinking water

Xuanbo Chen[1,2], Ping Li[3], Jiao Wang[2,4], Jiawei Wan[2,5], Nailiang Yang[2,5,*], Bo Xu[6], Lianming Tong[6], Lin Gu[5,7], Jiang Du[4], Jianjian Lin[3,*], Ranbo Yu[1,*], and Dan Wang[2,5,*]

[1] University of Science and Technology Beijing, China
[2] Chinese Academy of Sciences, China
[3] Qingdao University of Science and Technology, China
[4] Zhengzhou University, China
[5] University of Chinese Academy of Sciences, China
[6] Peking University, China
[7] Institute of Physics, Chinese Academy of Sciences, China

4117–4123



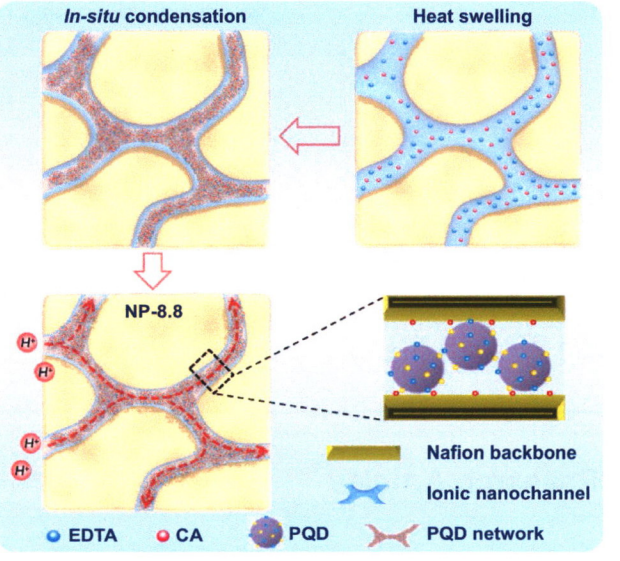
Hollow multishelled structure (HoMS) CuO/Cu_2O was introduced into the solar-vapour generation. The porous nano/micro HoMS enhanced light absorption, optimized the thermal regulation and water transport, resulting in a high water evaporation rate, and the heterogeneous semiconductors enhanced the production of reactive oxygen species for water disinfection.

Manipulating the ionic nanophase of Nafion by *in-situ* precise hybridization with polymer quantum dot towards highly enhanced fuel cell performances

Wenjia Wu[1], Zhuofan Zhou[1], Yan Wang[1], Yatao Zhang[1], Yong Wang[2], Jingtao Wang[1,*], and Yecheng Zou[3]

[1] Zhengzhou University, China
[2] Nanjing Tech University, China
[3] Shandong DongYue Polymer Material Co., Ltd., China

4124–4131



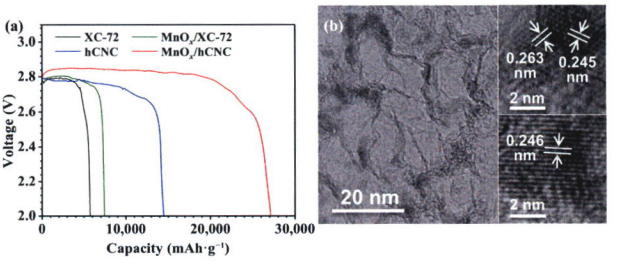
An *in-situ* precise hybridization strategy, mainly containing heat swelling-enabled uniform precursor entrance and microwave-assisted in-situ condensation process, is proposed for decorating Nafion ionic nanochannel. This decoration strategy can precisely manipulate the physical topology and chemical environment of ionic nanochannel without affecting the backbone nanophase function.

Defect-induced deposition of manganese oxides on hierarchical carbon nanocages for high-performance lithium-oxygen batteries

Baoxing Wang, Chenxia Liu, Lijun Yang, Qiang Wu*, Xizhang Wang*, and Zheng Hu*

Nanjing University, China

4132–4136



The MnO_x/hCNC cathode by defect-induced deposition exhibits high full discharge capacity and superior cycle life for Li-O_2 batteries, owing to the boosted reversibility of oxygen reactions by the highly dispersed MnO_x nanoparticles and the fast charge/mass transfer facilitated by the hierarchical carbon nanocages (hCNC).

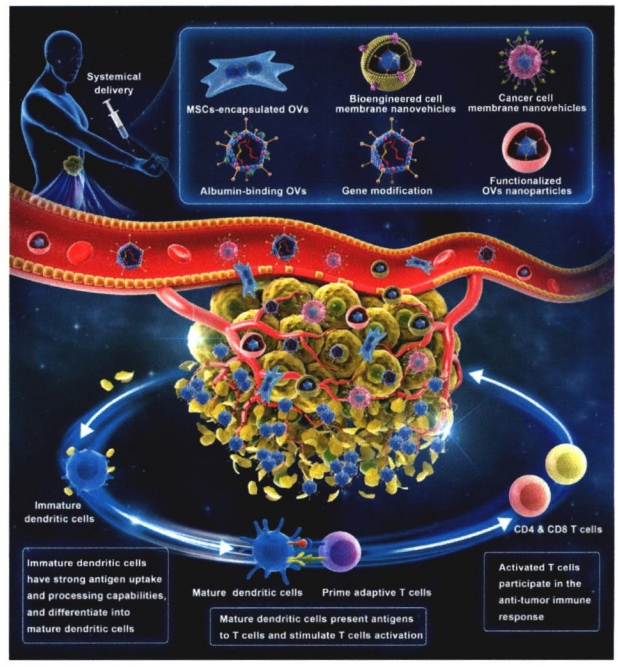
Nano biology

Review Article

Emerging systemic delivery strategies of oncolytic viruses: A key step toward cancer immunotherapy

Weiyue Ban[1], Jianhuan Guan[1], Hanwei Huang[2], Zhonggui He[1], Mengchi Sun[1,*], Funan Liu[2,*], and Jin Sun[1,*]

[1] Shenyang Pharmaceutical University, China
[2] China Medical University, China



This abstract graphic takes concerted action with abstract section and illustrates the development status of oncolytic viruses (OVs) systemic delivery modalities. Concretely, six representative systemic delivery models have been exhibited and the physiological disposition and influence for tumor immune microenvironment of OVs have been shown in this graphic.

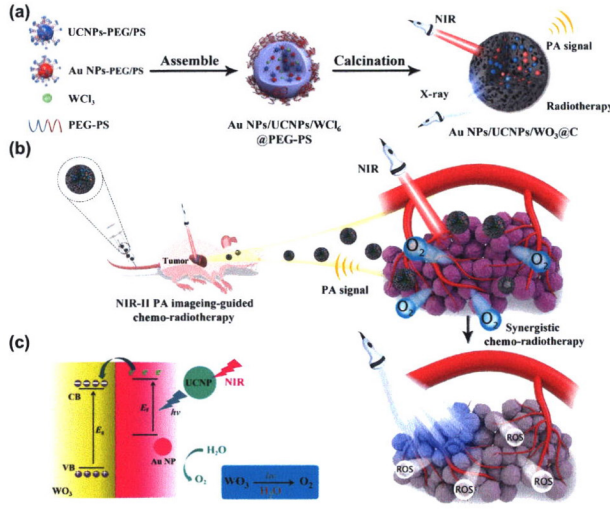
4137–4153

Research Articles

Mesoporous radiosensitized nanoprobe for enhanced NIR-II photoacoustic imaging-guided accurate radio-chemotherapy

Tao Chen[1], Lichao Su[1], Lisen Lin[1], Xiaoguang Ge[1], Feicheng Bai[1], Meng Niu[1], Chenlu Wang[1], Jibin Song[1], Shaolei Guo[2,*], and Huanghao Yang[1,*]

[1] Fuzhou University, China
[2] The First Affiliated Hospital of Sun Yat-Sen University, China



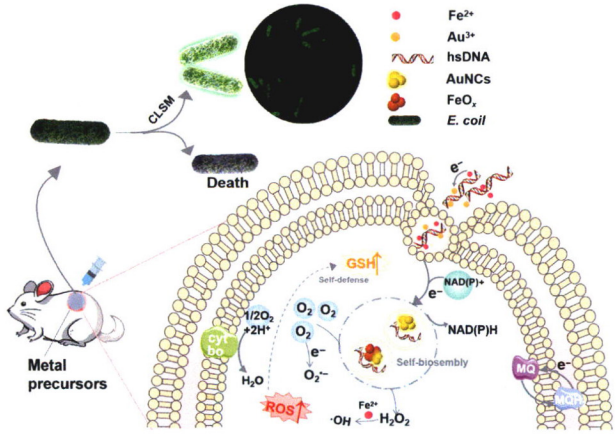
As showed in schematic illustration, we synthesized the WO_3-based nanoprobe (Au NPs/UCNPs/WO_3@C) as a smart theranostic agent with the excellent electron excitation and transfer scenarios capability for near-infrared (NIR-II) photoacoustic imaging guided accurate cancer chemo-radiotherapy, which can produce oxygen under radiation and achieve the goal of the hypoxia alleviation in tumor region.

4154–4163

Intelligent bio-assembly imaging-guided platform for real-time bacteria sterilizing and infectious therapy

Jiayu Zeng[1], Zengchao Guo[1], Yihan Wang[1], Zhaojian Qin[1], Yi Ma[3], Hui Jiang[1], Yossi Weizmann[2,*], and Xuemei Wang[1,*]

[1] Southeast University, China
[2] Ben-Gurion University of the Negev, Israel
[3] China Pharmaceutical University, China



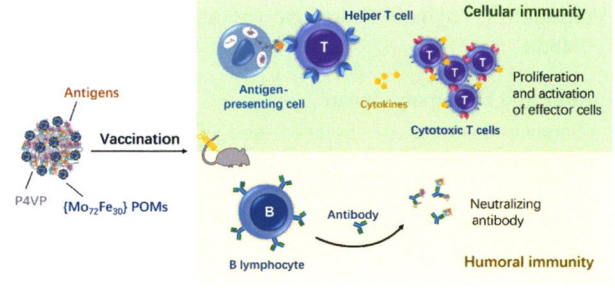
The scheme illustrates the microenvironment-responsive assembled nanoclusters for real-time *Escherichia coli* bioimaging and simultaneous *E. coli*-infected wound cure. In bacterial infections, the metal precursors (i.e., $HAuC_{14}$, FeC_{l2}, and herring sperm DNA) could be bio-self-assembled to multifunctional nanoclusters (NCs) that exhibit luminescence, in which $AuCl_4^-$ was biosynthesized via reductive biomolecules such as NADPH to the fluorescent AuNCs. While visualizing the bacteria, the microenvironment-responsive NCs were enabled to sterilize bacteria efficiently due to reactive oxygen species (ROS) accumulation. Besides, the bio-responsive self-assembled NCs complexes contributed to accelerating bacteria-infected wound healing.

4164–4174

A polymeric co-assembly of subunit vaccine with polyoxometalates induces enhanced immune responses

Xinpei Li, Xiaofeng He, Dongrong He, Yuan Liu, Kun Chen*, and Panchao Yin*

South China University of Technology, China



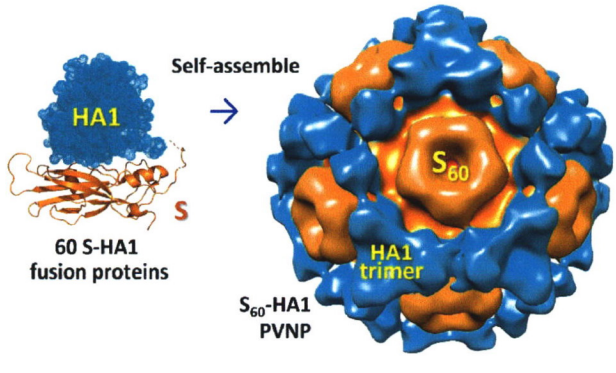
Supra-particle assemblies are co-assembled by poly(4-vinylpyridine), 2.5 nm iron/molybdenum oxide clusters ($\{Mo_{72}Fe_{30}\}$), and antigens of *Mycobacterium bovis* to enhance the vaccine immune response in mice. $\{Mo_{72}Fe_{30}\}$ and poly(4-vinylpyridine) together act as vaccine adjuvants that improve the magnitude and durability of antibody responses as well as the T cell-derived cytokine patterns, resulting in enhanced humoral and cellular immune responses.

4175–4180

Bioengineered pseudovirus nanoparticles displaying the HA1 antigens of influenza viruses for enhanced immunogenicity

Ming Xia[1], Md Rejaul Hoq[2], Pengwei Huang[1], Wen Jiang[2], Xi Jiang[1,3], and Ming Tan[1,3,*]

[1] Cincinnati Children's Hospital Medical Center, USA
[2] Purdue University, USA
[3] University of Cincinnati College of Medicine, USA



A new technology has been developed to generate unique S60-HA1 pseudovirus nanoparticles (PVNPs) that display the receptor-binding HA1 antigens of influenza viruses (IVs). These PVNPs offer new reagents for IV study and provide a promising flu vaccine candidate to fight the deadly influenza.

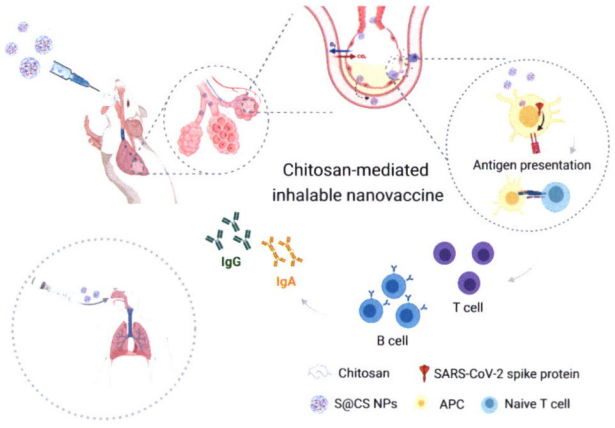
4181–4190

A chitosan-mediated inhalable nanovaccine against SARS-CoV-2

Shao-Hua Zhuo[1], Jun-Jun Wu[1], Lang Zhao[1], Wen-Hao Li[1], Yu-Fen Zhao[1,4], and Yan-Mei Li[1,2,3,*]

[1] Tsinghua University, China
[2] Beijing Institute for Brain Disorders, China
[3] Tsinghua University, China
[4] Institute of Drug Discovery Technology, Ningbo University, Ningbo 315221, China

4191–4200



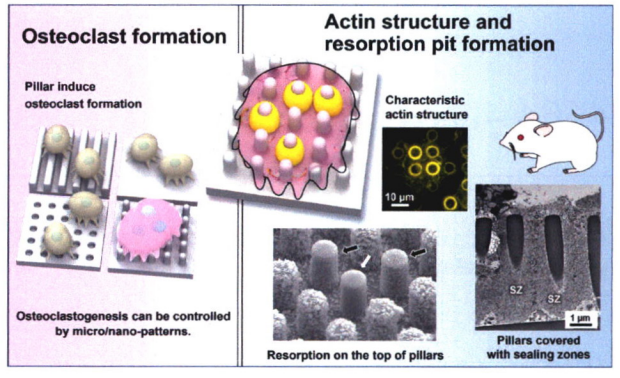
The chitosan-mediated inhalable nanovaccine amplifies spike protein immunogenicity, which offers a convenient and compliant strategy to reduce the use of needles and the need for medical staff.

Different micro/nano-scale patterns of surface materials influence osteoclastogenesis and actin structure

Tsukasa Akasaka[1,*], Miho Tamai[2], Yoshitaka Yoshimura[1], Natsumi Ushijima[1], Shinichiro Numamoto[1], Atsuro Yokoyama[1], Hirofumi Miyaji[1], Ryo Takata[1], Shuichi Yamagata[1], Yoshiaki Sato[1], Ko Nakanishi[1], and Yasuhiro Yoshida[1]

[1] Hokkaido University, Japan
[2] Okinawa Institute of Science and Technology Graduate University, Japan

4201–4211



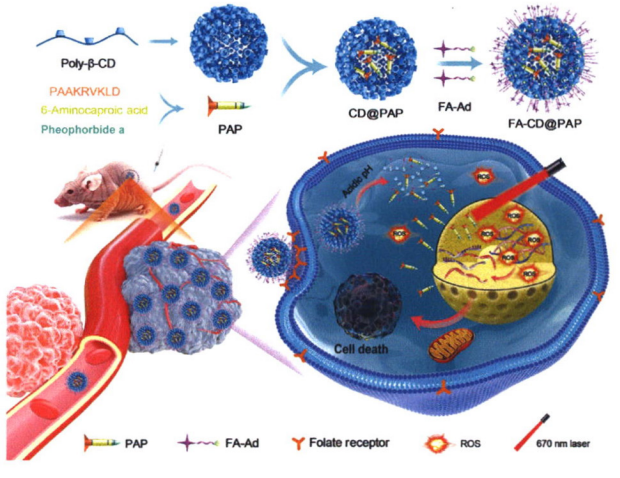
Optimal surface patterns for inducing osteoclastogenesis and characteristic actin structures on pillars were found.

A novel hierarchical targeting and controllable smart nanoparticles for enhanced *in situ* nuclear photodynamic therapy

Gankun Yuan, Qilu Wang, Zifan You, Xuening Chen, Jinping Xue, Xiao Jia*, and Juanjuan Chen*

Fuzhou University, China

4212–4223



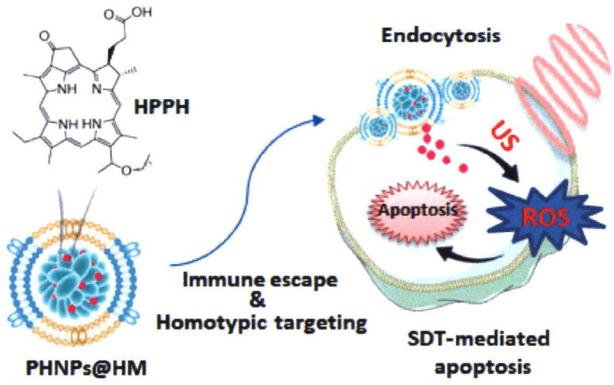
The prepared FA-CD@PAP nanoparticles (NPs) can specifically bind to folate receptors (FR)-overexpressed tumor tissues and cells, and decompose the tumor acidic environment to release the nuclear localization signal (NLS) peptide-conjugated photosensitizer PAP (PAP = pyropheophorbide a—PAAKRVKLD), leading to the enhanced nuclear accumulation. DNA could be damaged directly and instantaneously by the reactive oxygen species (ROS) generated inside nuclei for remarkably enhanced cell death.

Cancer-macrophage hybrid membrane-camouflaged photochlor for enhanced sonodynamic therapy against triple-negative breast cancer

Lishan Zhang[1,2], Ting Yin[1,2], Baozhen Zhang[2], Chong Yan[1], Chengyu Lu[1], Lanlan Liu[2], Ze Chen[2], Hui Ran[1,2], Qingxia Shi[1,2], Hong Pan[2,*], Aiqing Ma[1,2,*], and Lintao Cai[2,*]

[1] Guangdong Medical University, China
[2] Shenzhen Institute of Advanced Technology (SIAT), Chinese Academy of Sciences, China

4224–4232



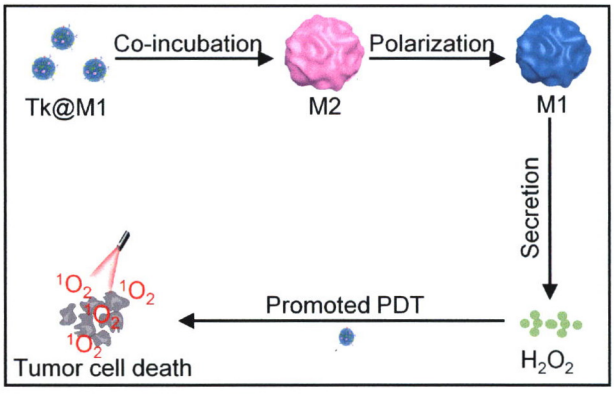
A 4T1 cancer cell-macrophage hybrid membrane (HM)-camouflaged sonosensitizer nanoplatform is constructed by encapsulating photochlor (HPPH)-loaded albumin nanoparticles (PHNPs). Through homologous adhesion recognition and immune escaping from hybrid membrane, HPPH can be efficiently targeted to the tumor cells and generate reactive oxygen species (ROS) for tumor suppression under ultrasound (US) irradiation.

Immunomodulatory hybrid bio-nanovesicle for self-promoted photodynamic therapy

Houli Liu[1], Yao Lei[1], Weidong Nie[1], Helin Zhao[1], Yuzhu Wu[1], Liping Zuo[1], Guanghao Wu[1], Ruili Yang[2,*], and Hai-Yan Xie[1,*]

[1] Beijing Institute of Technology, China
[2] Perking University, China

4233–4242



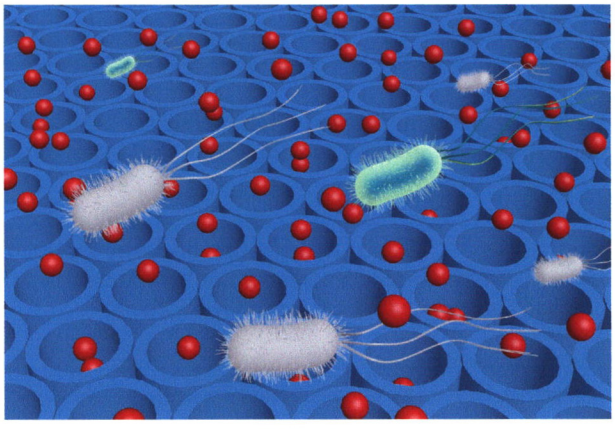
Hybrid bio-nanovesicles (Tk@M1) of thylakoid membranes and M1-macrophage derived extracellular vesicles actively target tumors, and then regulate the inactive tumor immune microenvironment by means of the native features of M1 EV and Tk. The activated tumors promote the photodynamic therapy effect of Tk@M1 attributed to the increased O_2 from catalase catalyzed decomposition of augmented H_2O_2.

An implantable antibacterial drug-carrier: Mesoporous silica coatings with size-tunable vertical mesochannels

Mengli Liu, Fang Huang, Chin-Te Hung, Liwei Wang, Wei Bi*, Yupu Liu, and Wei Li*

Fudan University, China

4243–4250



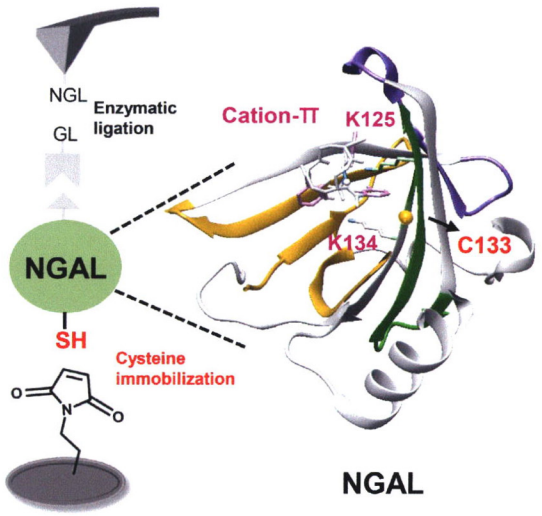
Mesoporous silica coatings (MSCs) with vertical and size-tunable mesochannels are fabricated on a variety of metal substrates via a nano-interfacial oriented assembly approach. Importantly, the MSCs on titanium substrates (Ti@MSCs) exhibit excellent drug adsorption, sustained release, and antibacterial performances.

Detection of weak non-covalent cation-π interactions in NGAL by single-molecule force spectroscopy

Jingyuan Nie, Yibing Deng, Fang Tian, Shengchao Shi, and Peng Zheng*

Nanjing University, China

4251–4257



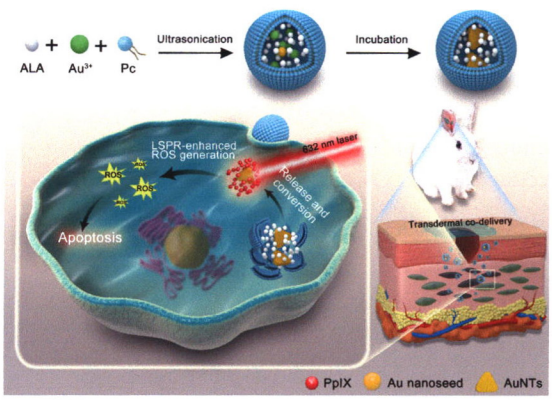
Cation-π interaction played an essential role in many biological systems. Here, we detected weak influences of cation-π interaction experimentally combining high-precision atomic force microscopy-based single-molecule force spectroscopy (AFM-SMFS) and cysteine-mediated site-specific protein immobilization.

Localized surface plasmon resonance improves transdermal photodynamic therapy of hypertrophic scars

Yunsheng Chen[1], Zhixi Yu[1], Xinxian Meng[1], Hua Li[1], Xiyang Sun[1,*], Dannong He[2], Yixin Zhang[1,2,*], and Zheng Zhang[1,*]

[1] Shanghai Jiao Tong University, China
[2] Shanghai National Engineering Research Center for Nanotechnology, China

4258–4265



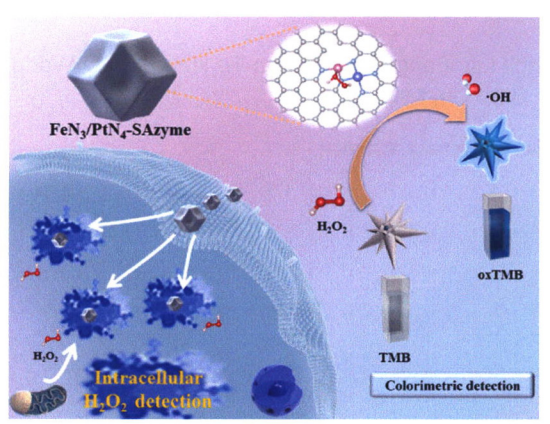
5-Aminolevulinic acid (ALA) and Au nanotriangles (AuNTs) co-delivery nanoethosomes (A/A-ES) achieve the transdermal co-delivery of ALA and AuNTs, and enhance ALA excitation via localized surface plasmon resonance (LSPR) effect. This work provides an effective strategy to improve transdermal photodynamic therapy (PDT) efficacy through LSPR-enhanced reactive oxygen species (ROS) generation

Diatomic active sites nanozymes: Enhanced peroxidase-like activity for dopamine and intracellular H_2O_2 detection

Shan Wang[1,2], Zunfu Hu[1,3,*], Qiulian Wei[1,2], Huimin Zhang[1], Weina Tang[1], Yunqiang Sun[1], Haiqiang Duan[1], Zhichao Dai[1], Qingyun Liu[2], and Xiuwen Zheng[1,*]

[1] Linyi University, China
[2] Shandong University of Science and Technology, China
[3] Linyi University, China

4266–4273



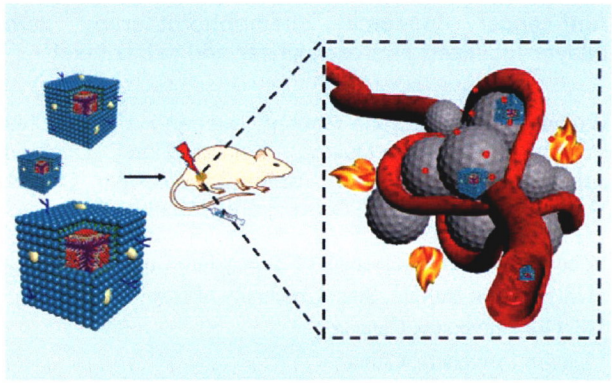
A highly efficient single atom nanoymes (FeN_3/PtN_4-SAzyme) with isolated Fe–Pt pairs was presented. With enhanced peroxidase-like activity, FeN_3/PtN_4-SAzyme could apply for colorimetric detection of dopamine and *in-situ* detection of intracellular H_2O_2.

A pH-responsive biomimetic drug delivery nanosystem for targeted chemo-photothermal therapy of tumors

Yanmin Ju[1,2], Zhiyi Wang[1], Zeeshan Ali[1], Hongchen Zhang[1], Yazhou Wang[1], Nuo Xu[3], Hui Yin[4], Fugeng Sheng[4], and Yanglong Hou[1,*]

[1] Peking University, China
[2] China Pharmaceutical University, China
[3] Fifth Medical Center of Chinese PLA General Hospital, China

4274–4284



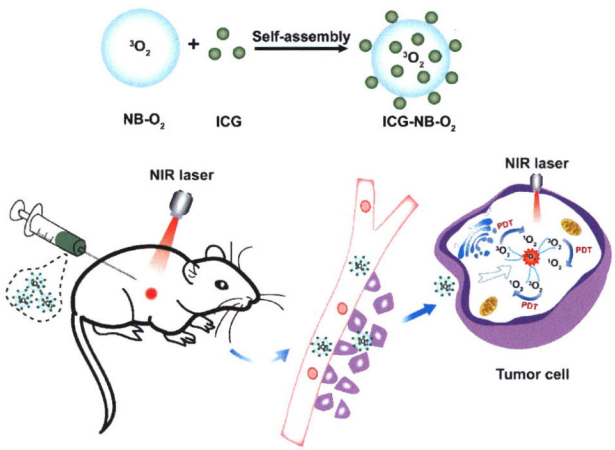
A pH-responsive and biomimetic drug delivery nanosystem $MnFe_2O_4$-DOX-MCM is developed for cancer treatment, which is capability of tumor targeting, pH-stimuli drug release, and chemo-photothermal therapeutic effects.

Indocyanine green assembled free oxygen-nanobubbles towards enhanced near-infrared induced photodynamic therapy

Li Yang[1], Bin Huang[1,2,*], Shiqi Hu[3], Yuan An[1], Jingyi Sheng[1], Yan Li[1], Yuxin Wang[3], and Ning Gu[1,*]

[1] Southeast University, China
[2] Jiangsu Second Normal University, China
[3] Nanjing Stomatology Hospital, China

4285–4293



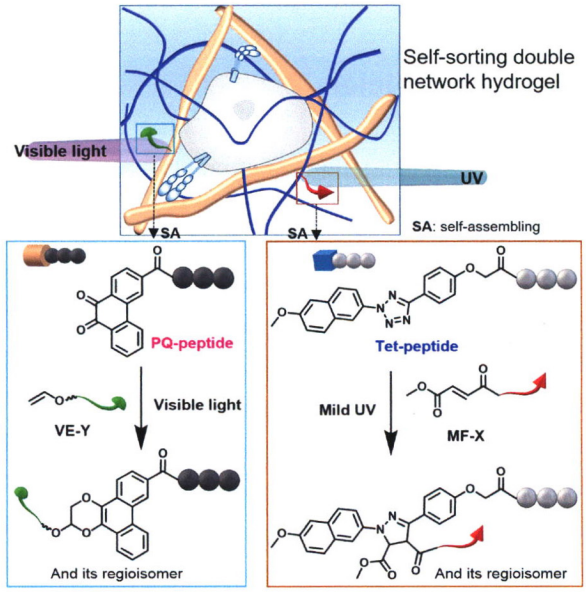
A facile route was developed to fabricate ICG-NBs-O_2 by assembling ICG molecules with free oxygen nanobubles (NBs-O_2) for enhanced photodynamic therapy (PDT) of oral cancer.

Self-sorting double network hydrogels with photo-definable biochemical cues as artificial synthetic extracellular matrix

Dongdong Wu, Hai Lei, Xian Xie, Liang Zhou, Peng Zheng, Yi Cao*, and Yan Zhang*

Nanjing University, China

4294–4301



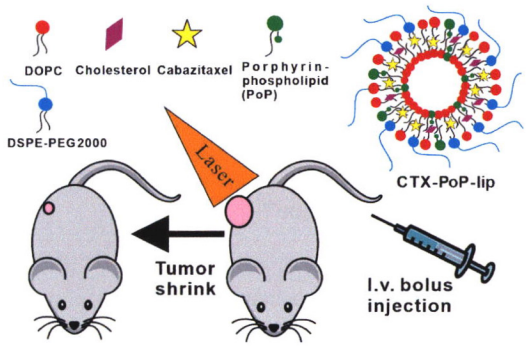
Combining peptide self-assembly and photo-click chemistry, a self-sorting double network hydrogel (SDNH) with spatially well-defined bioactive ligands was developed. The programmed SDNH with a desired function through photo-click reactions can be used for a variety of applications such as stem cell culture in 3D.

Anti-cancer liposomal chemophototherapy using bilayer-localized photosensitizer and cabazitaxel

Boyang Sun[1,2], Sanjana Ghosh[2], Xuedan He[2], Wei-Chiao Huang[2], Breandan Quinn[2], Meiling Tian[1], Dushyant Jahagirdar[3], Moustafa T. Mabrouk[2], Joaquin Ortega[3], Yumiao Zhang[4,*], Shuai Shao[1,*], and Jonathan F. Lovell[2,*]

[1] The First Affiliated Hospital of Zhengzhou University, China
[2] University at Buffalo, State University of New York, USA
[3] McGill University, Canada
[4] Tianjin University, China

4302–4309



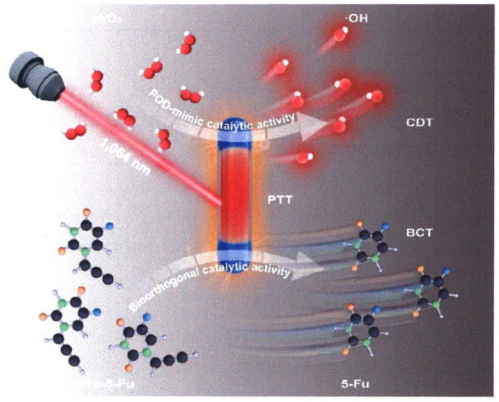
Cabazitaxel was loaded into the bilayer of porphyrin-phospholipid (PoP) liposomes and demonstrated synergy for combination chemotherapy and photodynamic therapy.

NIR-II photothermal therapy for effective tumor eradication enhanced by heterogeneous nanorods with dual catalytic activities

Linghua Zhang[1], Wenjie Wang[1], Meng Ou[1], Xiaoxiao Huang[2], Yu Ma[1], Jiayue Tang[1], Ting Hou[1], Sheng Zhang[1], Li Yin[1], Huan Chen[1], Yanglong Hou[2,*], and Ya Ding[1,*]

[1] China Pharmaceutical University, China
[2] Peking University, China

4310–4319



We successfully design and synthesize bovine serum albumin-coated heterogeneous Pd-Au nanorods to solve the current bottleneck problems of photothermal thermal therapy, and completely eliminate tumors in animal models without toxic side effects by collaborating with heterogeneous nanorod-mediated bioorthogonal catalytic therapy and chemodynamic therapy.

Nano detection

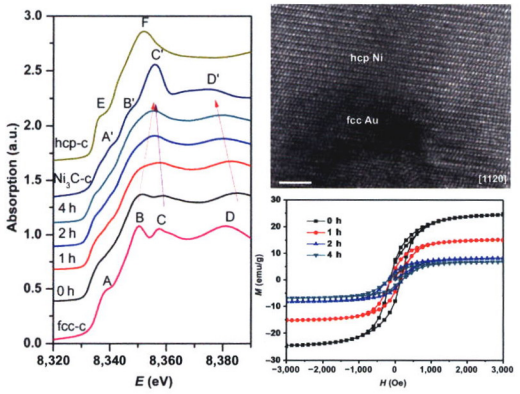
Research Articles

Dynamical investigation of tunable magnetism in Au@Ni-carbide nanocrystals by a combined soft and hard X-ray absorption spectroscopy

Weifeng Huang[2], Jianxin Kang[3], Tingwen Chen[3], Dawei Pang[4], Lihua Wang[4], Hang Wei[1,*], Changchun Yang[2], Dongfeng Zhang[3,*], and Lin Guo[3,*]

[1] Inner Mongolia University, China
[2] Jiujiang University, China
[3] Beihang University, China
[4] Beijing University of Technology, China

4320–4326

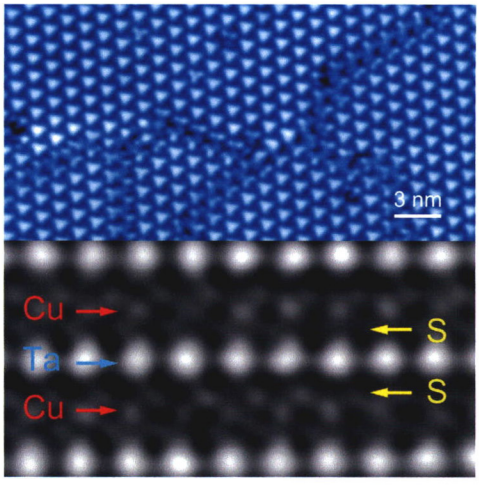


A series of Au@Ni-carbide magnetic materials are achieved from the controlled carbonation of Au@Ni core-shell structures. Hard X-ray absorption spectroscopy (XAS) at the metal K edge and soft XAS at both metal L edge and carbon K edge provide solid evidence for the carbonation process from fcc-Ni (fcc = face centered cubic) to NixC, rather than phase transformation to hcp-Ni (hcp = hexagonal close packed).

Modulation of electronic state in copper-intercalated 1T-TaS_2

Wenhao Zhang[1], Degong Ding[1], Jingjing Gao[2], Kunliang Bu[1], Zongxiu Wu[1], Li Wang[3], Fangsen Li[2], Wei Wang[2], Xuan Luo[2], Wenjian Lu[2], Chuanhong Jin[1,*], Yuping Sun[2,4,*], and Yi Yin[1,4,*]

[1] Zhejiang University, China
[2] Hefei Institutes of Physical Science, Chinese Academy of Sciences, China
[3] Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Sciences, China
[4] Nanjing University, China



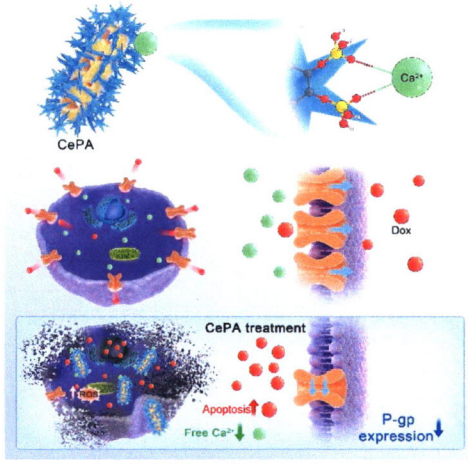
We characterized the structural and electronic modification of 1T-TaS_2 after Cu intercalation. Novel spatial electronic distributions have been identified in different domains, demonstrating the enhancement of interaction between the star of Davids (SDs) due to the interlayer Cu atoms.

4327–4333

Phytic acid-modified CeO_2 as Ca^{2+} inhibitor for a security reversal of tumor drug resistance

Zhimin Tian[1], Junlong Zhao[2], Shoujie Zhao[2], Huicheng Li[2], Zhixiong Guo[1], Zechen Liang[1], Jiayuan Li[1], Yongquan Qu[1,*], Dongfeng Chen[3,*], and Lei Liu[3,*]

[1] Northwestern Polytechnical University, China
[2] Fourth Military Medical University, China
[3] Army Medical University, China



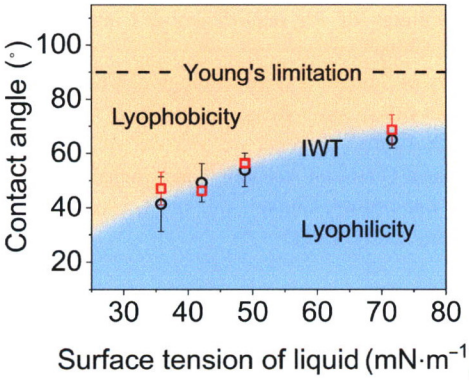
The Ca^{2+} negative regulation strategy of phytic acid (PA) modified nanoceria has been designed to successfully reverse tumor drug resistance and prevent from doxorubicin (Dox)-induced organ damage. The nano-inhibitor effectively deprives the intracellular excess free Ca^{2+}, along with subsequent downregulation of P-glycoprotein (P-gp), and thereby enhances the intracellular drug accumulation in the drug-resistant tumor cells, leading to the improved efficacy of chemotherapeutic agents.

4334–4343

Investigation on the intrinsic wetting thresholds of liquids by measuring the interaction forces of self-assembled monolayers

Yulong Li[1,2], Shaofan He[1,2], Zhe Xu[3], Zhonglong Luo[4], Hongyan Xiao[1], Ye Tian[1,2,5,*], and Lei Jiang[1,2]

[1] Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, China
[2] University of Chinese Academy of Sciences, China
[3] Beihang University, China
[4] Anhui University of Technology, China
[5] Ji Hua Laboratory, China



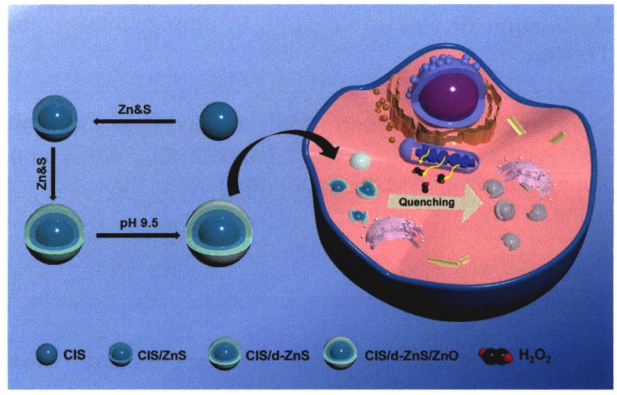
The intrinsic wetting thresholds (IWTs) of liquids were redefined from the perspective of interaction forces between self-assembled monolayers, which differed from 90° defined by Young's equation.

4344–4349

Ultrasensitive determination of intracellular hydrogen peroxide by equipping quantum dots with a sensing layer via self-passivation

Xixi Hu[1], Jia Liu[1], Haozhe Jin[1], Fei Huang[1], Zhaoyin Wang[1,*], Fang Wang[2], and Zhihui Dai[1,2,*]

[1] Nanjing Normal University, China
[2] Nanjing Normal University Center for Analysis and Testing, China



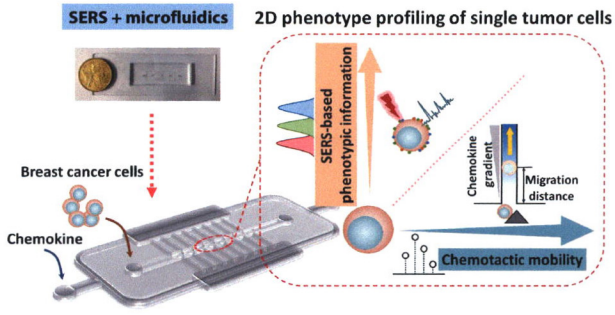
Self-passivation of $CuInS_2$-based quantum dots (QDs) is achieved in a simple one-step process, resulting in the spontaneous and rapid formation of ZnO shells outside of $CuInS_2$-based QDs. The ZnO shell, serving as a sensing layer, enables sensitive visualization of intracellular hydrogen peroxide generated by mitochondria.

4350–4356

2D profiling of tumor chemotactic and molecular phenotype at single cell resolution using a SERS-microfluidic chip

Yizhi Zhang[1,2], Lei Wu[1], Kuo Yang[1], Shenfei Zong[1], Zhuyuan Wang[1,*], and Yiping Cui[1,*]

[1] Southeast University, China
[2] Nanjing University of Aeronautics and Astronautics, China



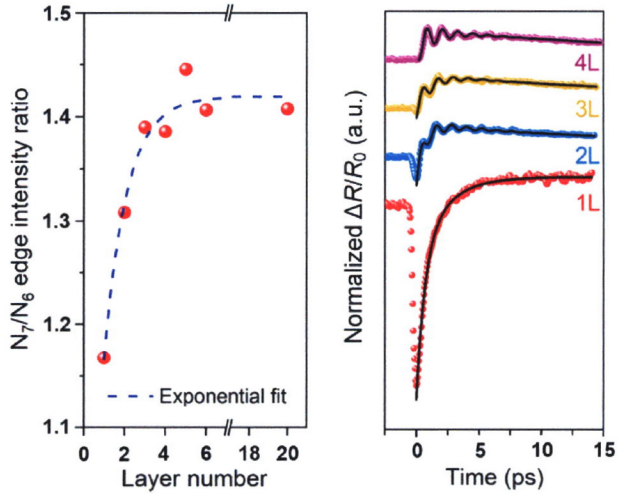
A surface enhanced Raman scattering (SERS)-microfluidic chip has been developed for two-dimensional (2D) profiling of tumor chemotactic and molecular phenotype at single-cell resolution.

4357–4365

Nonlinear electronic and ultrafast optical signatures in chemical vapor-deposited ultrathin PtS_2 ribbons

Shaolong Jiang[1,*], Jin Yang[2,3], Liang Zhu[1], Jiafeng Xie[4], Weiteng Guo[1], Erding Zhao[1], Chaoyu Chen[1,5], Tianwu Wang[4], Fuhai Su[2,*], Yanfeng Zhang[6,*], and Junhao Lin[1,*]

[1] Southern University of Science and Technology, China
[2] Hefei Institutes of Physical Science, Chinese Academy of Sciences, China
[3] University of Science and Technology of China, China
[4] Aerospace Information Research Institute, Chinese Academy of Science, China
[5] International Quantum Academy, and Shenzhen Branch, Hefei National Laboratory, China
[6] Peking University, China



Ultrathin 1T-PtS_2 ribbons with thickness centralized almost at 1L–4L and large domain size up to 210 μm are synthesized on Au foils using chemical vapor deposition (CVD) technique. The electron and optical absorption properties of PtS_2 are investigated using electron energy loss spectroscopy (EELS) and optical pump-probe spectroscopy (OPPS), showing strong nonlinear layer-dependent responses.

4366–4373

Nano device

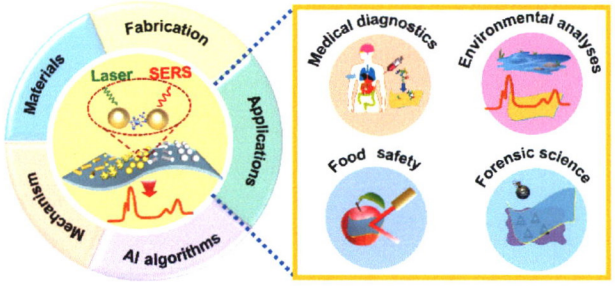
Review Article

State of the art in flexible SERS sensors toward label-free and onsite detection: From design to applications

Liping Xie[1,*], Hedele Zeng[1], Jiaxin Zhu[1], Zelin Zhang[1], Hong-bin Sun[1], Wen Xia[1], and Yanan Du[2,*]

[1] Northeastern University, China
[2] Tsinghua University, China

4374–4394



A state-of-the-art review of the flexible Surface-enhanced Raman scattering (SERS) sensors for point-of-care detection was provided from rational design to applications. Strategies of constructing the flexible SERS sensors were investigated in depth, enabling ultrasensitive detection of various analytes and high specificity with a fingerprint-like characteristic.

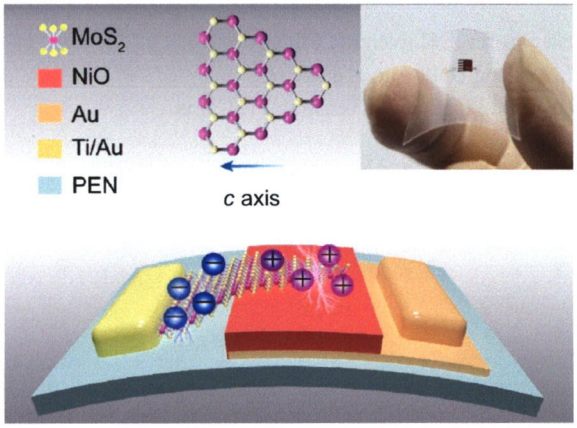
Research Articles

Fabry-Perot interference and piezo-phototronic effect enhanced flexible MoS_2 photodetector

Xuexia Chen, Xun Yang*, Qing Lou, Yuan Zhang, Yancheng Chen, Yacong Lu, Lin Dong*, and Chong-Xin Shan*

Zhengzhou University, China

4395–4402



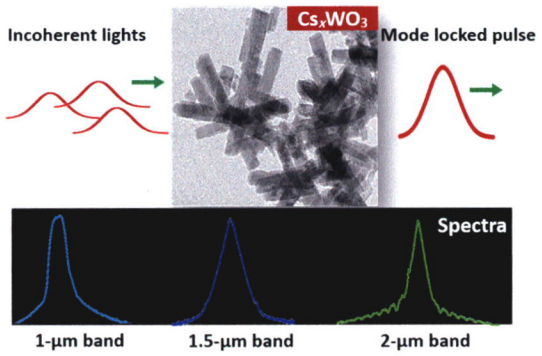
Fabry-Perot (F-P) interference and piezo-phototronic effect are utilized to improve the performance of flexible MoS_2/NiO photodetectors (PDs). The flexible photodetector exhibits an ultrahigh detectivity (D*) of 2.6×10^{14} Jones, which is the best value ever reported for flexible MoS_2 PDs.

Nano-Cs_xWO_3: Ultra-broadband nonlinear optical modulator for near-infrared and mid-infrared ultrafast fiber lasers generation

Nan Li[1,*], Heng Jia[2], Ming Guo[1], Wenying Zhang[1], Ji Wang[3], and Lijun Song[1,*]

[1] Jilin Engineering Normal University, China
[2] Jilin University, China
[3] Peng Cheng Laboratory, China

4403–4410

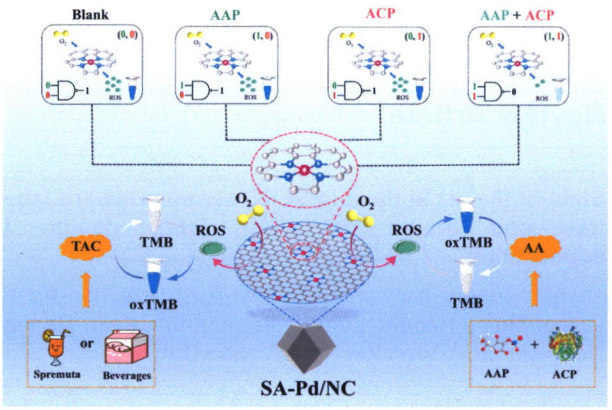


Cs_xWO_3 nanorods (NRs) as a novel ultra-broadband nonlinear optical modulator were successfully developed for ultrafast fiber lasers in three key wavelength bands from near-infrared (NIR) to mid-infrared (MIR) region.

Single-atom Pd catalysts as oxidase mimics with maximum atom utilization for colorimetric analysis

Zhe Li, Fangning Liu, Yuanyuan Jiang, Pengjuan Ni, Chenghui Zhang, Bo Wang, Chuanxia Chen*, and Yizhong Lu*

University of Jinan, China



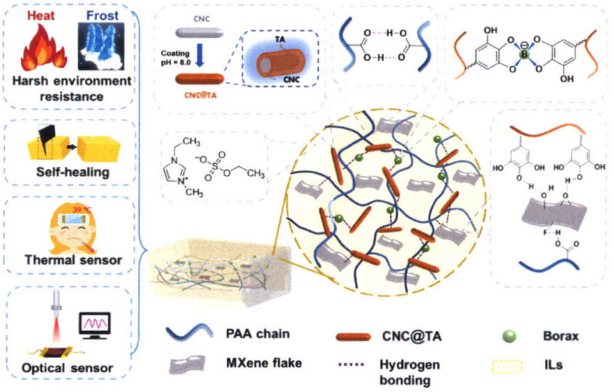
Single-atom Pd catalysts as oxidase mimics with maximum atom utilization are successfully applied to assay the total antioxidant capacity of fruit, determine the serum acid phosphatase activity, and construct NAND logic gate.

4411–4420

Ultradurable, freeze-resistant, and healable MXene-based ionic gels for multi-functional electronic skin

Yao Lu[1], Xinyu Qu[1], Siying Wang[1], Ye Zhao[1], Yanfang Ren[2], Wenli Zhao[1], Qian Wang[1,*], Chencheng Sun[3,*], Wenjun Wang[2], and Xiaochen Dong[1,*]

[1] Nanjing Tech University, China
[2] Liaocheng University, China
[3] Changshu Institute of Technology, China



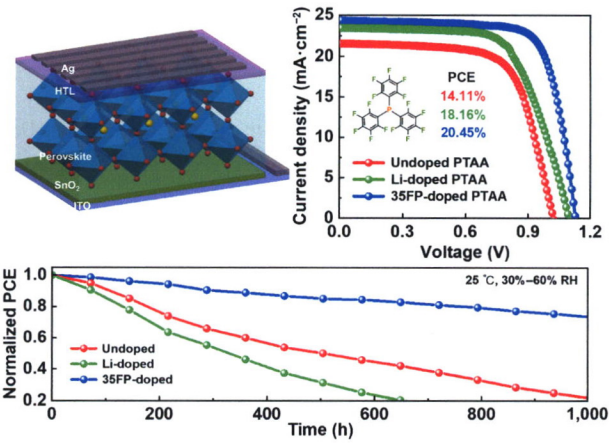
An ionic liquid incorporated and MXene-composited E-skin reveals highly durable and sensitive perception to multiple stimuli in harsh environments.

4421–4430

Stable and highly efficient perovskite solar cells: Doping hydrophobic fluoride into hole transport material PTAA

Chao Yu[1], Buyue Zhang[1,2], Chen Chen[1], Jintao Wang[1,2], Jian Zhang[1,*], Ping Chen[1], Chuannan Li[1], and Yu Duan[1,*]

[1] Jilin University, China
[2] Changchun University of Science and Technology, China



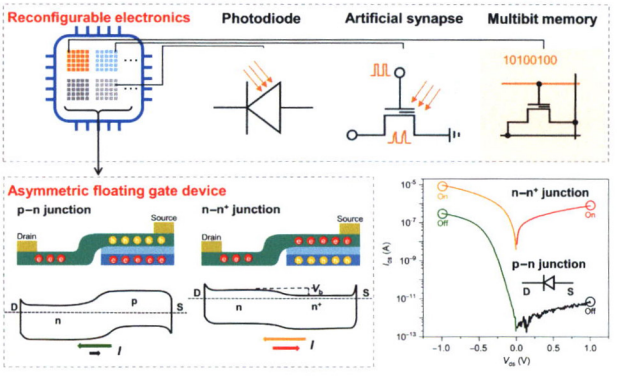
The perovskite solar cells with 35FP-doped have better performance (PCE = 20.45%) compared with undoped device (PCE = 14.11%). The 35FP-doped devices only fell by 20% of its original efficiency after 1, 000 h under ambient conditions without encapsulation.

4431–4438

Two-dimensional reconfigurable electronics enabled by asymmetric floating gate

Tengyu Jin[1,2], Jing Gao[2], Yanan Wang[2], Yue Zheng[2], Shuo Sun[2], Lei Liu[3], Ming Lin[4], and Wei Chen[1,2,5,*]

[1] International Campus of Tianjin University, China
[2] National University of Singapore, Singapore
[3] Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences, China
[4] Institute of Materials Research and Engineering (IMRE), Agency of Science, Technology, and Research (A*STAR), Singapore
[5] National University of Singapore (Suzhou) Research Institute, China



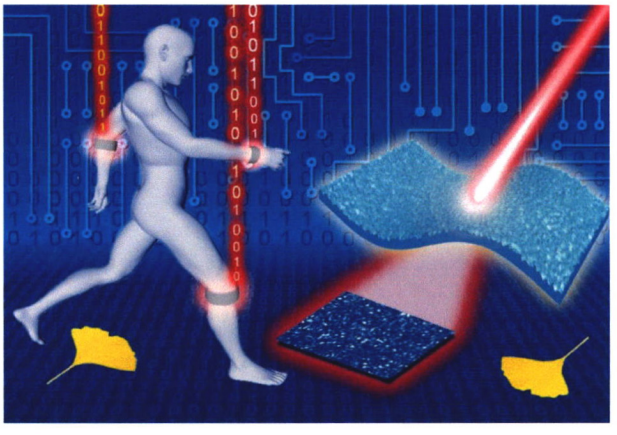
A reconfigurable WSe_2 optoelectronic device is enabled by applying an asymmetric floating gate (AFG) into a flash memory, whose channel can be continuously programmed into p–n or n–n^+ homojunctions by the AFG. As a result, a single AFG device can function as a photodiode, a 2-bit memory, or an artificial synapse under different working modes.

4439–4447

A flexible and stretchable bionic true random number generator

Yongbiao Wan[1,2], Kun Chen[1,2], Feng Huang[1,2], Pidong Wang[1,2], Xiao Leng[1,2], Dong Li[1,2], Jianbin Kang[1,2], Zhiguang Qiu[3,*], and Yao Yao[1,2,*]

[1] Microsystem and Terahertz Research Center, China Academy of Engineering Physics, China
[2] Institute of Electronic Engineering, China Academy of Engineering Physics, China
[3] Sun Yat-sen University, China



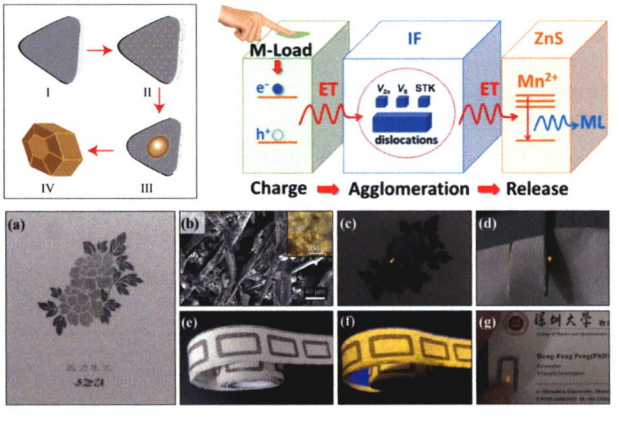
A flexible and stretchable bionic true random number generator (TRNG) is inspired by biological uniqueness and randomness. Random numbers extracted from laser speckle patterns of the flexible TRNG show superior randomness, robustness, and potential in application of flexible networked electronics.

4448–4456

Interface synergistic effects induced multi-mode luminescence

Ronghua Ma[1], Chunfeng Wang[1], Wei Yan[1], Mingzi Sun[2], Jianxiong Zhao[3], Yuantian Zheng[1], Xu Li[1], Longbiao Huang[1], Bing Chen[3], Feng Wang[3], Bolong Huang[2,*], and Dengfeng Peng[1,*]

[1] Shenzhen University, China
[2] The Hong Kong Polytechnic University, China
[3] City University of Hong Kong, Hong Kong, China



Mechanoluminescence has attracted intensive intentions due to their flexible properties and robust performances for broad applications. However, the development is usually limited in the single-phase materials. We synthesize the heterostructure biphase ZnS:Mn, which delivers efficient mechanoluminescence (ML) due to the abundant defects at the interfaces. The successful applications of ZnS:Mn in ink and papers open its potential in the future.

4457–4465

Nano unit

Highlight

Tempering force with mercy: An innovative peri-implant ligament with combined osteointegration and energy-dissipation

Xun Wang*

Tsinghua University, China

4466–4467

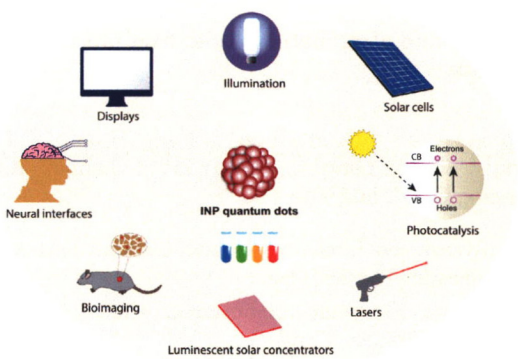
Review Article

Past, present and future of indium phosphide quantum dots

Houman Bahmani Jalali[1,†], Sadra Sadeghi[2,‡], Itir Bakis Dogru Yuksel[2,⊥], Asim Onal[3], and Sedat Nizamoglu[1,2,3,*]

Koç University, Turkey
† Present address: Istituto Italiano di Tecnologia, Italy
‡ Present address: Queen's University, Canada
⊥ Present address: Utrecht University, the Netherlands

4468–4489



This review focuses on the history, recent development, and future aspect of synthesis and application of colloidal indium phosphide (InP) quantum dots (QDs).

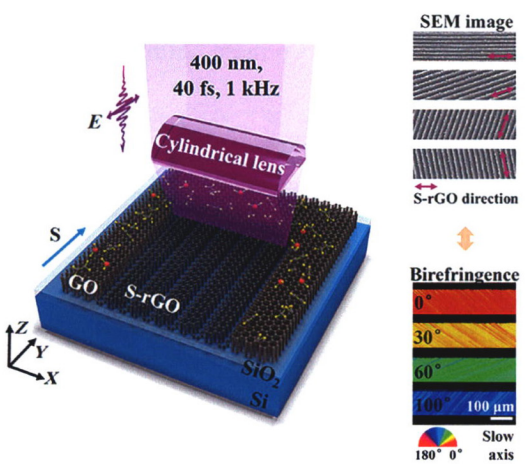
Research Articles

Phase constitution of the noble metal thin-film complex solid solution system Ag-Ir-Pd-Pt-Ru in dependence of elemental compositions and annealing temperatures

Tingting Zou[1,2], Bo Zhao[4], Wei Xin[1,3,*], Feiyue Wang[1,2], Hongbo Xie[1,2], Yuhang Li[1,2], Yuwei Shan[1], Kun Li[5], Yanbing Sun[5], and Jianjun Yang[1,*]

[1] Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences, China
[2] University of Chinese Academy of Sciences, China
[3] Northeast Normal University, China
[4] Changzhi University, China
[5] Changchun New Industries Optoelectronics Technology Co., Ltd, China

4490–4499

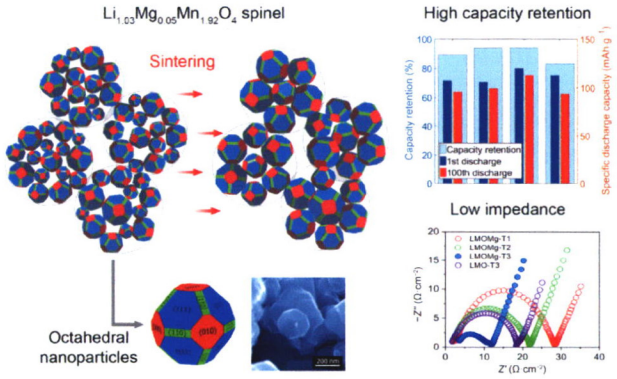


This article develops a feasible scheme for the high-speed preparation of large-area in-plane anisotropic photoelectronic graphene oxide thin film (< 100 nm), which is compatible with existing semi-conductor manipulation processes. This will also promote the preparation of industrial integrated devices.

Potential use of magnesium industrial waste for synthesis of Li and Mg co-doped $LiMn_2O_4$ nanoparticles as cathode material for Li-ion batteries: Effect of sintering temperature

Aleksei Llusco, Luis Rojas, Svetlana Ushak, and Mario Grageda*

Universidad de Antofagasta, Chile



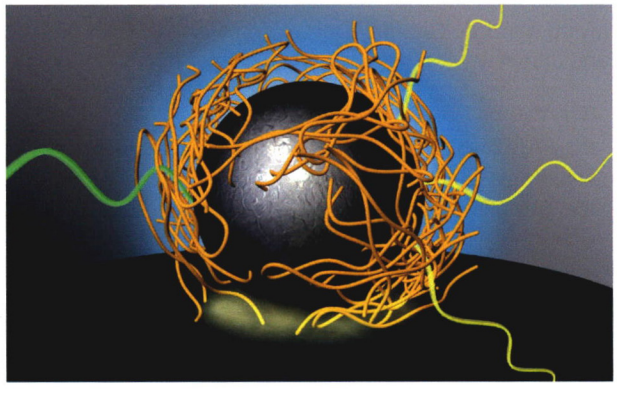
The use of $Mg(OH)_2$ for synthesis of Li and Mg co-doped $LiMn_2O_4$ (LMO) spinel nanoparticles at a sintering temperature of 750 °C is a potential strategy for development of cathode materials with high-rate capability and long cycling stability for lithium-ion (Li-ion) batteries, as well as for recovery of valuable resources from industrial waste generated in the production of Li_2CO_3.

4500–4516

***Operando* electrochemical SERS monitors nanoparticle reactions by capping agent fingerprints**

Kevin Wonner, Steffen Murke, Serena R. Alfarano, Pouya Hosseini, Martina Havenith*, and Kristina Tschulik*

Ruhr University Bochum, Germany



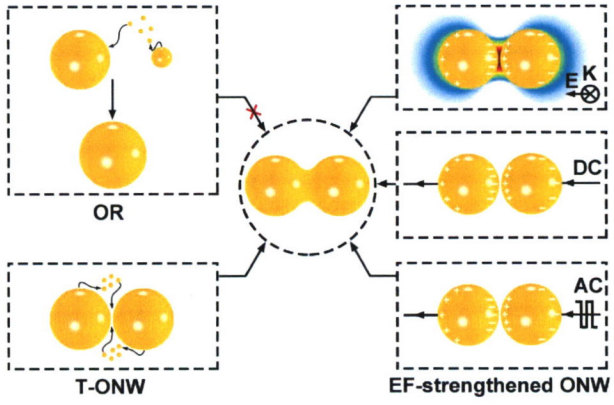
Capping agent effects on the electrochemical oxidation of silver nanoparticles (NPs) are studied in halide electrolyte solutions by coupled electrochemical surface-enhanced Raman spectroscopy (SERS). The reaction is directly monitored by the current response and the simultaneous Raman signal.

4517–4524

External field-strengthened Ostwald nanowelding

Moxia Li[1], Xi Xie[2], Yaomengli Xu[1], Jianfang Liu[1], Yanan Fu[2], Mei Han[1], Xucheng Li[3], Xidong Duan[1,*], Changjun Min[2,*], and Jiawen Hu[1,*]

[1] Hunan University, China
[2] Shenzhen University, China
[3] Xiamen University, China



The accomplishment of nanowelding typically requires the input of high energy, possibly causing appreciable damages to the brittle nanomaterial. This study reports an external field (EF, i.e., light, direct current (DC), and alternating current (AC))-strengthened Ostwald nanowelding (ONW) strategy to enable low-temperature nanowelding of Au nanoparticles (NPs) with nanoscale spacing in solution and proposes an electron localization mechanism to understand it.

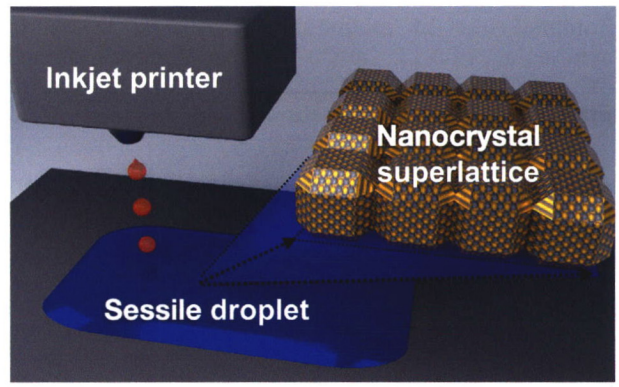
4525–4535

Inkjet printing of epitaxially connected nanocrystal superlattices

Daniel M. Balazs[†], N. Deniz Erkan, Michelle Quien, and Tobias Hanrath[*]

Cornell University, USA

[†] Present address: Institute of Science and Technology Austria, Austria



Monolayer $TiSe_2$ with Pt adatoms adsorption on the line defects was successfully fabricated on the Au(111) substrate. The density functional theory calculations show that the line defect itself has catalytic activity for hydrogen evlution reaction, and it will have better catalytic activity if it adsorbs Pt atoms.

4536–4543

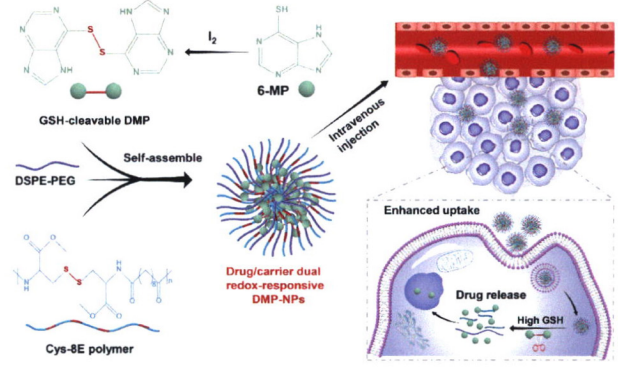
A drug/carrier dual redox-responsive system based on 6-mercaptopurine dimer-loaded cysteine polymer nanoparticles for enhanced lymphoma therapy

Liying Wang[1], Chunlei Dai[1], Yifen Fang[2], Xinru You[1,3,*], and Jun Wu[1,*]

[1] Sun Yat-sen University, China

[2] the Affiliated TCM Hospital of Guangzhou Medical University, China

[3] the Seventh Affiliated Hospital of Sun Yat-sen University, China



Traditional anticancer drug 6-mercaptopurine was dimerized and then encapsulated by a cysteine-based polymer to form a drug/carrier dual redox-responsive nanoplatform (DMP-NPs). The DMP-NPs achieved controllable drug release, enhanced tumor accumulation, and improved the anticancer effect against lymphoma therapy with high safety.

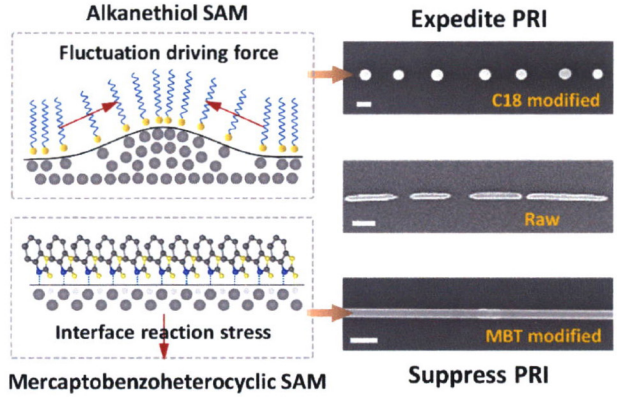
4544–4551

Self-assembled monolayer modulated Plateau-Rayleigh instability and enhanced chemical stability of silver nanowire for invisibly patterned, stable transparent electrodes

Gui-Shi Liu[1], Huajian Zheng[1], Zijie Zeng[1], Yexiong Wang[1], Weidong Guo[1], Ting Wang[3], Heng Chen[1], Yunsen Chen[1], Shiqi Hu[1], Lei Chen[1], Yaofei Chen[1], Weiguang Xie[1], Bo-Ru Yang[2,*], and Yunhan Luo[1,*]

[1] Jinan University, China

[2] Sun Yat-sen University, China



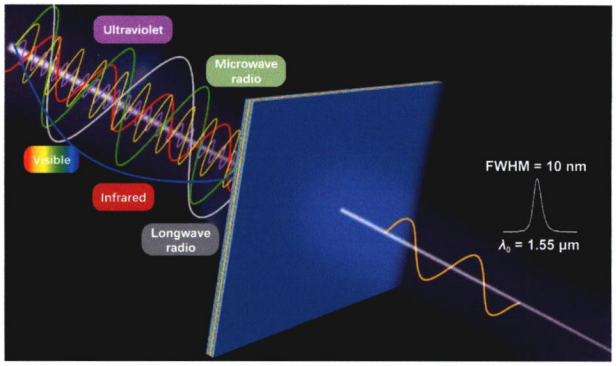
The control on Plateau-Rayleigh instability (PRI) of silver nanowire (AgNW) is readily realized by two kinds of self-assembled monolayers (SAMs), which not only provides the AgNW with superior anti-corrosion but also enables achieving invisible patterning of the AgNW network.

4552–4562

Coupled Tamm plasmon polaritons induced narrow bandpass filter with ultra-wide stopband

Qingquan Liu[1,2,3,4], Xinchao Zhao[1,3,4], Chenlu Li[1,2,3,4], Xinglei Zhou[1,4], Yu Chen[1], Shaowei Wang[1,3,4,5,*], and Wei Lu[1,2,3,4,5,*]

[1] Shanghai Institute of Technical Physics, Chinese Academy of Sciences, China
[2] ShanghaiTech University, China
[3] University of Chinese Academy of Sciences, China
[4] Shanghai Engineering Research Center of Energy-Saving Coatings, China
[5] Shanghai Research Center for Quantum Sciences, China



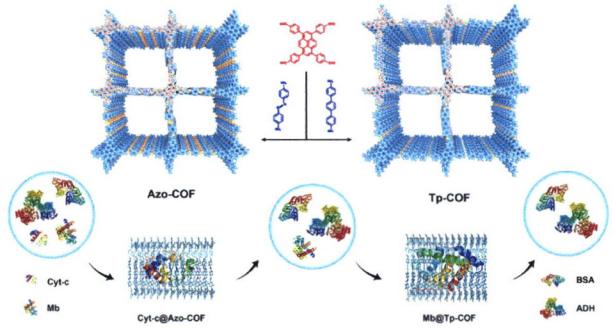
A narrow bandpass filter (NBPF) with ultra-wide stopband based on the coupled Tamm plasmon polaritons (TPPs) transmission theory is proposed and fabricated. It only allows the light with a wavelength of 1.55 μm to pass through and shields light with other wavelengths. This performance is much better than the traditional filters and those reported novel metamaterial filters.

4563–4568

Fine-tuned mesoporous covalent organic frameworks for highly efficient low molecular-weight proteins separation

Tienan Wang, Irfan Azhar, Yuting Yang, Yao Lu, Yuyang Tian, Nan Gao, Fengchao Cui*, Li Yang*, Xiaofei Jing*, and Guangshan Zhu

Northeast Normal University, China



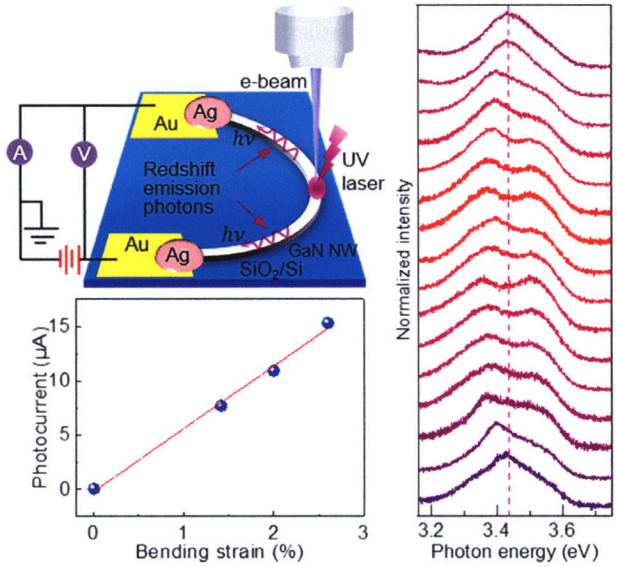
Two stable mesoporous covalent organic frameworks with well-regulated channels were synthesized and exhibited highly efficient size-selective separation for low molecular-weight proteins.

4569–4574

Bending strain effects on the optical and optoelectric properties of GaN nanowires

Xuewen Fu[1,*], Haixia Nie[1], Zepeng Sun[1], Min Feng[1], Xiang Chen[1], Can Liu[1], Fang Liu[1], Dapeng Yu[2], and Zhimin Liao[3,4,*]

[1] Nankai University, China
[2] Southern University of Science and Technology, China
[3] Peking University, China
[4] Peking University Yangtze Delta Institute of Optoelectronics, China



Elastic bending strain induces extraordinary splitting of near band emission and compelling enhancement of ultraviolet photoresponse in GaN nanowires.

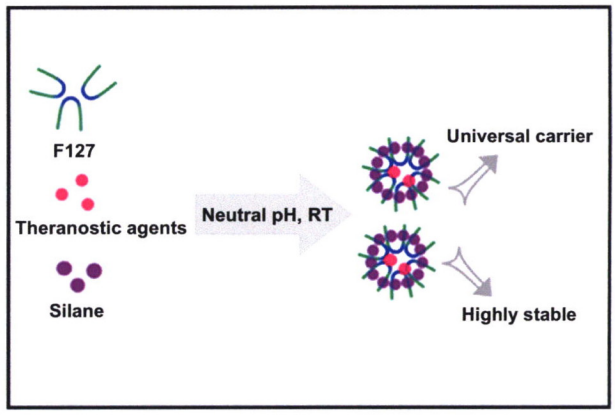
4575–4581

Highly stable hybrid single-micelle: A universal nanocarrier for hydrophobic bioimaging agents

Qiaoyu Zhou[1], Tiancong Zhao[1], Mengli Liu[1], Dongrui Yin[1], Minchao Liu[1], Ahmed A. Elzatahry[2], Fan Zhang[1], Dongyuan Zhao[1], and Xiaomin Li[1,*]

[1] Fudan University, China
[2] Qatar University, Qatar

4582–4589



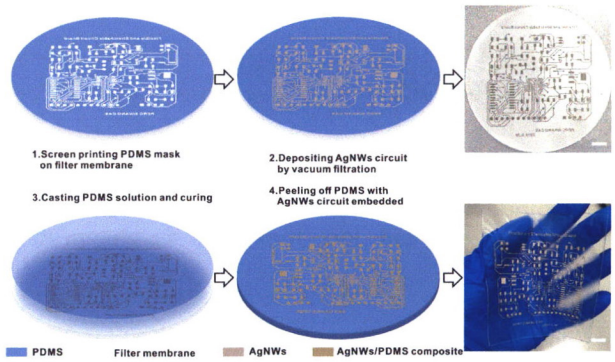
Highly stable hybrid single-micelles (ICG@H-micelles) are synthesized under mild conditions and exhibit improved structural and fluorescence stability.

High-resolution and large-size stretchable electrodes based on patterned silver nanowires composites

Yong Lin[1], Qingsong Li[2], Chen Ding[1], Jiayi Wang[1,3], Wei Yuan[1,*], Zhiyuan Liu[2], Wenming Su[1], and Zheng Cui[1,*]

[1] Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Sciences, China
[2] Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences, China
[3] University of Science and Technology of China, China

4590–4598



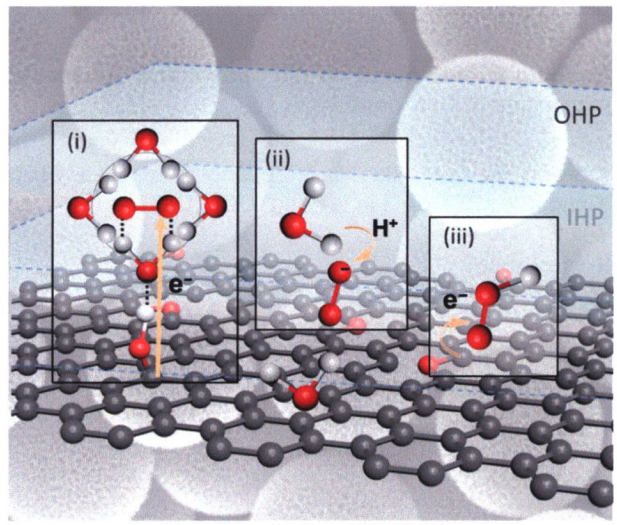
A method was developed for preparing high-resolution, large-size stretchable electrodes by pre-constructing silver nanowires (AgNWs) patterns through screen printing and vacuum filtration then embedding them into a polydimethylsiloxane (PDMS) matrix. These electrodes have been successfully used as a large-size stretchable circuit board for a smart display system and an 18-channel high-density electrode array for surface electromyography (EMG) recording.

Mechanism investigation of enhanced electrochemical H_2O_2 production performance on oxygen-rich hollow porous carbon spheres

Zhiping Deng and Xiaolei Wang*

University of Alberta, Canada

4599–4605

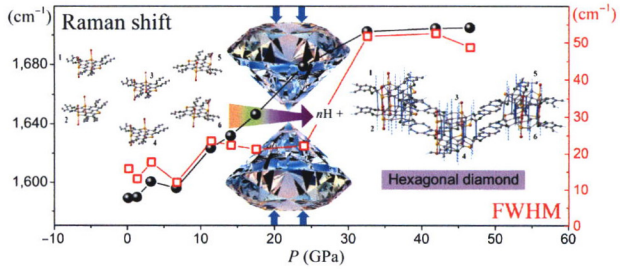


Oxygen functionalization on the hollow mesoporous carbon spheres (HMCSs) results in improved reactivity of these active sites, hydrophilic property of the surface, and tuned adsorption mode of oxygen, leading to significantly reduced overpotential, improved selectivity, and moderate stability for oxygen reduction to H_2O_2.

Dehydro-Diels–Alder reaction and diamondization of bowl-shaped clusters $C_{18}Te_3Br_4(Bu\text{-}O)_6$

Jinbo Zhang[1,2], Manli Ma[1], Rong Zhou[1], Hongqiang Chu[1], Xue Wang[1], Shaojie Wang[2], Huhu Tian[3,4], Zhipeng Yan[5], Mingtao Li[6], Zhongyan Wu[7], Bin Li[7], Jiafeng Yan[7], Lan Anh Thi Nguyen[7], Rongxing Cao[1], Guoqing Wu[1], Xianghua Zeng[1], Hao-Li Zhang[3,*], Jaeyong Kim[7,*], Lin Wang[2,*], and Yongjun Tian[2]

[1] Yangzhou University, China
[2] Yanshan University, China
[3] Lanzhou University, China
[4] Baotou Research Institute of Rare Earths, China
[5] Southern University of Science and Technology, China
[6] Center for High Pressure Science and Technology Advanced Research, China
[7] Hanyang University, Republic of Korea



Pressure-induced dehydro-Diels–Alder reaction occurred at ~ 7 GPa. Above 17.0 GPa, the intermolecular sp^3 bonding was built up in an amorphous state, that is pressure-induced diamondization. Dehydro-Diels–Alder reaction (decomposition) and diamondization (polymerization) specify the solid-state topochemical reaction, those are scarcely seen in solid-state. The pressure dependence of G band in Raman spectroscopy reflected $C_{18}Te_3Br_4(Bu\text{-}O)_6$ evolution with pressure.

4606–4612

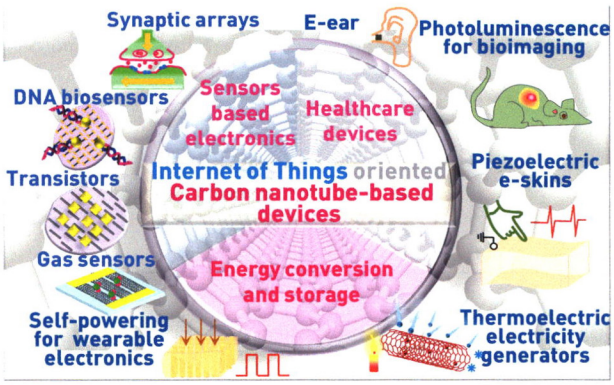
Semiconductor

Review Article

Emerging Internet of Things driven carbon nanotubes-based devices

Shu Zhang[1], Jinbo Pang[1,*], Yufen Li[1], Feng Yang[2,*], Thomas Gemming[3], Kai Wang[5], Xiao Wang[6], Songang Peng[7], Xiaoyan Liu[1], Bin Chang[1], Hong Liu[1,4,*], Weijia Zhou[1], Gianaurelio Cuniberti[11,*], and Mark H. Rümmeli[3,8,9,10]

[1] University of Jinan, China
[2] Southern University of Science and Technology, China
[3] Leibniz Institute for Solid State and Materials Research Dresden, Germany
[4] Shandong University, China
[5] Qingdao University China
[6] Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, China
[7] Institute of Microelectronics, Chinese Academy of Sciences, China
[8] Soochow University, China
[9] Centre of Polymer and Carbon Materials, Polish Academy of Sciences, Poland
[10] VŠB-Technical University of Ostrava, Czech Republic
[11] Technische Universität Dresden, Germany



This review provides the most advances of electronic devices applications of carbon nanotubes driven by the Internet of Things (IoT), including the transistor arrays, sensors, healthcare systems, and energy devices.

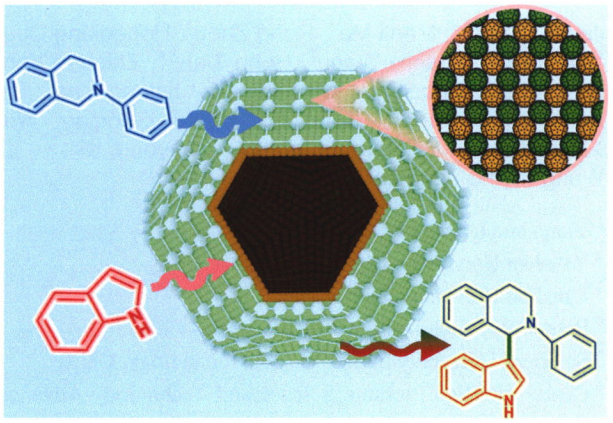
4613–4637

Research Articles

Fabricating a hollow cuboctahedral structure for N-doped carbon coated p-n heterojunctions towards high-performance photocatalytic organic transformation

Hao Gao, Liming Sun, Mengge Li, Wenwen Zhan*, Xiaojun Wang, and Xiguang Han*

Jiangsu Normal University, China



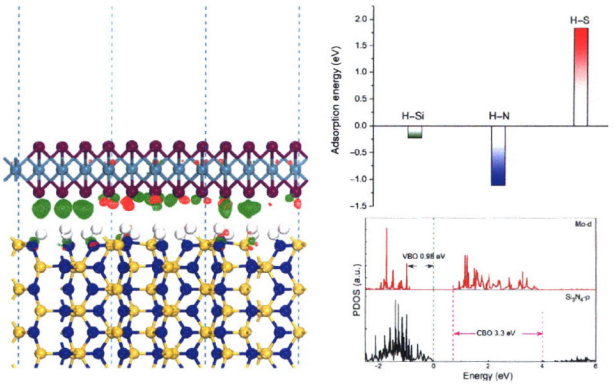
A novel hollow cubotahedral nanostructure composed of N-doped carbon layer and CuO/NiO heterojunctions has been successfully fabricated as the photocatalyst of cross-dehydrogenative coupling (CDC) reactions.

4638–4645

Selective hydrogenation improves interface properties of high-*k* dielectrics on 2D semiconductors

Yulin Yang[1], Tong Yang[2], Tingting Song[3], Jun Zhou[4], Jianwei Chai[4], Lai Mun Wong[4], Hongyi Zhang[1], Wenzhang Zhu[1], Shijie Wang[4,*], and Ming Yang[2,*]

[1] Xiamen University of Technology, China
[2] The Hong Kong Polytechnic University, Hong Kong, China
[3] China West Normal University, China
[4] Institute of Materials Research and Engineering, Agency for Science, Technology and Research (A*STAR), Singapore



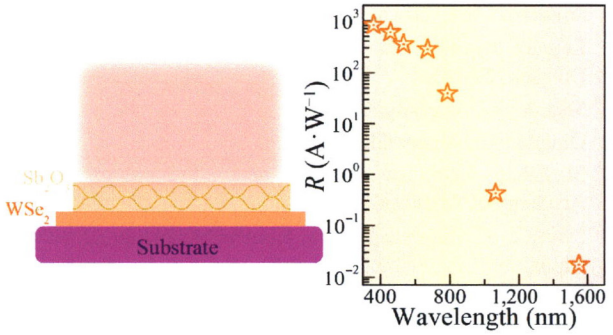
The hydrogenation process can passivate the interface states at the high-*k* dielectrics, but does not affect the two-dimensional (2D) semiconductors, enabling an improved integration of high-*k* dielectrics on 2D materials based nanoelectronics.

4646–4652

Broadband light absorption and photoresponse enhancement in monolayer WSe_2 crystal coupled to Sb_2O_3 microresonators

Kun Ye[1], Lixuan Liu[1,2], Congpu Mu[1,*], Kun Zhai[1,*], Shiliang Guo[1], Bochong Wang[1], Anmin Nie[1], Shuhan Meng[1], Fusheng Wen[1], Jianyong Xiang[1], Tianyu Xue[1], Ming Kang[3], Yongji Gong[2], Yongjun Tian[1], and Zhongyuan Liu[1,*]

[1] Yanshan University, China
[2] Beihang University, China
[3] Tianjin Normal University, China



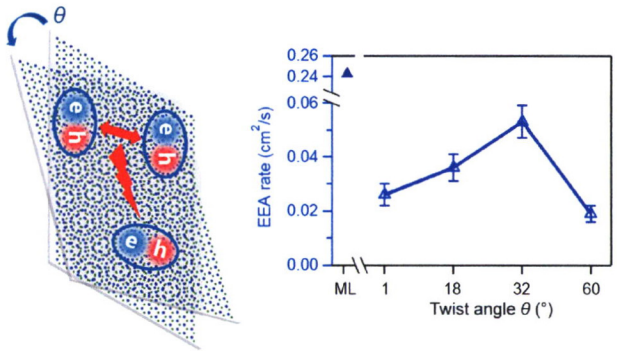
The significantly enhanced visible and expanded near infrared (NIR) light absorption of monolayer WSe_2 on integration with triangular Sb_2O_3 microresonators in wide thickness and lateral size distributions. As a photodetector, monolayer transition metal dichalcogenides (TMDCs) crystal coupled to Sb_2O_3 microresonators has been observed to exhibit the enhanced responsivity by at least or nearly 10^4 order in visible light region and the expanded one of ~ 1 $A \cdot W^{-1}$ in NIR range, better than most of the reported photodetectors based on monolayer TMDCs.

4653–4660

Controlling exciton-exciton annihilation in WSe_2 bilayers via interlayer twist

Yuzhong Chen, Bichuan Cao, Cheng Sun, Zedong Wang, Hongzhi Zhou, Linjun Wang*, and Haiming Zhu*

Zhejiang University, China



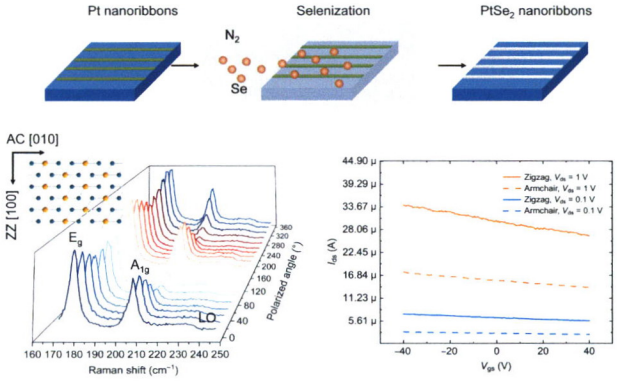
By combing ultrafast spectroscopy and first-principles calculation, we show that the twist angle in transition metal dichalcogenide (TMD) bilayers can act as an effective knob to tune the exciton-exciton annihilation dynamics.

4661–4667

Anisotropic electrical properties of aligned $PtSe_2$ nanoribbon arrays grown by a pre-patterned selective selenization process

Huaipeng Wang[1], Zhifang Liu[1], Yilin Sun[2,*], Xiaofan Ping[1], Jianlong Xu[3], Yingtao Ding[2], Haowen Hu[1], Dan Xie[1,*], and Tianling Ren[1,*]

[1] Tsinghua University, China
[2] Beijing Institute of Technology, China
[3] Soochow University, China



Anisotropic electrical properties of naturally aligned zigzag $PtSe_2$ nanoribbon arrays were investigated through angle-resolved polarized Raman spectroscopy and electrical measurements. The underlying mechanism of its selective growth and anisotropic conductivities are revealed using density functional theory and semi-classic Boltzmann transport theory.

4668–4676

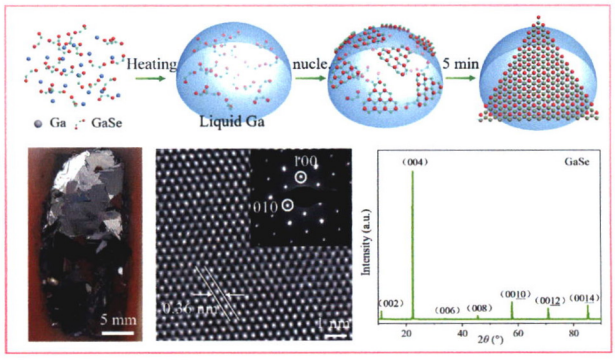
Synthesis

Research Articles

Ultrafast growth of high-quality large-sized GaSe crystals by liquid metal promoter

Zuxin Chen[1,5,6], Quan Chen[1], Zebing Chai[1], Bin Wei[2], Jun Wang[3], Yanping Liu[4], Yumeng Shi[5,*], Zhongchang Wang[6,*], and Jingbo Li[1,*]

[1] South China Normal University, China
[2] Sun Yat-Sen University, China
[3] Wuhan University, China
[4] Central South University, China
[5] Shenzhen University, China
[6] International Iberian Nanotechnology Laboratory, Portugal



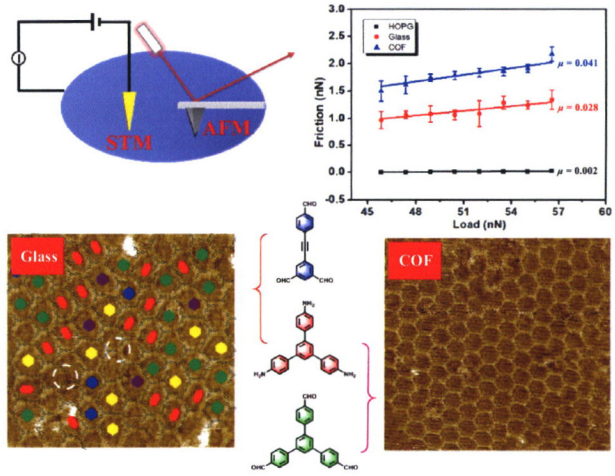
A liquid-metal-assisted chemical vapor deposition method is proposed to rapidly synthesize centimeter-sized GaSe crystals of high crystal quality, which show good performance of photodetector.

4677–4681

Construction and nanotribological study of a glassy covalent organic network on surface

Guangyuan Feng, Qingqing Luo, Mengqi Li, Yaru Song, Yongtao Shen*, Shengbin Lei*, and Wenping Hu

Tianjin University, China



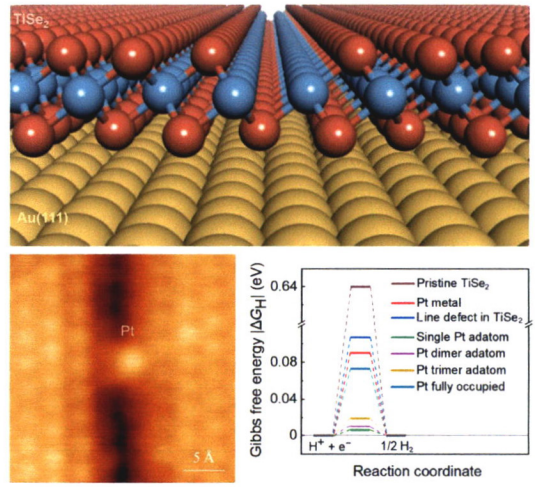
The large-scale, continuous, and low-defect glassy covalent organic networks (GCONs) was constructed based on dynamic covalent chemistry on surface, and the GCONs have lower friction coefficient in comparison with crystalline covalent organic frameworks (COFs).

4682–4686

Line defects in monolayer $TiSe_2$ with adsorption of Pt atoms potentially enable excellent catalytic activity

Zhipeng Song[1], Juxia Yi[1], Jing Qi[1], Qi Zheng[1], Zhili Zhu[1], Lei Tao[1], Yun Cao[1], Yan Li[1], Zhaoyan Gao[1], Ruizi Zhang[1,*], Li Huang[1], Geng Li[1,2,3], Ziqiang Xu[4], Xu Wu[4], Yeliang Wang[4], Chengmin Shen[1,2], Yu-Yang Zhang[1,2], Hongliang Lu[1,2,*], Xiao Lin[1,2,*], Shixuan Du[1,2,3], and Hong-Jun Gao[1,2,3]

[1] Institute of Physics and University of Chinese Academy of Sciences, Chinese Academy of Sciences, China
[2] CAS Center for Excellence in Topological Quantum Computation, Chinese Academy of Sciences, Chin
[3] Songshan Lake Materials Laboratory, China
[4] Beijing Institute of Technology, China



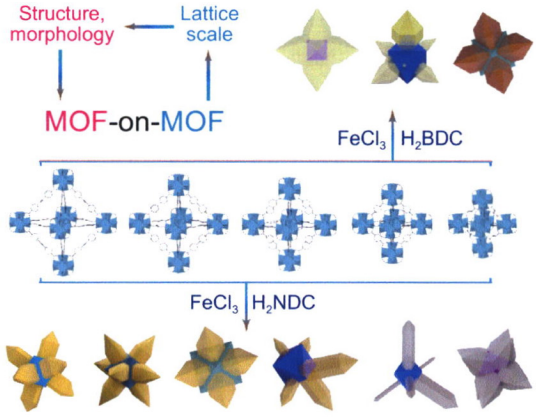
Monolayer $TiSe_2$ with Pt adatoms adsorption on the line defects were successfully fabricated on the Au(111) substrate. The density functional theory calculations shows that the line defect itself has catalytic activity for hydrogen evlution reaction, and it will have better catalytic activity if it adsorbs Pt atoms.

4687–4692

Flexible-on-rigid heteroepitaxial metal-organic frameworks induced by template lattice change

XiaoGang Wang, Han Cheng*, and XianZheng Zhang*

Wuhan University, China



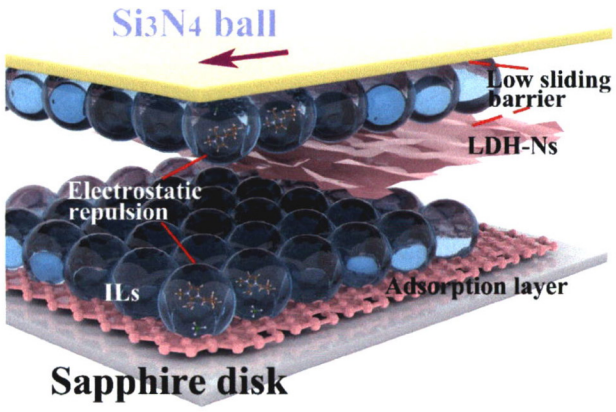
The modulation of chemical composition and framework topology on the molecular scale, and adjustment of morphology on the mesoscale were achieved during the construction of flexible-on-rigid hybrid-phase metal-organic frameworks.

4693–4699

Macroscale superlubricity under ultrahigh contact pressure in the presence of layered double hydroxide nanosheets

Kunpeng Wang[1], Lei Liu[1], Aisheng Song[1], Tianbao Ma[1], Hongdong Wang[1,2,*], Jianbin Luo[1,*], and Yuhong Liu[1,*]

[1] Tsinghua University, China
[2] Shanghai University, China



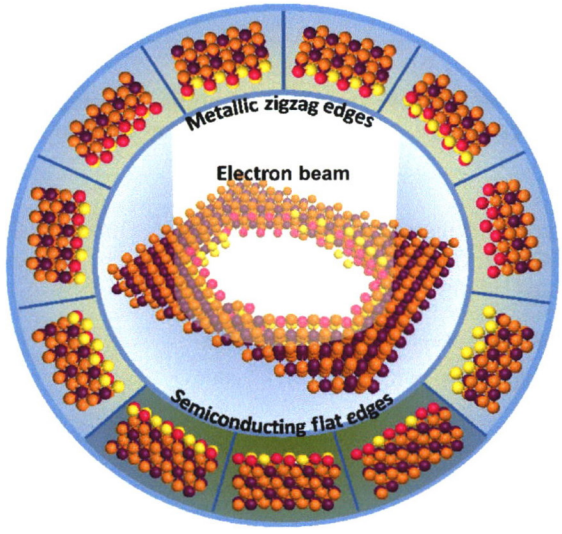
Macroscale superlubricity under ultrahigh contact pressure was enabled by the combination of layered double hydroxide nanosheets with ionic liquid.

4700–4709

Tailoring Bi_2Te_3 edge with semiconductor and metal properties under electron beam irradiation

Yuting Shen[1,2], Hailin Yu[1,*], Tao Xu[2], Qiubo Zhang[2,3], Kuibo Yin[2], Shan Cong[1], Yushen Liu[1], and Litao Sun[2,*]

[1] Changshu Institute of Technology, China
[2] Southeast University, China
[3] Lawrence Berkeley National Laboratory, USA



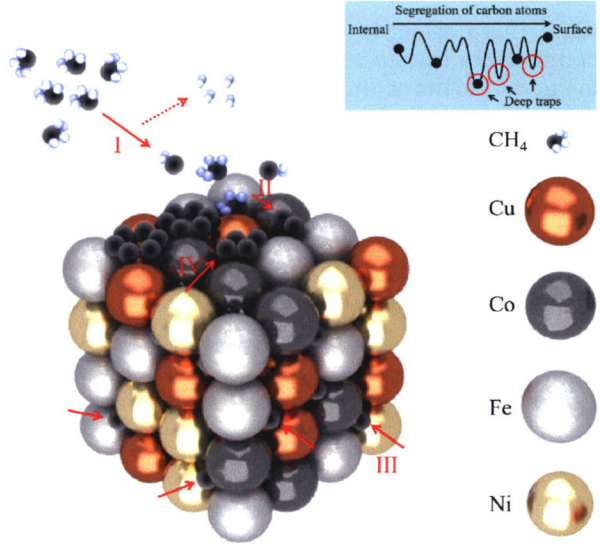
Electron beam irradiation can be utilized to tailor single-layer Bi_2Te_3 with semiconducting flat edges and metallic zigzag edges with atomic resolution.

4710–4716

Intrinsic-trap-regulating growth of clean graphene on high-entropy alloy substrate

Ning Cao[1], Peng Liu[1], Jialiang Pan[2], Liheng Liang[1], Kunpeng Cai[1], Qingguo Shao[1], Hongwei Zhu[2,*], and Xiaobei Zang[1,*]

[1] China University of Petroleum (East China), China
[2] Tsinghua University, China



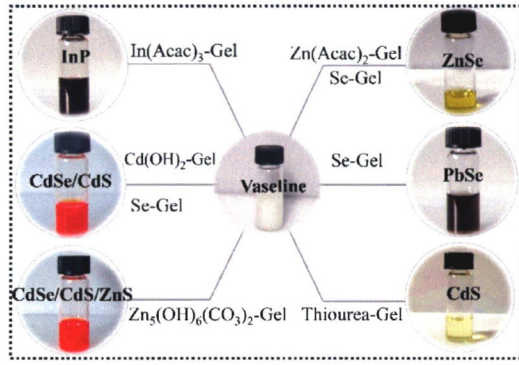
A facile approach to grow few-layer graphene on high-entropy alloy ($FeCoNiCu_x$) is presented and the growth mechanism of graphene is systematically investigated.

4717–4723

Universal precursors dispersed in Vaseline-octadecene gel for nanocrystal synthesis

Xiaofei Hu, Jiongzhao Li*, Zhe Wang, Xudong Qian, Chenqi Zhu, and Xiaogang Peng*

Zhejiang University, China



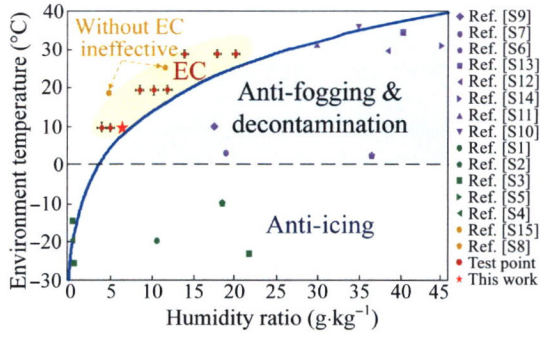
Small molecules in hydrocarbon gels are ideal precursors for synthesizing inorganic nanocrystals.

4724–4731

Self-cleaning of superhydrophobic nanostructured surfaces at low humidity enhanced by vertical electric field

Yijie Liu[1], Yujun Guo[1,*], Xueqin Zhang[1], Guoqiang Gao[1], Chaoqun Shi[1], Guizao Huang[1], Pengli Li[2], Qi Kang[2], Xingyi Huang[2,*], and Guangning Wu[1,*]

[1] Southwest Jiaotong University, China
[2] Shanghai Jiaotong University, China



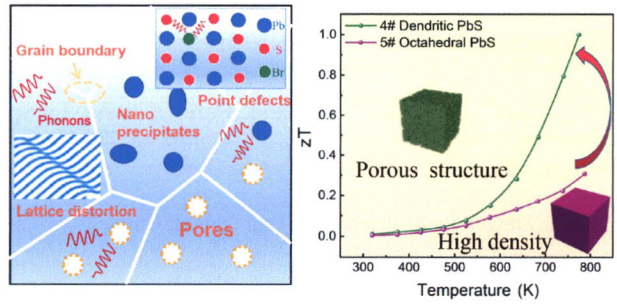
This paper realized the self-cleaning of superhydrophobic nanostructured surfaces above the dew point curve for the first time with the assistance of an electric field.

4732–4738

High thermoelectric properties with low thermal conductivity due to the porous structure induced by the dendritic branching in n-type PbS

Zhenyu Zhu[1], Janak Tiwari[2], Tianli Feng[2], Zhan Shi[3], Yue Lou[1,*], and Biao Xu[1,4,*]

[1] Nanjing University of Science and Technology, China
[2] The University of Utah, USA
[3] Jilin University, China
[4] Nanjing University, China



The difference in morphology of PbS nanocrystals leads to different stackings, tunable thermal conductivity. Ultimately the zT value of the porous structure (4#) is greatly improved under the multiple phonons scattering mechanism as compared to the high-density sample (5#).

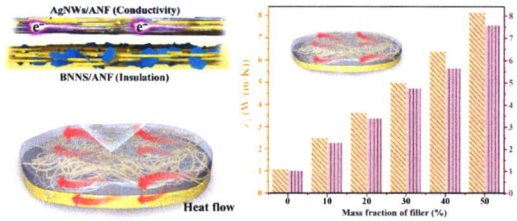
4739–4746

Janus (BNNS/ANF)-(AgNWs/ANF) thermal conductivity composite films with superior electromagnetic interference shielding and Joule heating performances

Yixin Han[1,2], Kunpeng Ruan[1,2], and Junwei Gu[1,2,*]

[1] Research & Development Institute of Northwestern Polytechnical University in Shenzhen, China
[2] Northwestern Polytechnical University, China

4747–4755



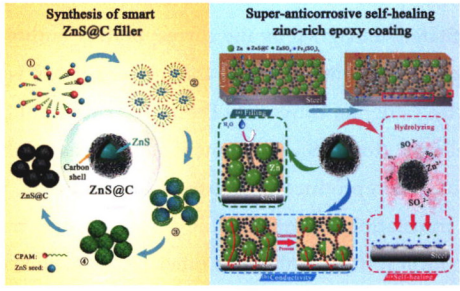
Janus (BNNS/ANF)-(AgNWs/ANF) thermal conductivity and electromagnetic interference shielding composite films exhibit "one side insulating, one side conducting" performance. And Janus (BNNS/ANF)-(AgNWs/ANF) composite film with thickness of 95 μm has a high in-plane thermal conductivity coefficient of 8.12 W/(m·K) and superior electromagnetic interference shielding effectiveness of 70 dB.

Smart ZnS@C filler for super-anticorrosive self-healing zinc-rich epoxy coating

Kai Yang[1,2], Yixue Duan[3], Guicheng Liu[2,*], Guoyan Ma[4], Hao Fu[2], Xuyong Chen[1], Manxiang Wang[2], Gangqiang Zhu[5], Woochul Yang[2,*], and Yiding Shen[1,*]

[1] Shaanxi University of Science and Technology, China
[2] Dongguk University, Republic of Korea
[3] Wuhan University of Technology, China
[4] Xi'an Shiyou University, China
[5] Shaanxi Normal University, China

4756–4764



Uniform carbon-coated ZnS (ZnS@C) nanoballs, as smart fillers, were synthesized to design super-anticorrosive self-healing zinc-rich epoxy coatings for protecting marine steel. The nano-size, C-shell, and ZnS-core of the smart filler enhance pore filling efficiency, active Zn-site amount, and self-healing effect, respectively, leading to efficient shielding protection and extended cathodic protection time.

Theory

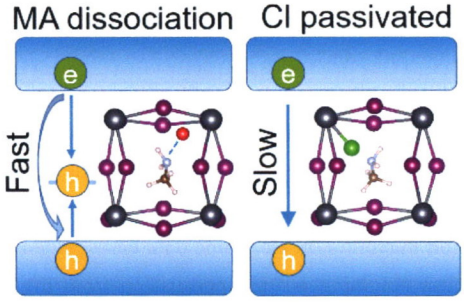
Research Article

Chemical passivation of methylammonium fragments eliminates traps, extends charge lifetimes, and restores structural stability of $CH_3NH_3PbI_3$ perovskite

Xi Zhao[1], Wei-Hai Fang[1], Run Long[1,*], and Oleg V. Prezhdo[2]

[1] Beijing Normal University, China
[2] University of Southern California, Los Angeles, USA

4765–4772



Dissociation of the methylammonium cation in $CH_3NH_3PbI_3$ undermines structural stability, produces deep hole traps, and decreases charge carrier lifetimes. Passivating methylammonium fragments with chlorines restores the stability, eliminates the traps, and makes charge lifetimes even longer than in pristine $CH_3NH_3PbI_3$.

Erratum to: Different micro/nano-scale patterns of surface materials influence osteoclastogenesis and actin structure (https://doi.org/10.1007/s12274-021-4026-3)

4773

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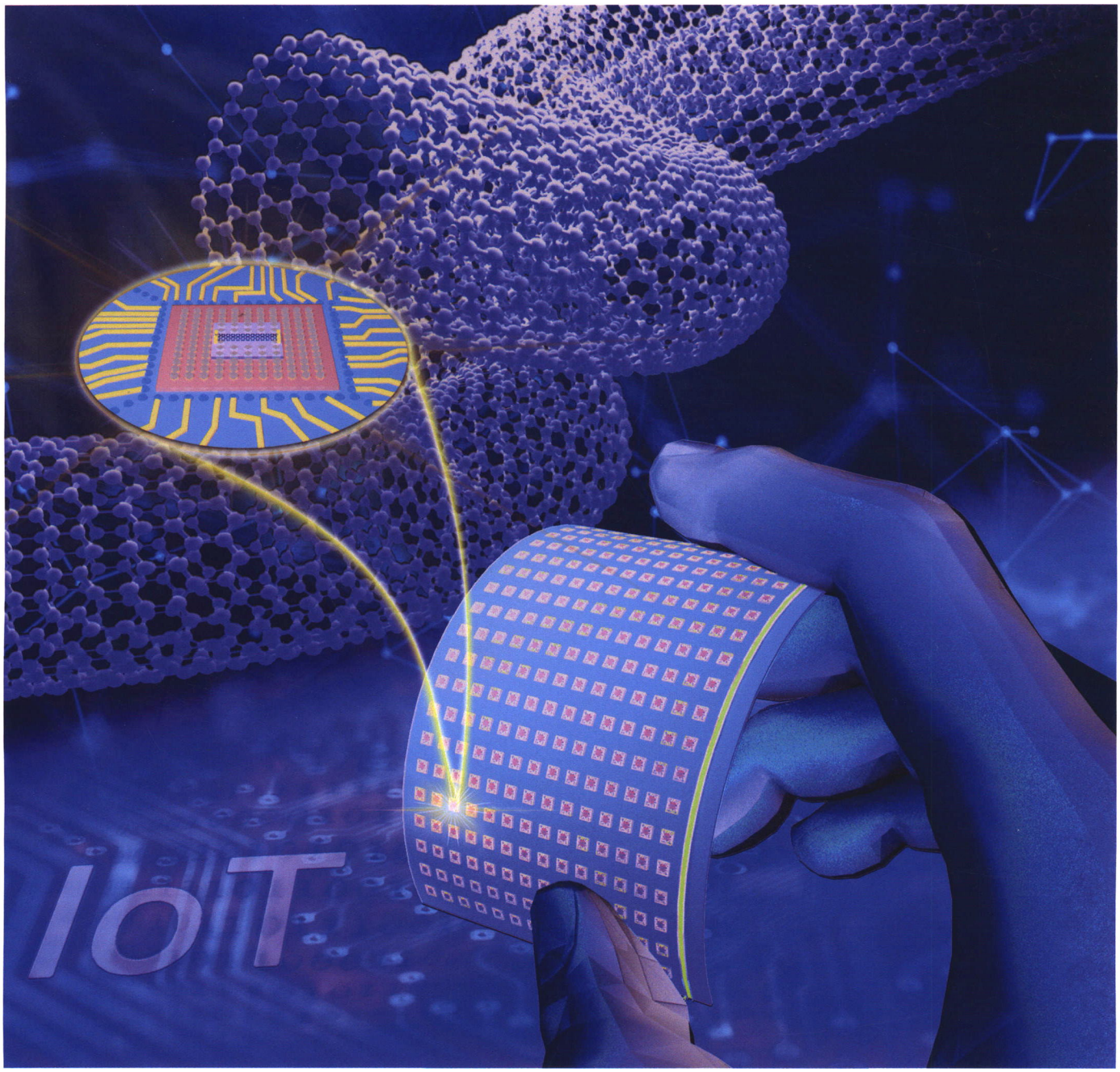

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