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Water on silicene: A hydrogen bond-autocatalyzed physisorption–chemisorption–dissociation transition



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Contents

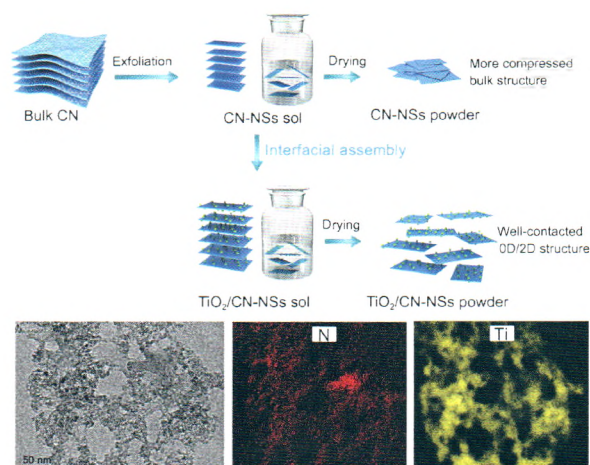
Research Articles

Enhanced photocatalytic activity by the construction of a TiO_2 /carbon nitride nanosheets heterostructure with high surface area via direct interfacial assembly

Zili Xu¹, Chuansheng Zhuang², Zhijuan Zou¹, Jingyu Wang^{1,*}, Xiaochan Xu¹, and Tianyou Peng^{2,*}

¹ Huazhong University of Science and Technology, China

² Wuhan University, China



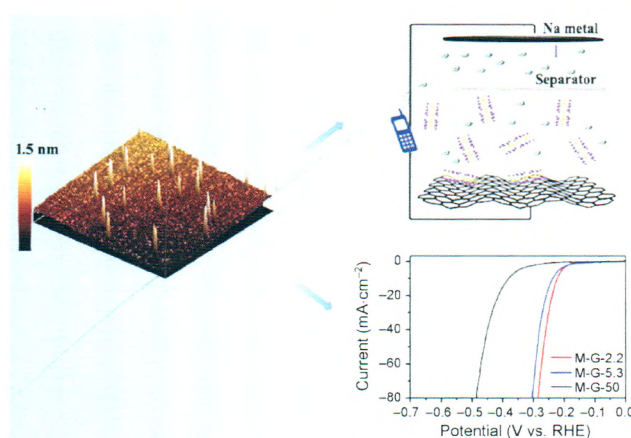
An interfacial assembly strategy has been developed for the construction of TiO_2 heterostructure modified with carbon nitride nanosheets (CN-NSs). The uniform dispersion of TiO_2 nanoparticles effectively restrains the re-stacking of ultrathin layers, resulting in a high specific surface area of $234.0 \text{ m}^2 \cdot \text{g}^{-1}$, and enhanced photocatalytic efficiency for the degradation of dyes and H_2 production.

2193–2209

Size-controlled MoS_2 nanodots supported on reduced graphene oxide for hydrogen evolution reaction and sodium-ion batteries

Weiyi Sun, Pan Li, Xue Liu, Jiajia Shi, Hongming Sun, Zhanliang Tao*, Fujun Li, and Jun Chen

Nankai University, China



MoS_2 nanodots supported on graphene, synthesized via heating-up and ultrasonication methods, demonstrate promising performances as bifunctional materials for batteries and electrocatalysis.

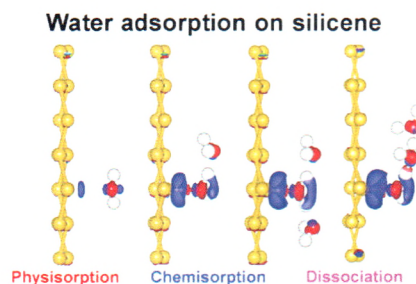
2210–2222

Water on silicene: A hydrogen bond-autocatalyzed physisorption–chemisorption–dissociation transition

Wei Hu^{1,2,*}, Zhenyu Li¹, and Jinlong Yang^{1,*}

¹ University of Science and Technology of China, China

² Lawrence Berkeley National Laboratory, USA



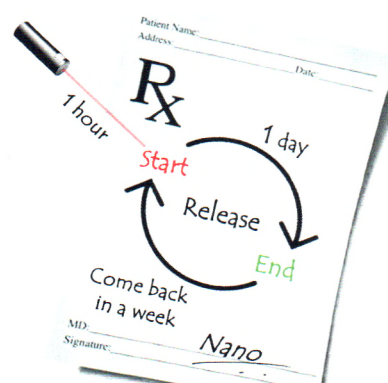
Water monomers, dimers, and trimers show different adsorption properties on silicene. On silicene, hydrogen bonding in dimers and trimers of water induces a transition from physisorption to chemisorption and then to dissociation. Unlike other 2D materials, silicene is hydrophilic owing to this hydrogen bond autocatalytic effect.

2223–2233

“Takeaway” drug delivery: A new nanomedical paradigm

Elena González-Domínguez, Benito Rodríguez-González, Moisés Pérez-Lorenzo*, and Miguel A. Correa-Duarte*

Universidade de Vigo, Spain



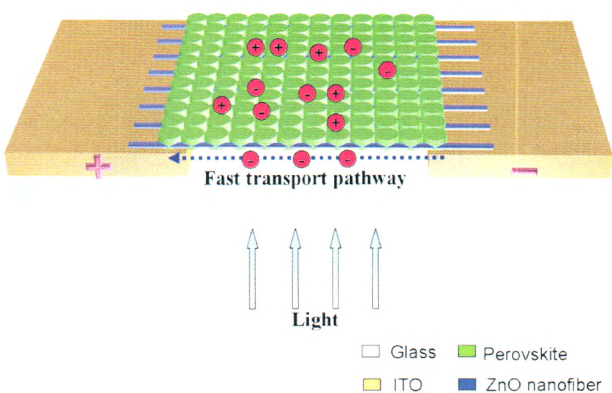
A far-ranging approach aiming at developing a new generation of drug delivery systems applicable beyond the point-of-care setting has been developed. This strategy shows great promise in those scenarios requiring a lengthy and yet switchable release of therapeutic agents.

2234–2243

High-performance UV-vis photodetectors based on electrospun ZnO nanofiber-solution processed perovskite hybrid structures

Fengren Cao, Wei Tian, Bangkai Gu, Yulong Ma, Hao Lu, and Liang Li*

Soochow University, China



A high-performance photodetector based on a hybrid structure consisting of electrospun ZnO nanofibers and perovskite films is demonstrated. Compared to pristine ZnO or perovskite, the hybrid photodetector shows increased on-off ratio, faster response speed, and higher responsivity and detectivity.

2244–2256

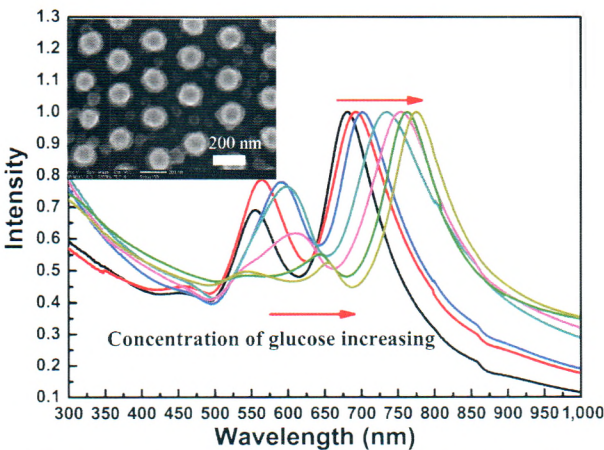
Functionalized periodic Au@MOFs nanoparticle arrays as biosensors for dual-channel detection through the complementary effect of SPR and diffraction peaks

Lifeng Hang^{1,2}, Fei Zhou¹, Dandan Men^{1,2}, Huilin Li^{1,2}, Xinyang Li¹, Honghua Zhang¹, Guangqiang Liu¹, Weiping Cai¹, Cuncheng Li³, and Yue Li^{1,2,*}

¹ Institute of Solid State Physics, Chinese Academy of Sciences, China

² University of Science and Technology of China, China

³ University of Jinan, China



Au@MIL-100(Fe) NP arrays modified with 3-aminophenylboronic acid hemisulfate exhibited sensitive responses to different glucose concentrations with good selectivity. The surface plasma resonance and diffraction peaks exhibited satisfactory complementary sensitivity to glucose detection in different concentration regions.

2257–2270

Non-FCC rich Au crystallites exhibiting unusual catalytic activity

Gangaiah Mettela¹, Nisha Mammen², Joydip Joardar³, Shobhana Narasimhan², and Giridhar U. Kulkarni^{4,*}

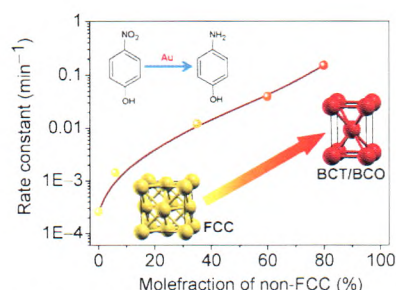
¹ Jawaharlal Nehru Centre for Advanced Scientific Research, India

² Theoretical Sciences Unit, Jawaharlal Nehru Centre for Advanced Scientific Research, India

³ International Advanced Research Centre for Powder Metallurgy & New Materials, India

⁴ Centre for Nano and Soft Matter Sciences, India

2271–2279



Penta-twinned bipyramidal Au microcrystallites with a highly corrugated morphology host unconventional non-FCC Au phases. The mole-fraction of non-face-centered cubic (non-FCC) Au is varied simply by changing the shape-directing Ag(I) content and the thermolysis temperature. The highest mole fraction of non-FCC Au achieved was 85%. The strained non-FCC phases obtained exhibited nearly three orders of magnitude higher catalytic activity compared to that from the FCC phase or from an uncatalyzed reaction. This catalytic improvement is due to the higher d-band energy associated with the non-FCC phases.

Positively charged graphene/Fe₃O₄/polyethylenimine with enhanced drug loading and cellular uptake for magnetic resonance imaging and magnet-responsive cancer therapy

Baoji Du^{1,2}, Jianhua Liu^{3,4}, Guanyu Ding¹, Xu Han¹, Dan Li^{1,*}, Erkang Wang^{1,*}, and Jin Wang^{1,4,5,*}

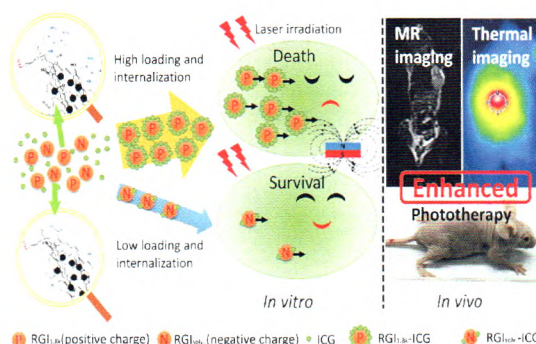
¹ Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, China

² University of Chinese Academy of Sciences, China

³ The Second Hospital of Jilin University, China

⁴ Jilin University, China

⁵ State University of New York at Stony Brook, USA



First, we prepared the positively charged reduced graphene oxide anchoring iron oxide (RGI) modified by 1.8 kDa polyethylenimine (RGI_{1.8k}), which could load more indocyanine green (ICG) molecules and could be more effectively internalized into the cells than the negatively charged RGI synthesized by a solvothermal method (RGI_{solv}). The resulting RGI_{1.8k}-ICG showed excellent phototherapy, magnetic resonance imaging, and thermal imaging with the help of magnetic targeting *in vitro* and *in vivo*.

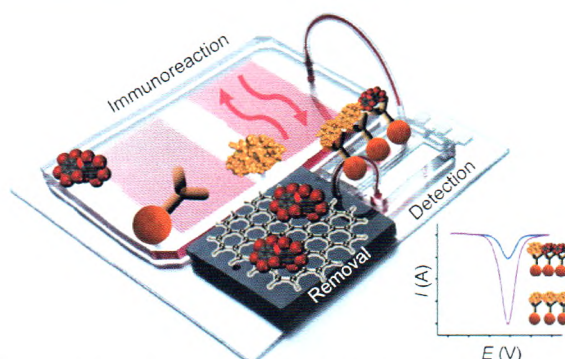
2280–2295

Toward integrated detection and graphene-based removal of contaminants in a lab-on-a-chip platform

Andrzej Chałupniak¹ and Arben Merkoçi^{1,2,*}

¹ Campus UAB, Spain

² ICREA, Spain



This work presents a novel approach for in-chip electrochemical detection of polybrominated diphenyl ethers and its removal using a graphene-based composite.

2296–2310

Atomic-scale observation of a two-stage oxidation process in Cu_2O

Huihui Liu¹, He Zheng¹, Lei Li¹, Huaping Sheng¹, Shuangfeng Jia^{1,*}, Fan Cao¹, Xi Liu^{1,2}, Boyun Chen^{1,3}, Ru Xing⁴, Dongshan Zhao¹, and Jianbo Wang^{1,5,*}

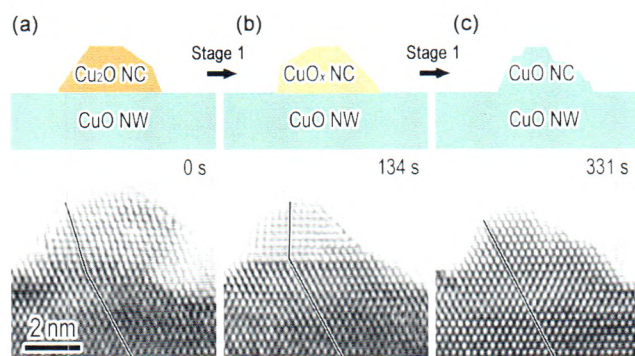
¹ Wuhan University, China

² Middle School Attached to Huazhong University of Science and Technology, China

³ Shuiguohu Senior Middle School, China

⁴ Baotou Normal College, China

⁵ Central South University, China



In situ transmission electron microscopy reveals a two-stage oxidation process in Cu_2O . A previously unreported intermediate CuO_x phase is found and the possible crystal structure is discussed.

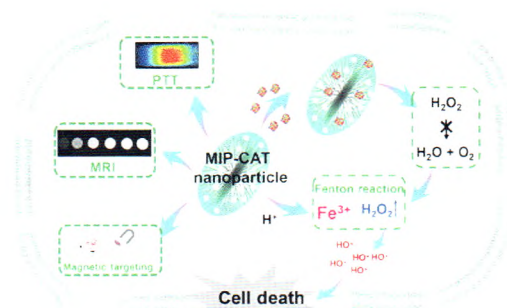
2344–2350

Catalase-imprinted $\text{Fe}_3\text{O}_4/\text{Fe@fibrous SiO}_2/\text{polydopamine}$ nanoparticles: An integrated nanoplatform of magnetic targeting, magnetic resonance imaging, and dual-mode cancer therapy

Jinxing Chen¹, Shan Lei¹, Kun Zeng¹, Mozhen Wang^{1,*}, Anila Asif², and Xuewu Ge^{1,*}

¹ University of Science and Technology of China, China

² COMSATS Institute of Information Technology, Pakistan



Integrated nanoplatform of magnetic targeting, MR imaging, and dual-modal radical/PTT cancer therapy

A multifunctional cancer therapeutic nanoplatform integrates magnetic targeting, magnetic resonance imaging (MRI), and photothermal and radical therapy.

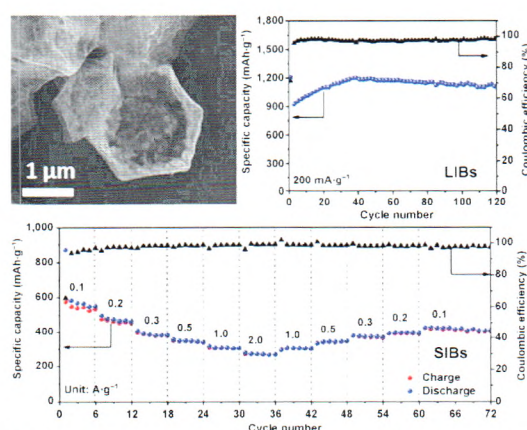
2351–2363

Interface-modulated fabrication of hierarchical yolk-shell $\text{Co}_3\text{O}_4/\text{C}$ dodecahedrons as stable anodes for lithium and sodium storage

Yuzhu Wu¹, Jiashen Meng¹, Qi Li^{1,*}, Chaojiang Niu¹, Xuanpeng Wang¹, Wei Yang¹, Wei Li¹, and Liqiang Mai^{1,2,*}

¹ Wuhan University of Technology, China

² University of California, Berkeley, USA



A facile interface-modulated method is developed to synthesize carbon-based Co_3O_4 composites with a yolk-shell structure by controlling the heat-treatment process. Results reveal that the yolk-shell $\text{Co}_3\text{O}_4/\text{C}$ dodecahedrons exhibit a high specific capacity, excellent cycling performance, and outstanding rate capability as anodes for lithium-ion batteries and sodium-ion batteries.

2364–2376

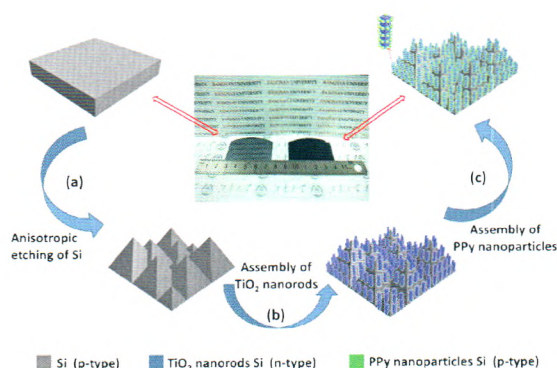
Fabrication of 3D biomimetic composite coating with broadband antireflection, superhydrophilicity, and double p-n heterojunctions

Gang Shi¹, Xin Zhang¹, Jianhua Li¹, Haiyan Zhu¹, Ying Li^{1,*}, Liping Zhang¹, Caihua Ni¹, and Lifeng Chi^{2,3,*}

¹ Jiangnan University, China

² Soochow University, China

³ Westfälische Wilhelms-Universität Münster, Germany



A three-dimensional (3D) biomimetic composite coating was achieved by wet etching and hydrothermal synthesis coupled with chemical oxidation. The coating exhibited broadband antireflection with less than 4% reflectivity in the wavelength range of 200 to 2,300 nm, superhydrophilicity with a low water contact angle of 1.8°, and efficient charge separation.

2377–2385

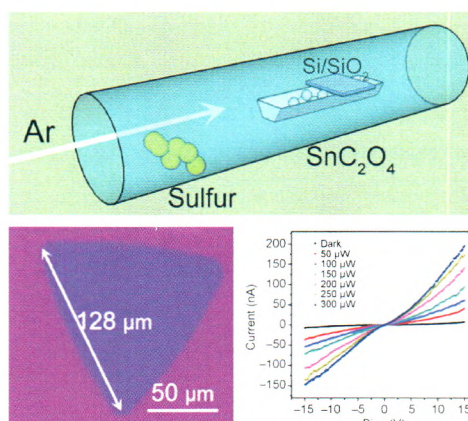
Synthesis of large-scale atomic-layer SnS₂ through chemical vapor deposition

Gonglan Ye¹, Yongji Gong^{1,3,*}, Sidong Lei¹, Yongmin He¹, Bo Li¹, Xiang Zhang¹, Zehua Jin¹, Liangliang Dong¹, Jun Lou¹, Robert Vajtai¹, Wu Zhou², and Pulickel M. Ajayan^{1,*}

¹ Rice University, USA

² Oak Ridge National Lab, USA

³ Beihang University, China



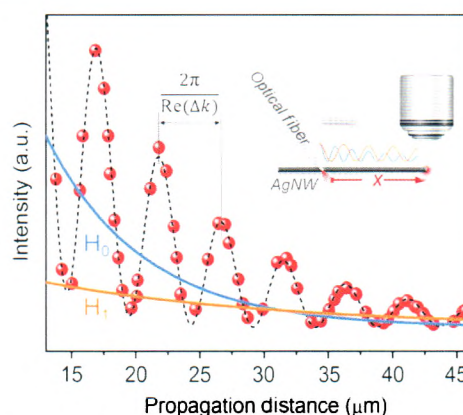
Large-scale, atomic-layer two-dimensional SnS₂ with high crystal quality is successfully grown by chemical vapor deposition. The resultant SnS₂ crystals are used as photodetectors and show high external quantum efficiency.

2386–2394

Decoupling co-existing surface plasmon polariton (SPP) modes in a nanowire plasmonic waveguide for quantitative mode analysis

Sanggon Kim, Sabrina Bailey, Ming Liu, and Ruoxue Yan*

University of California, Riverside, USA



Different surface plasmon polariton modes that are simultaneously excited in a Ag nanowire waveguide can be distinguished using an interference method, and their propagation parameters are measured separately for the first time.

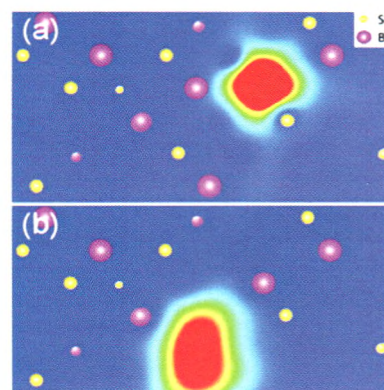
2395–2404

Correlation between types of defects/vacancies of Bi_2S_3 nanostructures and their transient photocurrent

Mingyang Liu¹, Luqing Wang¹, Pei Dong¹, Liangliang Dong¹, Xifan Wang¹, Jarin Joyner¹, Xiangjian Wan², Boris I. Yakobson^{1,*}, Robert Vajtai^{1,*}, Pulickel Ajayan¹, and Pol Spanos^{1,*}

¹ Rice University, USA

² Nankai University, China



Correlation between the transient photocurrent of Bi_2S_3 microspheres with nanorod assemblies and the types and concentrations of their defects/vacancies were investigated by positron annihilation spectrometry.

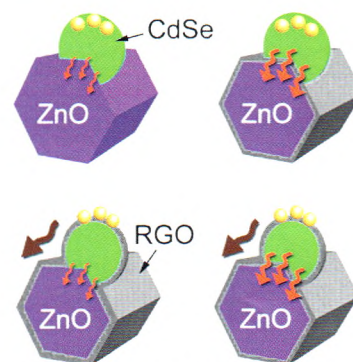
2405–2414

Design and roles of RGO-wrapping in charge transfer and surface passivation in photoelectrochemical enhancement of cascade-band photoanode

Zhuo Zhang¹, Mingi Choi¹, Minki Baek¹, Insung Hwang¹, Changshin Cho¹, Zexiang Deng², Jinwoo Lee¹, and Kijung Yong^{1,*}

¹ POSTECH, Republic of Korea

² Sun Yat-Sen University, China



This study elucidates the roles of reduced graphene oxide (RGO) in the charge transfer and surface passivation of photoanodes by the precise design of a RGO-wrapped photoanode and examination of its photoelectrochemical properties.

2415–2430

Sorafenib delivery nanoplatfrom based on superparamagnetic iron oxide nanoparticles magnetically targets hepatocellular carcinoma

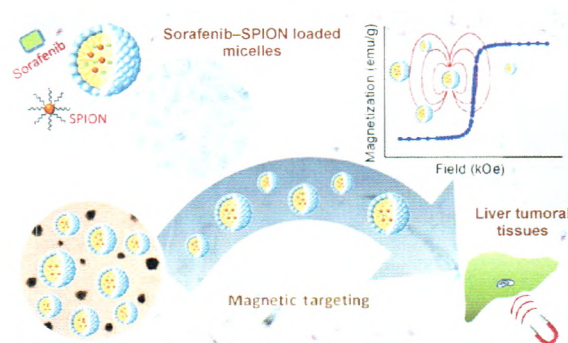
Nicoletta Depalo¹, Rosa Maria Iacobazzi², Gianpiero Valente³, Ilaria Arduino³, Silvia Villa⁴, Fabio Canepa⁴, Valentino Laquintana³, Elisabetta Fanizza³, Marinella Striccoli¹, Annalisa Cutrignelli³, Angela Lopedota³, Letizia Porcelli², Amalia Azzariti², Massimo Franco³, Maria Lucia Curri¹, and Nunzio Denora^{3,*}

¹ Istituto per i Processi Chimico-Fisici-CNR UOS Bari, Italy

² Istituto Tumori IRCCS Giovanni Paolo II, Italy

³ Università degli Studi di Bari Aldo Moro, Italy

⁴ Università di Genova, Italy



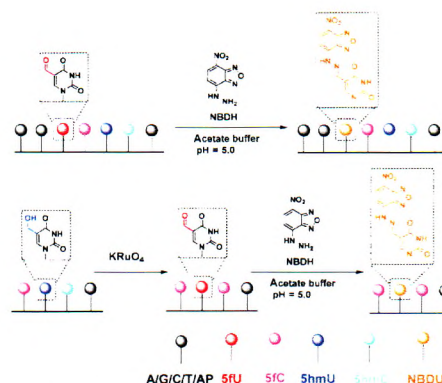
This paper reports on the fabrication of novel magnetic nanoformulations using polyethylene glycol modified phospholipid micelles loaded with colloidal superparamagnetic iron oxide nanoparticles and sorafenib. The obtained magnetic nanovectors represent a promising candidate for magnetic targeting of a chemotherapeutic agent to tumor sites to achieve an efficacious treatment of hepatocellular carcinoma.

2431–2448

A highly efficient fluorescence-based switch-on detection method of 5-formyluracil in DNA

Chaoxing Liu, Yuqi Chen, Yafen Wang, Fan Wu, Xiong Zhang, Wei Yang, Jiaqi Wang, Yi Chen, Zhiyong He, Guangrong Zou, Shaoru Wang, and Xiang Zhou*

Wuhan University, China



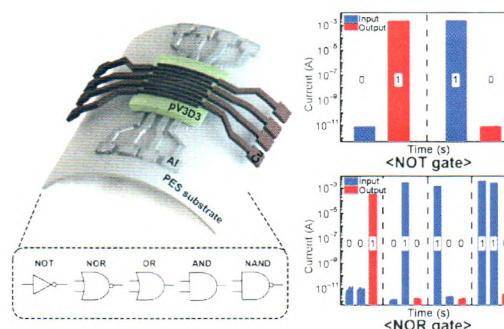
We developed a fluorescence-based switch-on method to specifically detect a natural thymidine modification, 5-formyl-2'-deoxyuridine (5fU) in single-stranded and double-stranded DNA via an addition-elimination reaction of aldehyde with hydrazine under mild conditions. This reaction is not affected by the presence of abasic sites and 5-formyl-2'-deoxycytosine, the modified cytosine counterpart of 5fU. We further developed an oxidation-labeling strategy to detect 5-hydroxymethyl-2'-deoxyuridine (5hmU) via the chemical oxidation of 5hmU to 5fU.

2449–2458

Zero-static-power nonvolatile logic-in-memory circuits for flexible electronics

Byung Chul Jang, Sang Yoon Yang, Hyejeong Seong, Sung Kyu Kim, Junhwan Choi, Sung Gap Im, and Sung-Yool Choi*

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



A flexible nonvolatile logic-in-memory circuit enabling normally-off computing can be implemented using a poly(1,3,5-trivinyl-1,3,5-trimethyl cyclotrisiloxane) (pV3D3)-based memristor array. For the first time, we experimentally demonstrated our implementation of MAGIC-NOT and -NOR gates during multiple cycles and even under bent conditions. Other functions, such as OR, AND, NAND, and a half adder, are also realized within the crossbar array.

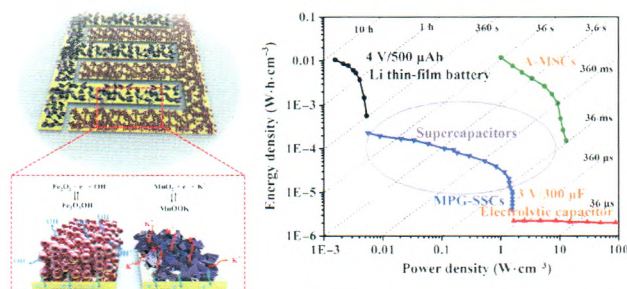
2459–2470

Capacitance and voltage matching between MnO₂ nanoflake cathode and Fe₂O₃ nanoparticle anode for high-performance asymmetric micro-supercapacitors

Zehua Liu¹, Xiaocong Tian¹, Xu Xu^{1,*}, Liang He¹, Mengyu Yan¹, Chunhua Han¹, Yan Li¹, Wei Yang¹, and Liqiang Mai^{1,2,*}

¹ Wuhan University of Technology, China

² University of California, Berkeley, USA



Planar asymmetric micro-supercapacitors (A-MSCs) are designed and fabricated by a facile and controllable microfabrication process with MnO₂ and Fe₂O₃ employed as the cathodic and anodic materials, respectively. By matching the voltage and capacitance of MnO₂ and Fe₂O₃, the A-MSCs show high capacitance, high energy density, and wide operation voltage range.

2471–2481

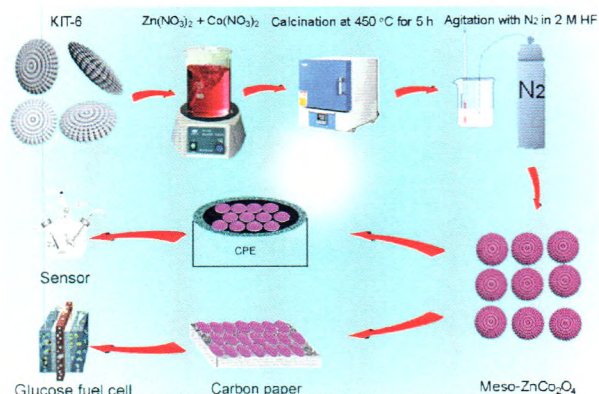
Uniform ordered mesoporous ZnCo_2O_4 nanospheres for super-sensitive enzyme-free H_2O_2 biosensing and glucose biofuel cell applications

Shiqiang Cui¹, Li Li¹, Yaping Ding^{1,*}, Jiangjiang Zhang¹, Qingsheng Wu², and Zongqian Hu^{3,*}

¹ Shanghai University, China

² Tongji University, China

³ Beijing Institute of Radiation Medicine, China



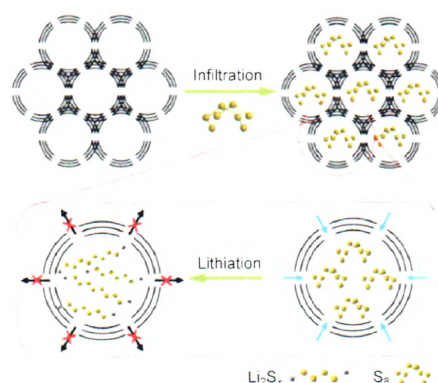
Mesoporous ZnCo_2O_4 nanospheres were first used in super-sensitive H_2O_2 biosensing and glucose biofuel cells.

2482–2494

Three-dimensionally ordered, ultrathin graphitic-carbon frameworks with cage-like mesoporosity for highly stable Li-S batteries

Huijuan Yu, Hanwen Li, Shouyi Yuan, Yuchi Yang, Jiahui Zheng, Jianhua Hu, Dong Yang*, Yonggang Wang*, and Angang Dong*

Fudan University, China



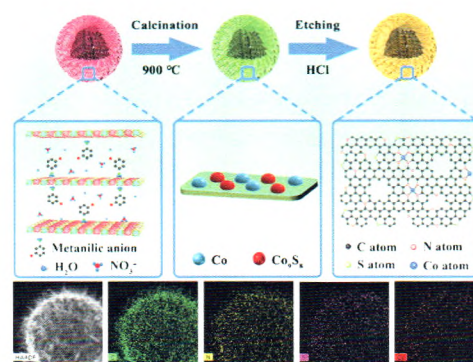
Three-dimensionally ordered, ultrathin graphitic-carbon frameworks with unique cage-like mesoporosity, derived from self-assembled Fe_3O_4 nanoparticle superlattices, were successfully utilized as a sulfur host for high-performance lithium-sulfur batteries with high specific capacity and exceptional cycling stability.

2495–2507

A Co-N/C hollow-sphere electrocatalyst derived from a metanilic CoAl layered double hydroxide for the oxygen reduction reaction, and its active sites in various pH media

Jun Wang, Liquan Li, Xu Chen, Yanluo Lu, Wensheng Yang*, and Xue Duan

Beijing University of Chemical Technology, China



Porous Co-N/C hollow spheres were successfully prepared by carbonization of metanilic anions in the confined space between the layers of cobalt-aluminum layered double hydroxides. These Co-N/C catalysts exhibited remarkably high electrocatalytic activity and durability for the oxygen reduction reaction at different pH levels. The Co-N_x sites act as the oxygen reduction reaction (ORR) active sites in acidic and neutral solutions, but have a negligible effect on ORR activity in alkaline conditions.

2508–2518

Deriving phosphorus atomic chains from few-layer black phosphorus

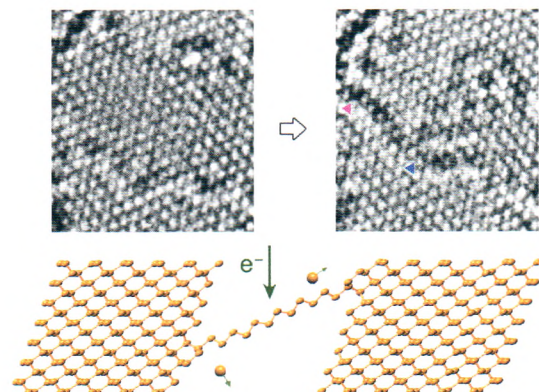
Zhangru Xiao¹, Jingsi Qiao², Wanglin Lu¹, Guojun Ye^{3,4}, Xianhui Chen^{3,4}, Ze Zhang¹, Wei Ji^{2,*}, Jixue Li^{1,*}, and Chuanhong Jin^{1,*}

¹ Zhejiang University, China

² Renmin University of China, China

³ University of Science and Technology of China, China

⁴ Nanjing University, China



Phosphorus atomic chains were obtained by *in situ* sublimation of few-layer black phosphorus.

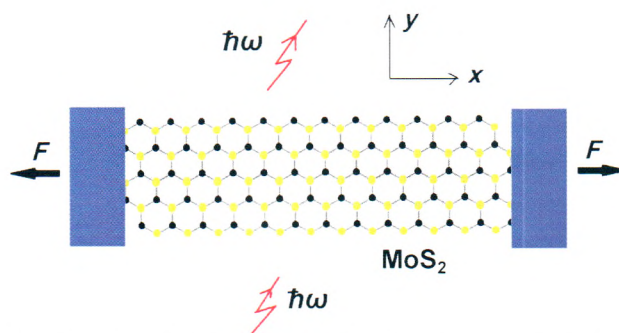
2519–2526

Controlling the luminescence of monolayer MoS₂ based on the piezoelectric effect

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

¹ Swansea University, UK

² University of Electronic Science and Technology of China, China



A theoretical analysis of the stimulated emission of monolayer MoS₂, taking into consideration the piezoelectric effect, has been conducted using quantum mechanics. It is observed that the extra piezoelectric charges induced by the applied mechanical forces increase the overall charge density of MoS₂, subsequently enhancing the emission intensity.

2527–2534

Direct identification of monolayer rhenium diselenide by an individual diffraction pattern

Zhen Fei¹, Bo Wang², Ching-Hwa Ho³, Fang Lin⁴, Jun Yuan^{1,5}, Ze Zhang¹, and Chuanhong Jin^{1,*}

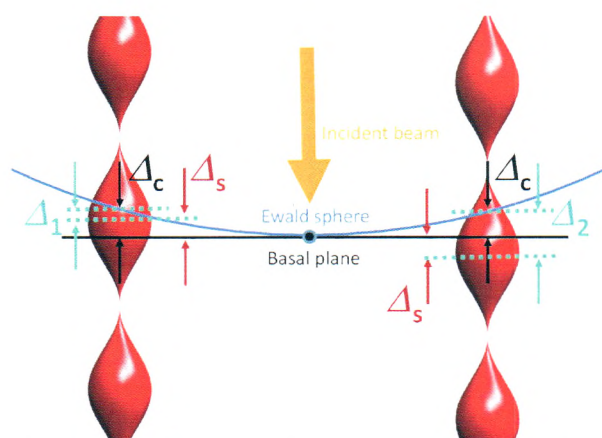
¹ Zhejiang University, China

² Lanzhou University, China

³ Taiwan University of Science and Technology, Taipei 106, Taiwan, China

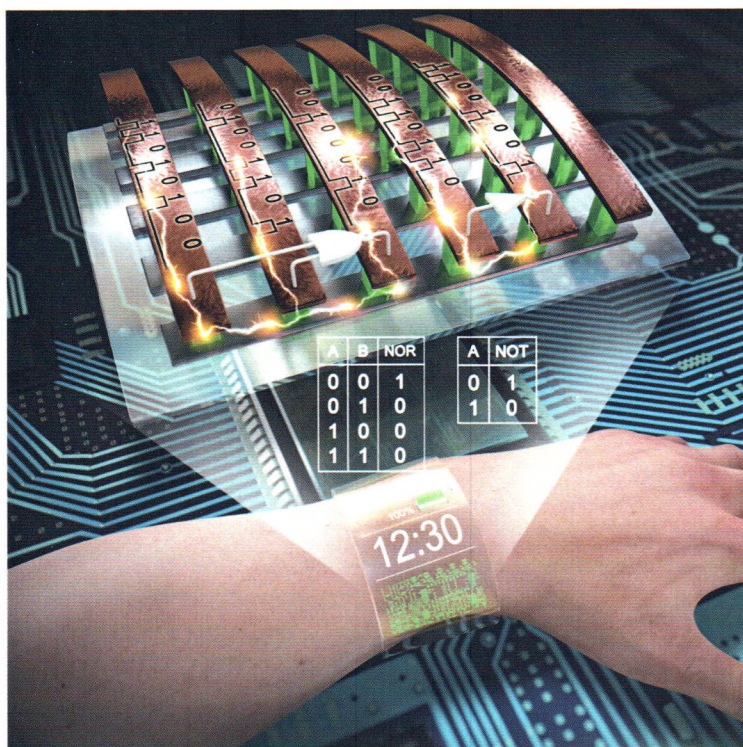
⁴ South China Agricultural University, China

⁵ University of York, UK



An individual diffraction pattern was used to identify monolayer rhenium diselenide and its vertical orientation.

2535–2544



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