Nano Research

November · 2020
Volume 13 · Number 11

QK2062743

Nanoparticles for targeted cancer radiotherapy

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Graphitic nanorings for super-long lifespan lithium-ion capacitors

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Nano Research
Vol. 13, No. 11, November 2020 ISSN 1998-0124 CN 11-5974/O4

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Review Articles

Nanoparticles for targeted cancer radiotherapy

Roger M. Pallares[1] and Rebecca J. Abergel[1,2,*]

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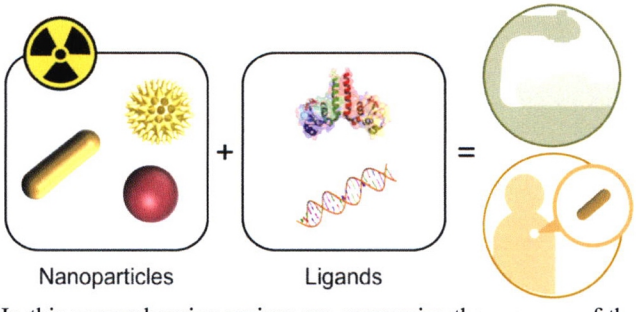

In this comprehensive review, we summarize the progress of the use of nanoparticles for targeted radiotherapy, where nanoparticles can be employed either as sensitizers for external beam radiation or as radionuclide delivery systems for internal radiotherapy.

2887–2897

Recent advances in nanomaterials for sonodynamic therapy

Ting Xu[1], Shaojing Zhao[1], Changwei Lin[2,*], Xiuli Zheng[3,*], and Minhuan Lan[1,*]

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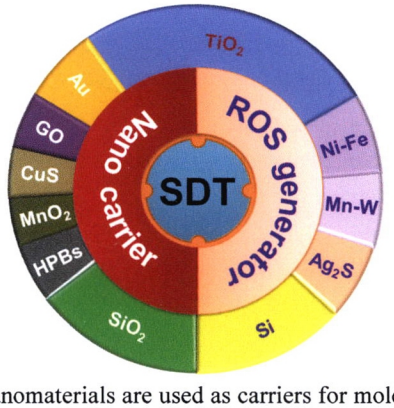

Inorganic nanomaterials are used as carriers for molecular sonosensitizers or directly as sonosensitizers for sonodynamic therapy.

2898–2908

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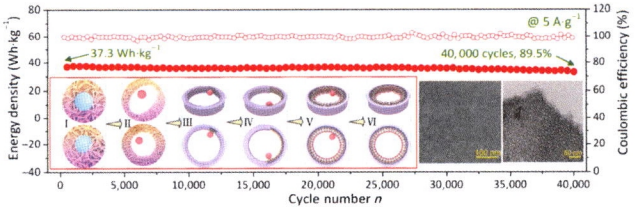
Research Articles

Graphitic nanorings for super-long lifespan lithium-ion capacitors

Guangchao Li, Zhoulan Yin, Yuqing Dai, Bianzheng You, Huajun Guo, Zhixing Wang, Guochun Yan, Yong Liu, and Jiexi Wang*

Central South University, China



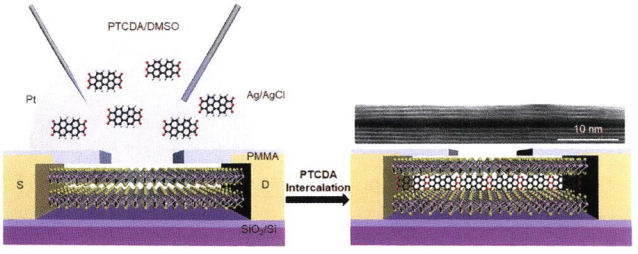
Novel quasi zero-dimensional (0D) porous graphitic carbon nanorings (PGCNs) derived from carbon dots are proposed and the formation mechanism from carbon dots to PGCNs is revealed. As used in AC//PGCNs dual carbon Li-ion capacitors, outstanding retention of ~ 90% after 40,000 cycles is presented, outperforming the state-of-art ones.

2909–2916

Intercalation and hybrid heterostructure integration of two-dimensional atomic crystals with functional organic semiconductor molecules

Wen He[1], Han Zang[1], Songhua Cai[1,2], Zhangyan Mu[1], Cheng Liu[1], Mengning Ding[1,*], Peng Wang[1,*], and Xinran Wang[1,*]

[1] Nanjing University, China
[2] The Hong Kong Polytechnic University, Hong Kong, China



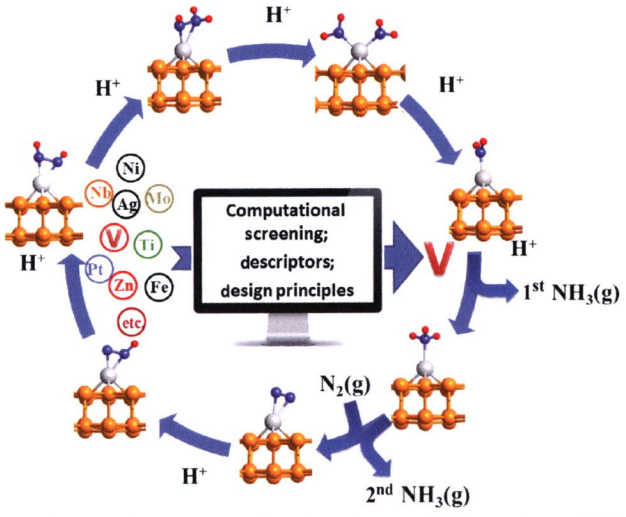
The intercalation of perylene-3,4,9,10-tetracarboxylic dianhydride (PTCDA) into the layers of MoS_2 is the first on-chip reaction that intercalated the neutral and functional organic molecules into two-dimensional (2D) atomic crystals to form functional hybrid heterostructure. Improved transport performance was achieved, along with the construction of single layer molecular tunneling transistor.

2917–2924

Activity origin and design principles for atomic vanadium anchoring on phosphorene monolayer for nitrogen reduction reaction

Xiongyi Liang, Xiangxuan Deng, Chen Guo, and Chi-Man Lawrence Wu*

City University of Hong Kong, Hong Kong, China



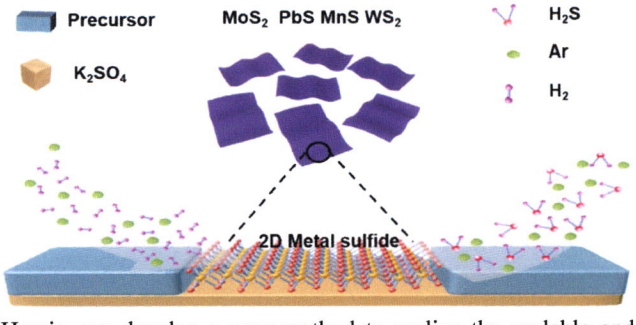
A high-throughput screening based on density functional theory (DFT) was performed to investigate the potential of 23 atomic transition metals (Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Y, Zr, Nb, Mo, Tc, Ru, Rh, Pd, Ag, Cd, W, Pt and Au) supported on phosphorene monolayer as electrocatalyst for nitrogen reduction reaction (NRR). Activity origin and design principles between activation barrier and intrinsic electronic properties have been established.

2925–2932

Scalable and controllable synthesis of 2D high-proportion 1T-phase MoS_2

Xiang Gao, Liukang Xiong, Jiabin Wu, Jun Wan, and Liang Huang*

Huazhong University of Science and Technology, China



Herein, we develop a new method to realize the scalable and controllable synthesis of MoS_2 by using K_2SO_4 salt as a simultaneous high-temperature sulfur source and template. We also synthesize various high-quality single crystalline two-dimensional transition-metal sulfides (WS_2, PbS, MnS and Ni_9S_8) benefiting from the multifunctional K_2SO_4.

2933–2938

万方数据

Controllable optical emission wavelength in all-inorganic halide perovskite alloy microplates grown by two-step chemical vapor deposition

Mohammad K. Hossain[1,2], Pengfei Guo[4], Wayesh Qarony[3], Yuen H. Tsang[3], Chaoping Liu[5], Sai W. Tsang[1], Johnny C. Ho[1], and Kin M. Yu[1,*]

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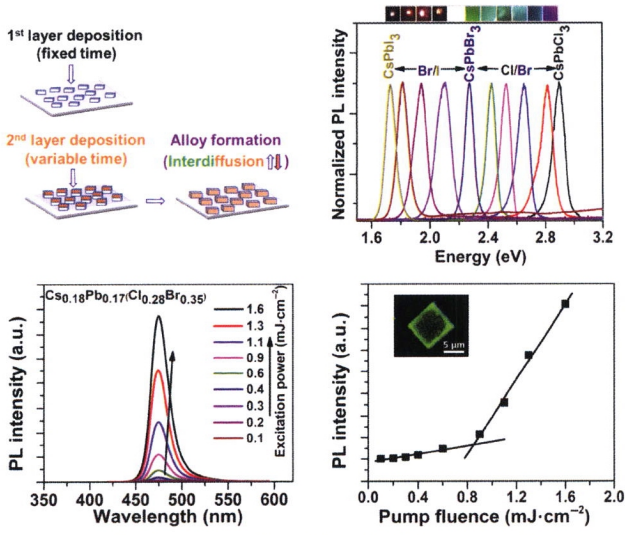
[2] Comilla University, Bangladesh
[3] The Hong Kong Polytechnic University, Hong Kong, China
[4] Taiyuan University of Technology, China
[5] Shantou University, China



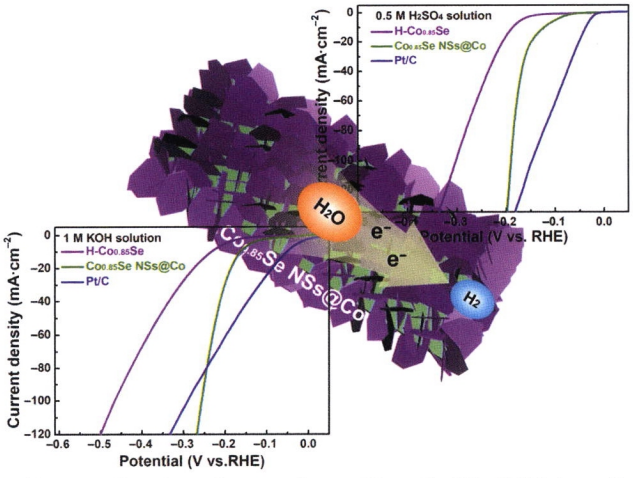
A two-step chemical vapor deposition (CVD) approach for growing all inorganic mixed anion halide perovskite alloys is developed, allowing precise composition tuning by controlling the deposition time in each step. Exploiting the fast diffusion of halide anions, this two-step CVD technique mitigates the complexities in the multi-parameter optimization required for composition tuning in the conventional CVD process.

2939–2949

Self-supporting $Co_{0.85}Se$ nanosheets anchored on Co plate as highly efficient electrocatalyst for hydrogen evolution reaction in both acidic and alkaline media

Rong Qin[1], Jiagang Hou[2], Caixia Xu[1,*], Hongxiao Yang[1], Qiuxia Zhou[1], Zizhong Chen[1], and Hong Liu[1,3,*]

[1] University of Jinan, China
[2] Qilu University of Technology (Shandong Academy of Sciences), China
[3] Shandong University, China



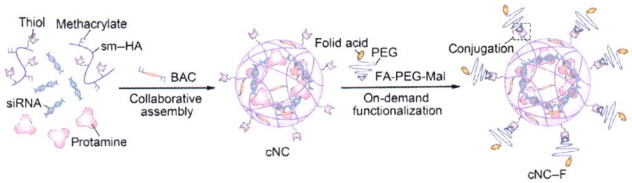
Self-supporting $Co_{0.85}Se$ nanosheets ($Co_{0.85}Se$ NSs@Co) is easily fabricated with interlinking three dimensional $Co_{0.85}Se$ nanosheets network arranged on conductive Co substrate. Benefiting from bulky integral architecture and high surface area, as-made $Co_{0.85}Se$ NSs@Co shows high electrocatalytic performances toward hydrogen evolution reaction (HER) with low overpotential, good structure stability, and high catalytic durability in both acidic and alkaline media. With the merits of scalable preparation as well as superior activity and catalytic durability, $Co_{0.85}Se$ NSs@Co presents promising application prospect as one type of low-cost binder-free electrocatalyst for HER in wide media.

2950–2957

Collaborative assembly-mediated siRNA delivery for relieving inflammation-induced insulin resistance

Shiyang Shen, Li Zhang, Mengru Li, Zhizi Feng, Huixia Li, Xiao Xu, Shiqi Lin, Ping Li, Can Zhang, Xiaojun Xu*, and Ran Mo*

China Pharmaceutical University, China



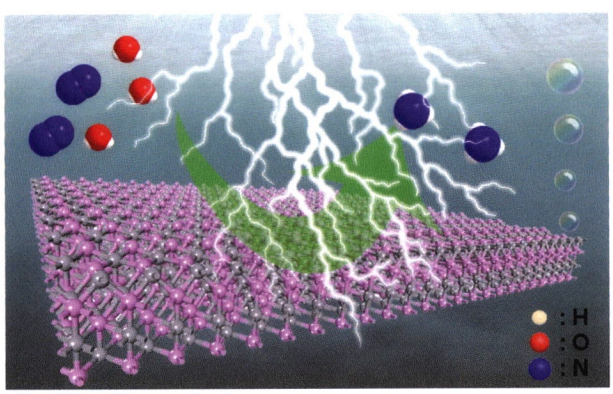
This research article reported a collaboratively-assembled small interfering RNA (siRNA) nanocomplex to relieve the inflammation-induced insulin resistance by silencing the expression of the inflammatory proteins of the activated macrophages.

2958–2966

Electrocatalytic N_2 reduction to NH_3 with high Faradaic efficiency enabled by vanadium phosphide nanoparticle on V foil

Peipei Wei[1], Qin Geng[1], Ali Imran Channa[1], Xin Tong[1], Yongsong Luo[1], Siyu Lu[2], Guang Chen[3], Shuyan Gao[4], Zhiming Wang[1,*], and Xuping Sun[1,*]

[1] University of Electronic Science and Technology of China, China
[2] Zhengzhou University, China
[3] Qufu Normal University, China
[4] Henan Normal University, China



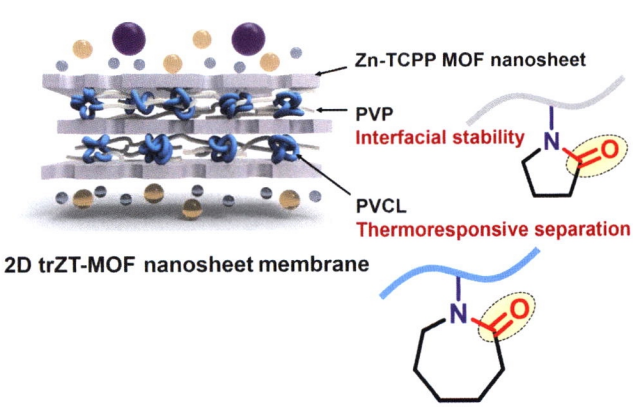
Vanadium phosphide nanoparticle on V foil as a high-active and stable catalyst achieves a high Faradaic efficiency of 22% with a large NH_3 yield of 8.35×10^{-11} mol·s^{-1}·cm^{-2} at 0 V vs. the reversible hydrogen electrode. Furthermore, deep insights into the mechanism are studied by a theoretical investigation.

2967–2972

Interfacially stable MOF nanosheet membrane with tailored nanochannels for ultrafast and thermo-responsive nanofiltration

Wei Jia[1,2], Baohu Wu[3], Shengtong Sun[1,*], and Peiyi Wu[1,2,*]

[1] Donghua University, China
[2] Fudan University, China
[3] Jülich Centre for Neutron Science (JCNS), Germany



Mechanically robust, high-separation-performance, thermo-responsive, yet interfacially stable lamellar membrane is successfully assembled from zinc tetrakis(4-carboxyphenyl) porphyrin (Zn-TCPP) metal-organic framework (MOF) nanosheets stabilized by twin-chain polymers with respective roles.

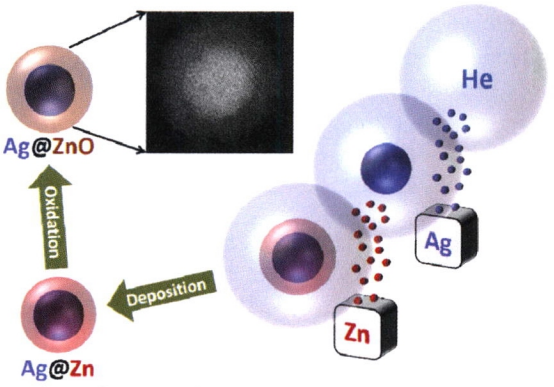
2973–2978

万方数据

Helium droplet assisted synthesis of plasmonic Ag@ZnO core@shell nanoparticles

Alexander Schiffmann*, Thomas Jauk, Daniel Knez, Harald Fitzek, Ferdinand Hofer, Florian Lackner, and Wolfgang E. Ernst*

Graz University of Technology, Austria



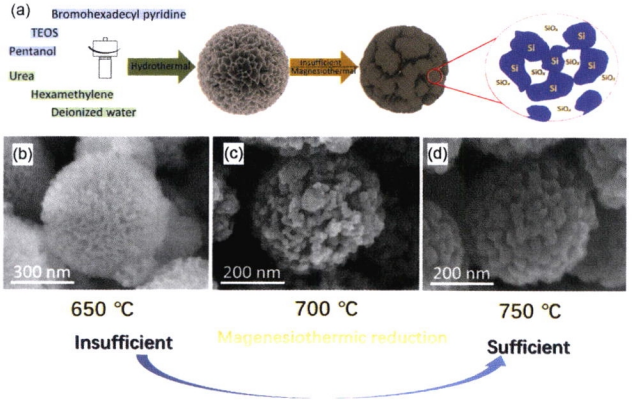
Plasmonic Ag@Zn core@shell nanoparticles are formed in a unique way inside a pristine environment employing the helium droplet synthesis approach. After subsequent oxidation the Ag@ZnO nanoparticles are investigated by several analysis techniques including scanning transmission electron microscopy, ultraviolet photoelectron spectroscopy, and two-photon photoelectron spectroscopy.

2979–2986

A combination of hierarchical pore and buffering layer construction for ultrastable nanocluster Si/SiO$_x$ anode

Kun Zeng, Tong Li, Xianying Qin*, Gemeng Liang, Lihan Zhang, Qi Liu, Baohua Li*, and Feiyu Kang*

Tsinghua University, China



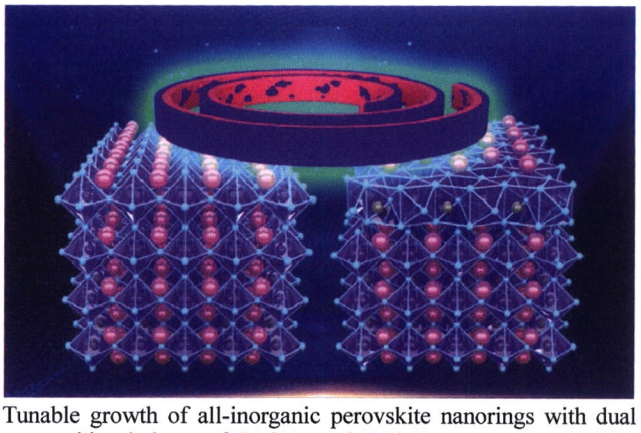
The highly porous Si/SiO$_x$ anode with cross-linked mesopores is synthesized through insufficient magnesiothermic reduction from highly porous silica spheres. The retained SiO$_x$ component protects the Si crystallite and porous structure from deforming, bringing about impressive electrochemical performance.

2987–2993

All-inorganic dual-phase halide perovskite nanorings

Yapeng Zheng[1,2], Tao Yang[1], Zhi Fang[1,2], Minghui Shang[2], Zuotai Zhang[3], Jack Yang[4,5], Jiaxin Fan[4], Weiyou Yang[2,*], Xinmei Hou[1,*], and Tom Wu[4,*]

[1] University of Science and Technology Beijing, China
[2] Ningbo University of Technology, China
[3] Southern University of Science and Technology, China
[4] University of New South Wales, Australia
[5] Australian Nuclear Science and Technology Organization, Australia



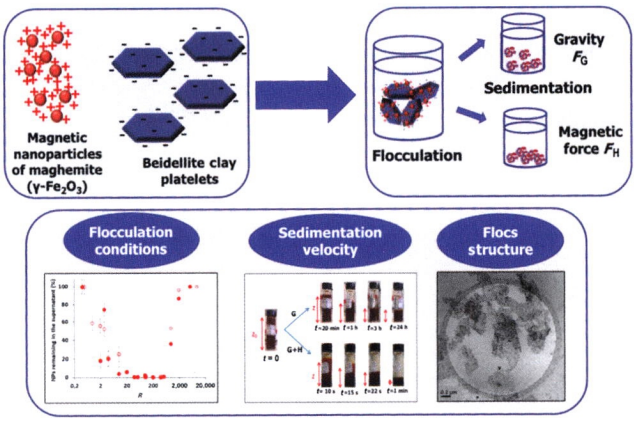
Tunable growth of all-inorganic perovskite nanorings with dual compositional phases of $CsPbBr_3$ and $CsPb_2Br_5$ was reported, which was driven by the axial stress resulted from the lattice mismatch during the transformation of $CsPbBr_3$ to $CsPb_2Br_5$.

2994–3000

Flocculation and magnetically-assisted sedimentation of size-sorted beidellite platelets mixed with maghemite nanoparticles

Sofia Housni, Sébastien Abramson*, Jean-Michel Guigner, Pierre Levitz, and Laurent Michot

Sorbonne Université, France



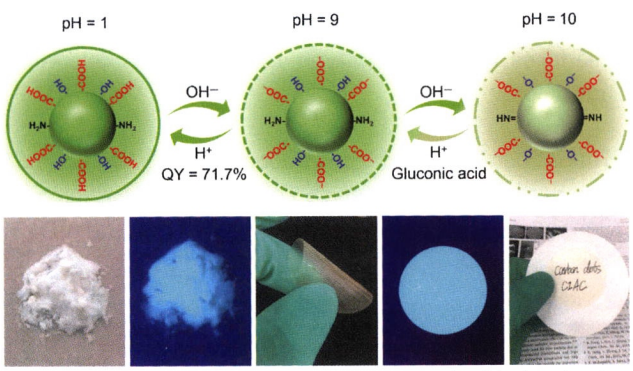
A model system composed of beidellite clay platelets and magnetic nanoparticles of maghemite was studied to improve the flocculation and decantation steps of water treatment processes.

3001–3011

Ultrastable and ultrasensitive pH-switchable carbon dots with high quantum yield for water quality identification, glucose detection, and two starch-based solid-state fluorescence materials

Daiyong Chao[1,2], Jinxing Chen[2], Qing Dong[1,2], Weiwei Wu[2], Desheng Qi[1], and Shaojun Dong[1,2,*]

[1] Jilin University, China
[2] Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, China



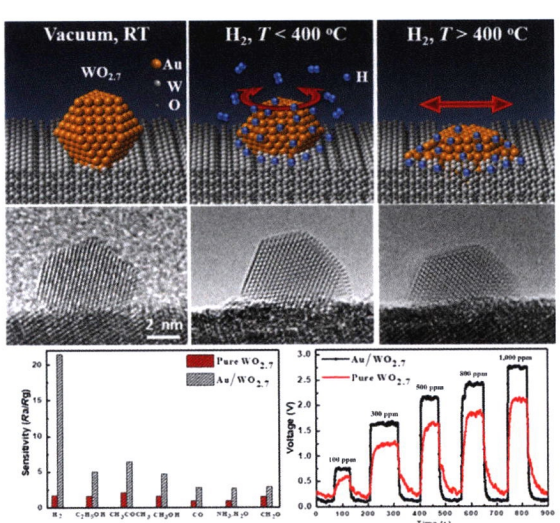
Highly-efficient green emissive CDs (m-CDs) with the absolute quantum yield of 71.7% in water are prepared through a facile solvothermal method. Owing to the unique optical behavior, the m-CDs were used as a fluorescent probe for water quality identification, glucose detection, and two environment-friendly starch-based solid-state fluorescence materials (powder and film).

3012–3018

Understanding the structural evolution of Au/$WO_{2.7}$ compounds in hydrogen atmosphere by atomic scale *in situ* environmental TEM

Fei Hui[1], Chong Li[2], Yanhui Chen[1], Chunhui Wang[1], Jingping Huang[1], Ang Li[1,*], Wei Li[1], Jin Zou[3], and Xiaodong Han[1,*]

[1] Beijing University of Technology, China
[2] Zhengzhou University, China
[3] The University of Queensland, Australia



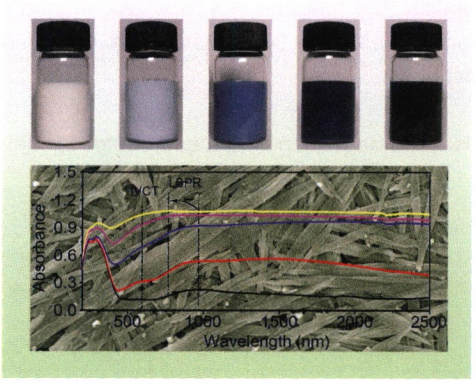
Aberration-corrected environmental transmission electron microscopy (TEM) was used to investigate the atomic-scale microstructural evolution *in situ* during the reaction between H_2 and Au/$WO_{2.7}$ compound.

3019–3024

Surface-ligand protected reduction on plasmonic tuning of onedimensional MoO_{3-x} nanobelts for solar steam generation

Xindian Li, Dongyang Wang, Yun Zhang, Luntao Liu, and Wenshou Wang*

Shandong University, China



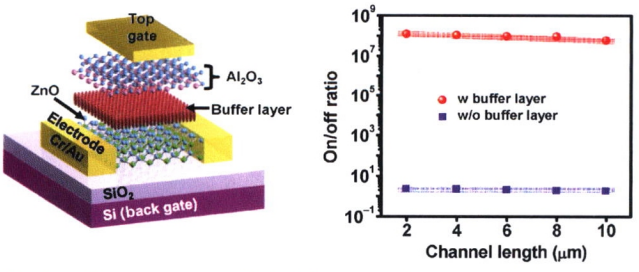
A surface-ligand protected reduction strategy was designed for the synthesis of one-dimensional (1D) MoO_{3-x} nanobelts with tunable plasmonic absorption in a wide wavelength range from 200 to 2,500 nm. Owing to the broad plasmonic absorption and unique 1D nanostructure, the MoO_{3-x} nanobelts were easily deposited as photothermal film in the interfacial solar evaporator, exhibiting excellent performance in solar steam generation.

3025–3032

Tuning the inhomogeneous charge transport in ZnO interfaces for ultrahigh on/off ratio top-gated field-effect-transistor arrays

Thanh Luan Phan[1], Dinh Loc Duong[1,2], Tuan Khanh Chau[1,2], Sidi Fan[1,2], Won Tae Kang[1], Thi Suong Le[1,2], Hyun Yong Song[1,2], Linfeng Sun[1], Van Tu Vu[1], Min Ji Lee[1], Quoc An Vu[1,2], Young Hee Lee[1,2], and Woo Jong Yu[1,*]

[1] Sungkyunkwan University, Republic of Korea
[2] Institute for Basic Science (IBS), Republic of Korea



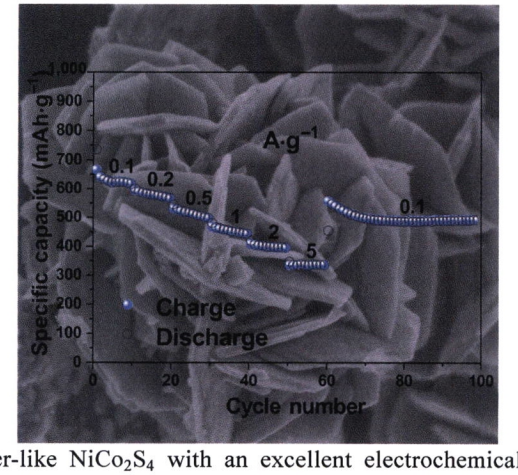
The interface between oxide/oxide layers shows an inhomogeneous charge transport behavior, which reveals a high conductivity owing to interface-doped. A buffer layer not only reduces the interface trap density, but also effectively enhances the gate electric field modulation at the hetero-interface. Our device demonstrates a pronounced ultrahigh on/off ratio of $\geq 10^8$, which is 8-order of magnitude higher than that of a device without buffer layer.

3033–3040

Flower-like $NiCo_2S_4$ nanosheets with high electrochemical performance for sodium-ion batteries

Yongqiang Miao[1], Xiaosen Zhao[1], Xin Wang[1], Chenhui Ma[1], Lu Cheng[1], Gang Chen[1], Huijuan Yue[1,*], Lei Wang[2], and Dong Zhang[1,*]

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



Flower-like $NiCo_2S_4$ with an excellent electrochemical performance is utilized as the anode for sodium-ion batteries under the ether electrolyte system at a voltage range of 0.3–3 V, and its sodium storage mechanism is studied by *ex situ* X-ray diffraction (XRD), Raman, X-ray photoelectron spectroscopy (XPS) and transmission electron microscopy (TEM). Moreover, quantitative kinetic analysis for $NiCo_2S_4$ also unravels the high contribution of pseudocapacitance mechanism in this system.

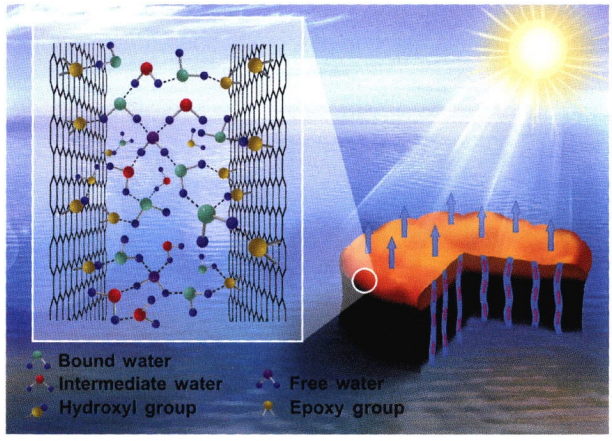
3041–3047

Vertically aligned reduced graphene oxide/$Ti_3C_2T_x$ MXene hybrid hydrogel for highly efficient solar steam generation

Wei Li[1], Xiaofeng Li[1,*], Wei Chang[1], Jing Wu[1], Pengfei Liu[1], Jianjun Wang[2], Xi Yao[3], and Zhong-Zhen Yu[1,*]

[1] Beijing University of Chemical Technology, China
[2] Institute of Chemistry, Chinese Academy of Sciences, China
[3] City University of Hong Kong, Hong Kong, China

3048–3056



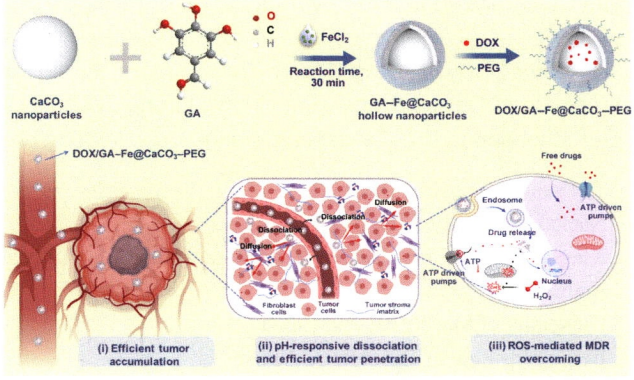
A vertically aligned reduced graphene oxide/MXene hybrid hydrogel is fabricated with aligned channels as an independent solar steam generation device to reduce the water vaporization enthalpy for highly efficient solar steam generation, which achieves a water evaporation rate of 2.09 $kg \cdot m^{-2} \cdot h^{-1}$ with a high conversion efficiency of 93.5% under 1-sun irradiation.

Metal-polyphenol-network coated $CaCO_3$ as pH-responsive nanocarriers to enable effective intratumoral penetration and reversal of multidrug resistance for augmented cancer treatments

Ziliang Dong, Yu Hao, Quguang Li, Zhijuan Yang, Yujie Zhu, Zhuang Liu, and Liangzhu Feng*

Soochow University, China

3057–3067



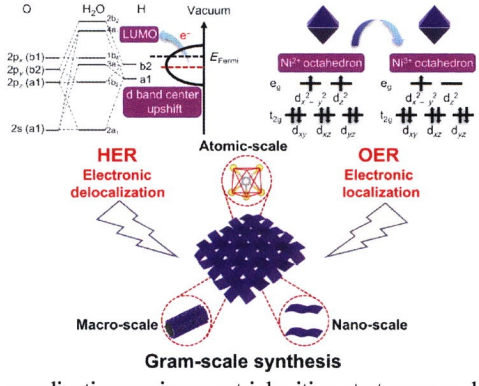
Metal-polyphenol-network coated $CaCO_3$ hollow nanoparticles obtained via a one-pot self-templated coordination reaction were utilized as pH-responsive nanocarriers to enable effective intratumoral penetration and reactive oxygen species (ROS)-mediated reversal of multidrug resistance for effective cancer treatment via combined chemodynamic and chemo-therapy.

Reaction environment self-modification on low-coordination Ni^{2+} octahedra atomic interface for superior electrocatalytic overall water splitting

Kaian Sun[1,2], Lei Zhao[1], Lingyou Zeng[1], Shoujie Liu[2], Houyu Zhu[1], Yanpeng Li[1], Zheng Chen[2], Zewen Zhuang[2], Zhaoling Li[3], Zhi Liu[1], Dongwei Cao[2], Jinchong Zhao[1], Yunqi Liu[1,*], Yuan Pan[1,*], and Chen Chen[2,*]

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

3068–3074



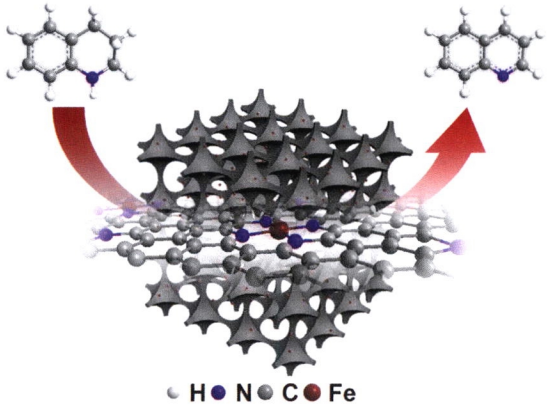
A novel coordination environment inheriting strategy was developed for the synthesis of low-coordination Ni^{2+} octahedra atomic interface. Advanced spectroscopic techniques and theoretical calculations reveal that the self-matching electron delocalization and localization state at the bifunctional active sites L-Ni-8 enables an ideal reaction environment at both cathode and anode. To improve the efficiency of using the self-modification reaction environment at L-Ni-8, all of the structural features from atomic-scale to macro-scale are integrated together to drive superior overall water splitting performance at high current density.

万方数据

Atomic iron on mesoporous N-doped carbon to achieve dehydrogenation reaction at room temperature

Zheng Chen[1,*], Wenjuan Yang[2], Yue Wu[3], Chao Zhang[3], Jun Luo[4], Chen Chen[3], and Yadong Li[3]

[1] Anhui Normal University, China
[2] Shenzhen University, China
[3] Tsinghua University, China
[4] Tianjin University of Technology, China



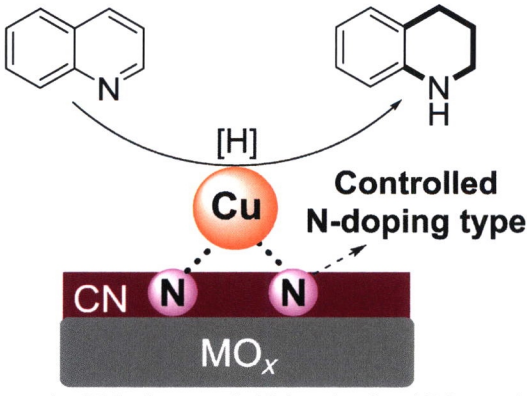
Atomic iron on mesoporous N-doped carbon is synthesized through pyrolysis of melamine formaldehyde resin coordinated with ferric salt. The atomic iron with unique charge and coordination characteristics shows superior catalytic performance in dehydrogenation reaction at room temperature.

3075–3081

Controlling N-doping type in carbon to boost single-atom site Cu catalyzed transfer hydrogenation of quinoline

Jian Zhang[1], Caiyan Zheng[2], Maolin Zhang[3], Yajun Qiu[1], Qi Xu[1], Weng-Chon Cheong[4], Wenxing Chen[5], Lirong Zheng[6], Lin Gu[7], Zhengpeng Hu[2], Dingsheng Wang[1,*], and Yadong Li[1,*]

[1] Tsinghua University, China
[2] Nankai University, China
[3] King Abdullah University of Science and Technology, Saudi Arabia
[4] University of Macau, Macau, China
[5] Beijing Institute of Technology, China
[6] Institute of High Energy Physics, Chinese Academy of Sciences, China
[7] Institute of Physics, Chinese Academy of Sciences, China



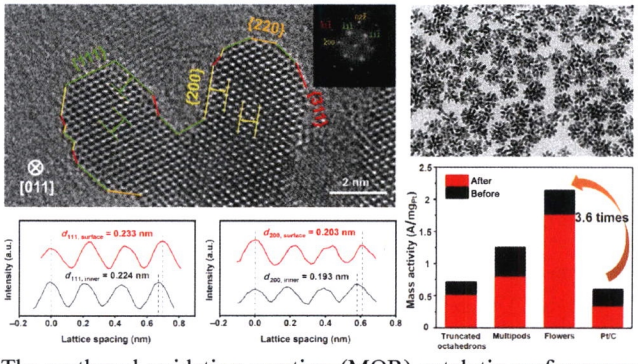
We report that N-doping types in N-doped carbon (CN) materials can be controlled by compounding with different metal oxides (MO_x) to optimize the performance of loaded single-atom site Cu catalyst for transfer hydrogenation of quinoline under mild conditions.

3082–3087

Atomic-scaled surface engineering Ni-Pt nanoalloys towards enhanced catalytic efficiency for methanol oxidation reaction

Aixian Shan[1,2], Shuoyuan Huang[1], Haofei Zhao[1], Wengui Jiang[1], Xueai Teng[1], Yingchun Huang[1], Chinping Chen[2,*], Rongming Wang[1,*], and Woon-Ming Lau[1,*]

[1] University of Science and Technology Beijing, China
[2] Peking University, China



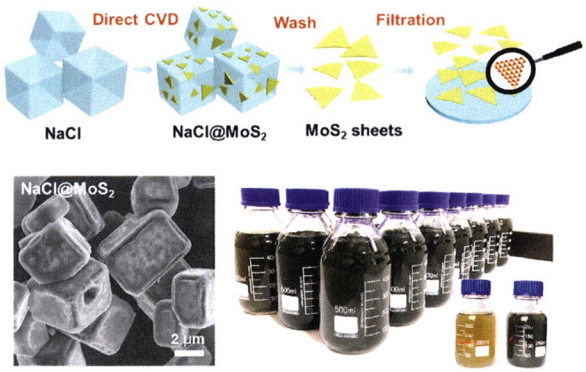
The methanol oxidation reaction (MOR) catalytic performance can be promoted by atomic-scaled nano-engineering and surface-engineering for Ni-Pt nanoparticles.

3088–3097

Scalable salt-templated directed synthesis of high-quality MoS_2 nanosheets powders towards energetic and environmental applications

Lijie Zhu, Pengfei Yang, Yahuan Huan, Shuangyuan Pan, Zhaoqian Zhang, Fangfang Cui, Yuping Shi, Shaolong Jiang, Chunyu Xie, Min Hong, Jiatian Fu, Jingyi Hu, and Yanfeng Zhang*

Peking University, China



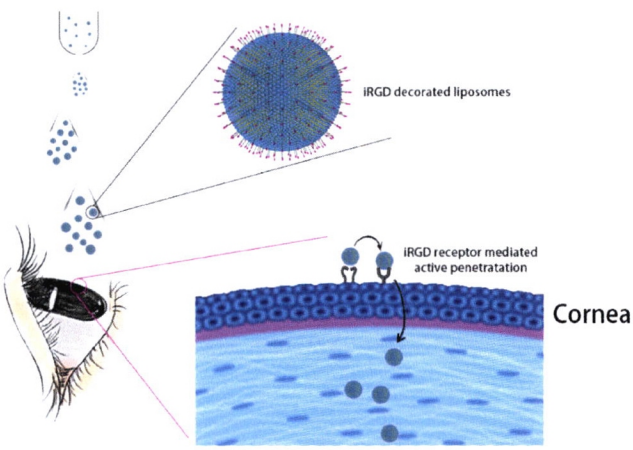
A mass of MoS_2 nanosheets powders are synthesized through a facile salt-templated low-pressure chemical vapor deposition (CVD) process, followed with a green transfer process, i.e., a facile water dissolution-filtration process by virtue of the high water-solubility of NaCl. Thus-fabricated MoS_2 nanosheets powders show wonderful dispersibility in diverse liquid solutions, allowing it to be assembled onto arbitrary substrates for developing versatile applications.

3098–3104

iRGD decorated liposomes: A novel actively penetrating topical ocular drug delivery strategy

Hai Huang[1], Xiaorong Yang[1], Huili Li[1], Hansi Lu[1], James Oswald[2], Yongmei Liu[1], Jun Zeng[1], Chaohui Jin[1], Xingchen Peng[1], Jiyan Liu[1], and Xiangrong Song[1,*]

[1] Sichuan University, China
[2] University of Waterloo, Canada



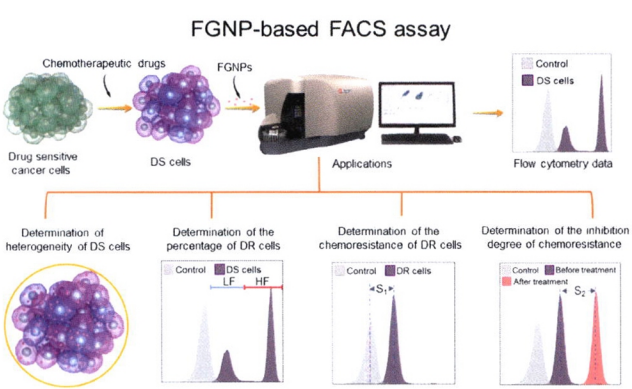
An iRGD decorated liposome was developed for ocular drug delivery via topical administration, which could prolong the corneal retention time and enhance corneal permeability in an iRGD receptor mediated manner.

3105–3109

Fluorescent glycan nanoparticle-based FACS assays for the identification of genuine drug-resistant cancer cells with differentiation potential

Chenglong Wang[1,2], Wencai Guan[2], Rong Chen[1], Yael Levi-Kalisman[3], Yichun Xu[4], Liwen Zhang[4], Min Zhou[1,*], Guoxiong Xu[2,*], and Hongjing Dou[1,*]

[1] Shanghai Jiao Tong University, China
[2] Fudan University, China
[3] Hebrew University of Jerusalem, Israel
[4] Shanghai Biochip Co. Ltd. and National Engineering Center for Biochip at Shanghai, China



A fluorescent glycan nanoparticle (FGNP)-based fluorescence-activated cell sorting (FACS) assay was developed to identify genuine drug-resistant cancer cells and detect cancer resistance.

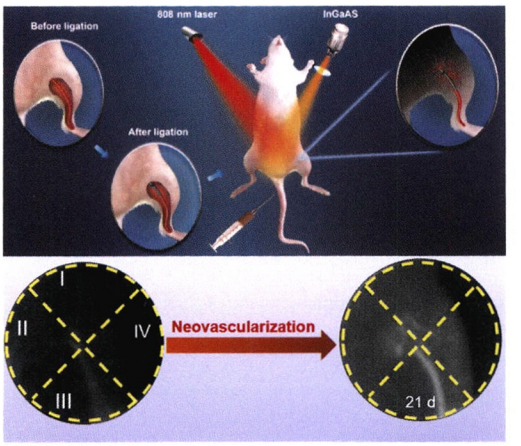
3110–3122

万方数据

Tracking the *in vivo* spatio-temporal patterns of neovascularization via NIR-II fluorescence imaging

Mo Chen, Sijia Feng, Yimeng Yang, Yunxia Li, Jian Zhang, Shiyi Chen*, and Jun Chen*

Fudan University, China



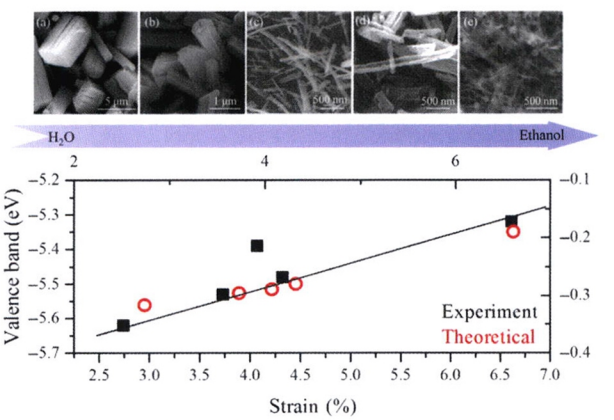
The study presents a second near-infrared (NIR-II) fluorescence imaging strategy based on lead sulfide quantum dots to dynamically monitor vascular injury and spatio-temporal patterns of neovascularization *in vivo*, which will further assist with studying the underlying mechanism of neovascularization.

3123–3129

Morphology and strain control of hierarchical cobalt oxide nanowire electrocatalysts via solvent effect

Xiuming Bu, Xiongyi Liang, Kingsley O. Egbo, Zebiao Li, You Meng, Quan Quan, Yang Yang Li, Kin Man Yu, Chi-Man Lawrence Wu*, and Johnny C. Ho*

City University of Hong Kong, Hong Kong, China



The combination of morphological design and strain control strategy: Porous Co_3O_4 nanowires with tunable compressive strain were prepared via thermal-oxidation-transformation of easily prepared oxalic acid-cobalt nitrate composite. The prepared catalyst exhibits the excellent activity and stability for oxygen evolution reaction, which is even better than the noble-metal catalyst of RuO_2.

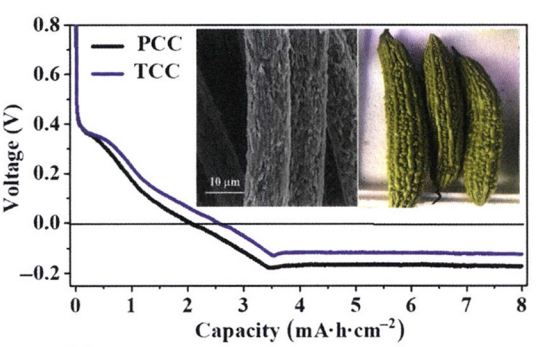
3130–3136

Ultra-stable K metal anode enabled by oxygen-rich carbon cloth

Yangyang Xie[1], Junxian Hu[1], Zexun Han[1], Hailin Fan[2], Jingyu Xu[1], Yanqing Lai[1], and Zhian Zhang[1,*]

[1] Central South University, China

[2] Contemporary Amperex Technology Co., Ltd., China



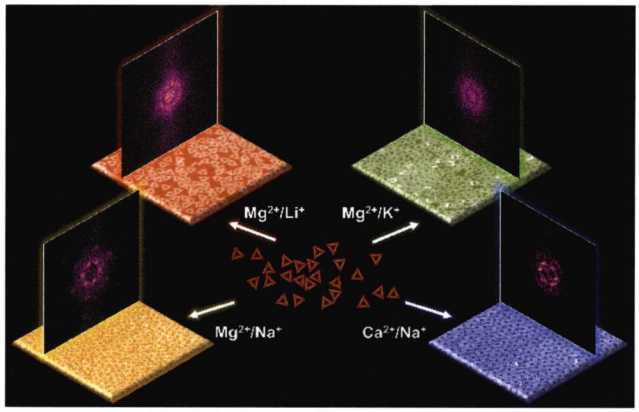
An oxygen-rich treated carbon cloth (TCC) with K-philic functional groups as K metal anode host enables to reduce the over-potential and uniform the distribution of deposited K. Both density function theory (DFT) calculations and experiment results demonstrate that the introduced oxygen functional groups can enhance the affinity of K and matrix and facilitate to uniform deposition. Even at high current density and high capacity, TCC electrode still exhibits excellent cycling stability with a momordica charantia-like morphology.

3137–3141

Self-assembly of highly ordered DNA origami lattices at solid-liquid interfaces by controlling cation binding and exchange

Yang Xin[1], Salvador Martinez Rivadeneira[1], Guido Grundmeier[1], Mario Castro[2], and Adrian Keller[1,*]

[1] Paderborn University, Germany
[2] Universidad Pontificia Comillas de Madrid, Spain



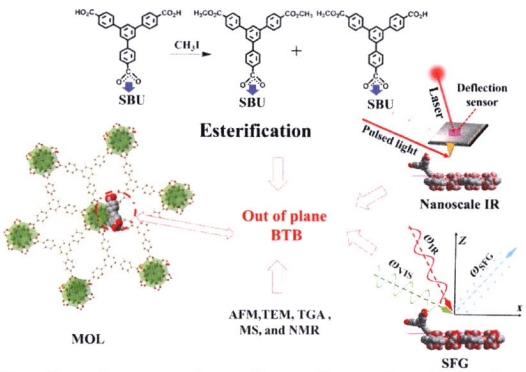
The effect of different cation species on the surface-assisted assembly of DNA origami lattices is investigated by high-speed atomic force microscopy (AFM). By rationally selecting the employed monovalent and divalent cation species for their DNA- and mica-binding properties, DNA origami lattices of unprecedented quality and order can be obtained.

3142–3150

Probing surface structure on two-dimensional metal-organic layers to understand suppressed interlayer packing

Peican Chen, Yi Liu, Xuefu Hu, Xiaolin Liu, En-Ming You, Xudong Qian, Jiawei Chen, Liangping Xiao, Lingyun Cao, Xinxing Peng, Zhongming Zeng, Yibing Jiang, Song-Yuan Ding, Honggang Liao, Zhaohui Wang, Da Zhou, and Cheng Wang*

Xiamen University, China



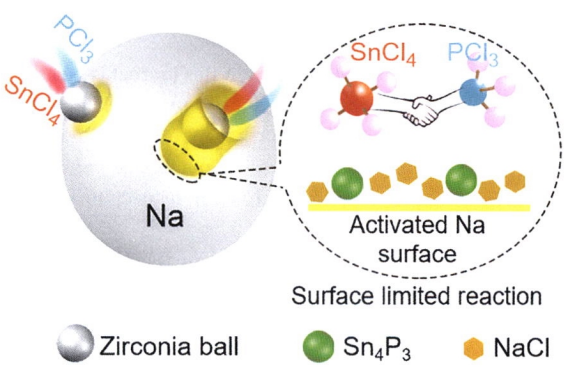
Dangling ligands on surface of two-dimensional metal-organic layer were detected by a combination of surface sensitive techniques including sum-frequency generation spectroscopy, nanoscale infrared microscopy, aberration-corrected transmission electron microscopy, and atomic force microscopy, as well as compositional analysis. This finding well explains the suppression of interlayer packing of these two-dimensional (2D) materials.

3151–3156

Ultrafine Sn_4P_3 nanocrystals from chloride reduction on mechanically activated Na surface for sodium/lithium ion batteries

Zhiliang Liu[1,2], Xiangxi Wang[1], Zhuoyan Wu[3], Sungjin Yang[2], Shaolei Yang[2], Shunpeng Chen[2], Xinteng Wu[1], Xinghua Chang[4], Piaoping Yang[1,*], Jie Zheng[2,*], and Xingguo Li[2,*]

[1] Harbin Engineering University, China
[2] Peking University, China
[3] China Three Gorges Corporation, China
[4] Central South University, China



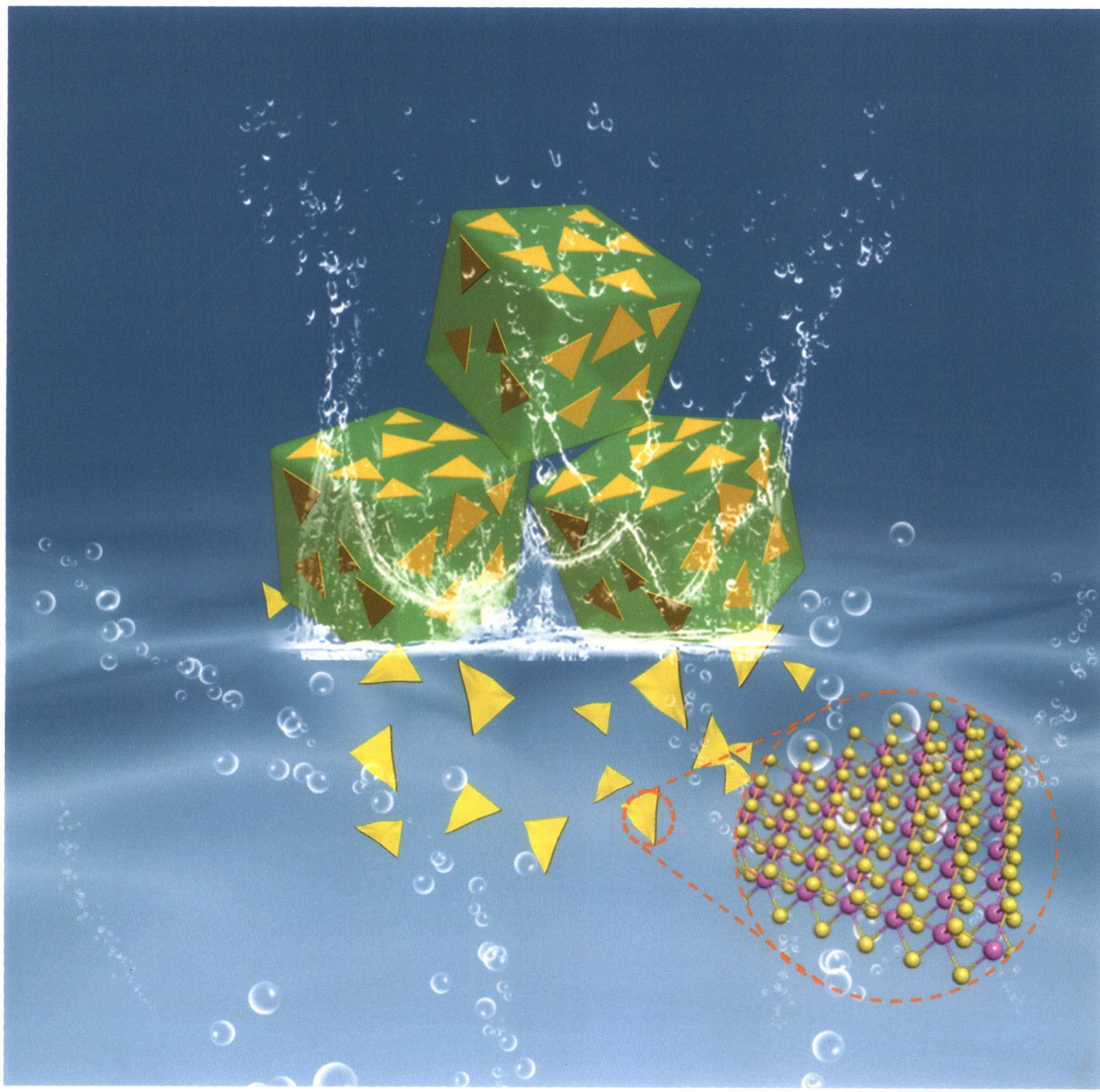
A simple and controllable method is developed to prepare ultrafine Sn_4P_3 nanocrystals through simultaneous reduction of $SnCl_4$ and PCl_3 on mechanically activated Na surface and *in-situ* combination.

3157–3164

ISSN 1998-0124
CN 11-5974/O4

Nano Research

Volume 13 · Number 11 · November 2020
(Monthly, started in 2008)



纳米研究（英文版）（月刊，2008年创刊） 第13卷 第11期 2020年11月出版

Editors-in-Chief	Yadong Li, Shoushan Fan	主管单位	中华人民共和国教育部
Sponsored by	Tsinghua University & Chinese Chemical Society	主办单位	清华大学
Edited by	Nano Research Editorial Office		中国化学会
Published by	Tsinghua University Press	主　　编	李亚栋　范守善
Address	Xueyan Building,	编　　辑	《纳米研究》编辑部
	Tsinghua University,	出版发行	清华大学出版社有限公司
	Beijing 100084, China	印刷单位	北京地大彩印有限公司
Website	www.theNanoResearch.com & www.springer.com/journal/12274		

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