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Conductive polymers for stretchable supercapacitors

Aqueous organic redox flow batteries

Vertically-aligned nanostructures for electrochemical energy storage



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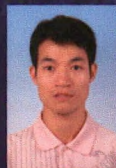
Shaojun Guo



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Aleksandra Vojvodic



Dingsheng Wang



Dunwei Wang



Shuangyin Wang



Changzheng Wu



Hui Wu



Yujie Xiong

Nano
Research

**Young Innovators
Award
in NanoEnergy
2019**

Special Issue- NR45



Yuan Yang



Wei You



Guihua Yu



Yan Yu



Jovana Zečević



Qiang Zhang



Tierui Zhang



Xinbo Zhang



Yanfeng Zhang



Jing Zhao



Gengfeng Zheng



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Contents

Editorial

The *Nano Research* Young Innovators (NR45) Awards in nanoenergy

Hailiang Wang^{1,*} and Hongjie Dai^{2,*}

¹ Yale University, USA

² Stanford University, USA

1975–1977

Review Articles

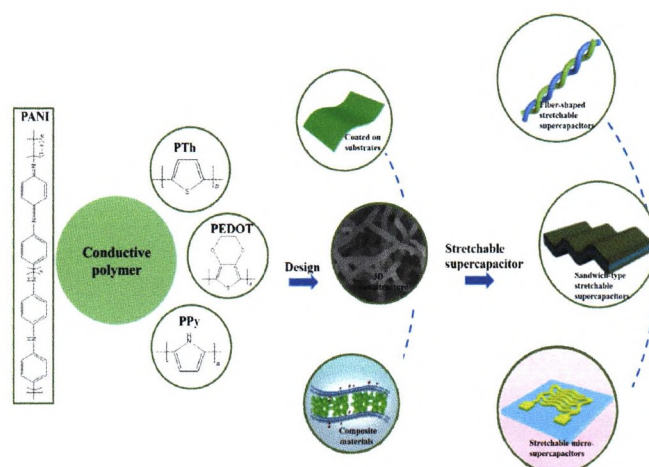
Conductive polymers for stretchable supercapacitors

Yaqun Wang^{1,*}, Yu Ding², Xuelin Guo², and Guihua Yu^{2,*}

¹ Shandong University of Science and Technology, China

² The University of Texas at Austin, USA

1978–1987



This review summarizes the material and structural design for conductive polymer-based stretchable supercapacitors and discusses the challenge and important directions in this emerging field.

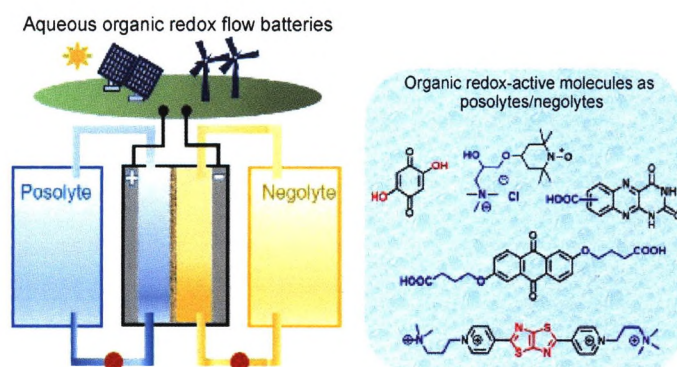
Aqueous organic redox flow batteries

Vikram Singh^{1,2}, Soeun Kim^{1,2}, Jungtaek Kang¹, and Hye Ryung Byon^{1,2,*}

¹ Korea Advanced Institute of Science and Technology (KAIST), Republic of Korea

² KAIST Institute for NanoCentury, Republic of Korea

1988–2001



Recent developments in aqueous organic redox flow batteries, including the molecular design and the corresponding cycling performance as these organic redox molecules are employed as either the negolyte or posolyte. New strategies using nanotechnology and our perspective for the future development of this rapidly growing field are included.

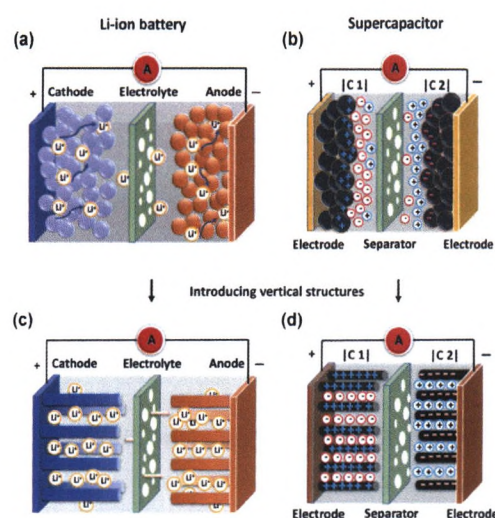
Vertically-aligned nanostructures for electrochemical energy storage

Xue Wang^{1,2}, Tianyang Wang², James Borovilas², Xiaodong He^{1,*}, Shanyi Du^{1,*}, and Yuan Yang^{2,*}

¹ Harbin Institute of Technology, China

² Columbia University, USA

2002–2017



This review summarizes battery kinetics to illustrate the importance of low tortuosity in electrodes, and then introduces various methods to create vertically aligned nanostructures, such as direct growth, templating and microfabrications.

Ni-based cathode materials for Na-ion batteries

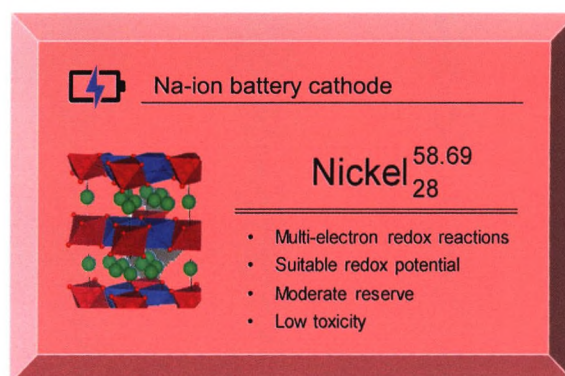
Chenglong Zhao^{1,2}, Yaxiang Lu^{1,2,*}, Liquan Chen¹, and Yong-Sheng Hu^{1,2,3,*}

¹ Institute of Physics, Chinese Academy of Sciences, China

² University of Chinese Academy of Sciences, China

³ Yangtze River Delta Physics Research Center Co. Ltd, China

2018–2030



The potential strategies on designing layered oxide cathodes of Na-ion batteries have been introduced through the discussion of Ni-based cathode materials.

Crystal phase engineering on photocatalytic materials for energy and environmental applications

Song Bai^{1,2,*}, Chao Gao², Jingxiang Low², and Yujie Xiong^{2,*}

¹ Zhejiang Normal University, China

² University of Science and Technology of China, China

2031–2054



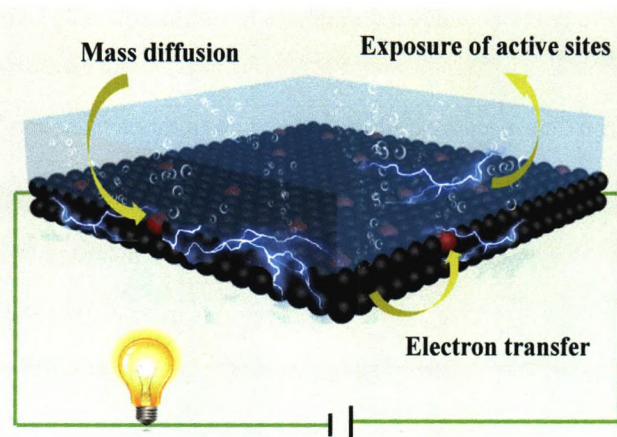
Phase design of photocatalytic materials has shown great promise for enhanced performance in energy and environmental applications. This review summarizes the state-of-the-art progress on the phase-engineered photocatalytic materials with fundamental mechanisms.

Rational design of three-phase interfaces for electrocatalysis

Yuqing Wang, Yuqin Zou*, Li Tao, Yanyong Wang, Gen Huang, Shiqian Du, and Shuangyin Wang*

Hunan University, China

2055–2066



This review covers a summarization of design principles and synthetic strategies for triple-phase interfaces to optimize electrocatalytic performance of gas-involving electrocatalysis.

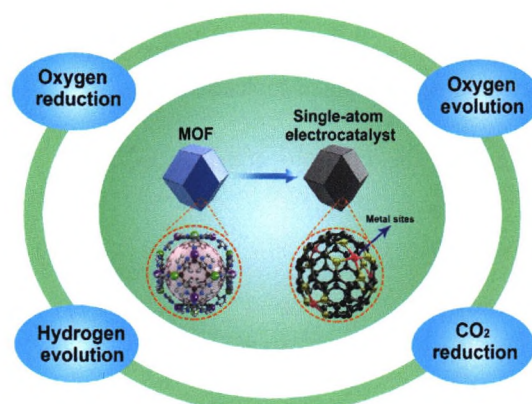
Metal organic frameworks derived single atom catalysts for electrocatalytic energy conversion

Tingting Sun¹, Lianbin Xu², Dingsheng Wang^{1,*}, and Yadong Li¹

¹ Tsinghua University, China

² Beijing University of Chemical Technology, China

2067–2080



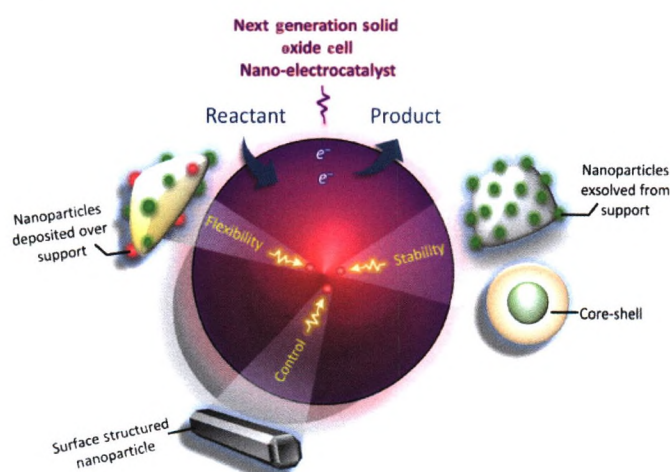
We summarize the recent progress in the synthesis and characterization of metal-organic framework (MOF)-derived single atom catalysts, mainly focusing on their electrocatalytic applications in the oxygen reduction reaction (ORR), hydrogen evolution reaction (HER), oxygen evolution reaction (OER), and CO₂ reduction.

Nanoengineering of solid oxide electrochemical cell technologies: An outlook

Juliana Carneiro and Eranda Nikolla*

Wayne State University, USA

2081–2092



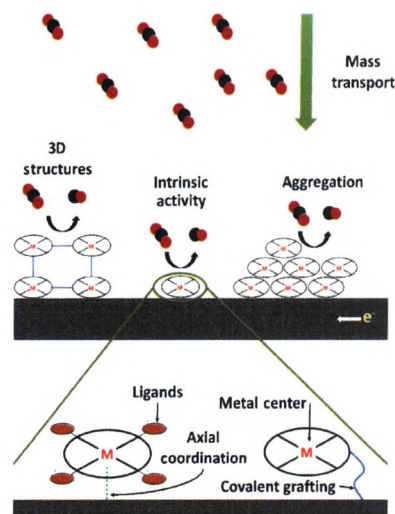
In this perspective, we discuss the progress in nanoengineering electrodes for solid oxide electrochemical cells (SOCs), highlighting the advantages and challenges of the use of nano-electrocatalysts. We suggest approaches that merge important nanoengineering strategies in order to obtain nano-structured electrodes with optimal electrocatalytic activity, selectivity and stability.

Heterogeneous molecular catalysts for electrocatalytic CO₂ reduction

Nathan Corbin, Joy Zeng, Kindle Williams, and Karthish Manthiram*

Massachusetts Institute of Technology, USA

2093–2125



Molecular catalysts immobilized onto electrodes are discussed for electrocatalytic CO₂ reduction. The various underlying factors and design strategies contributing to observed performance are discussed to provide an overview of the field.

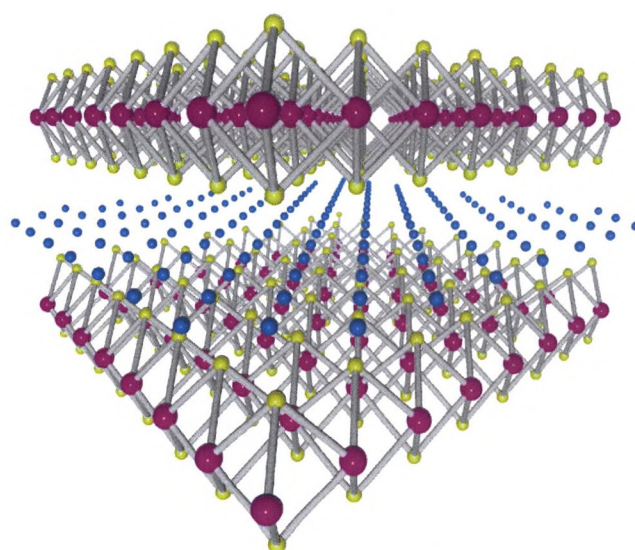
Recent progress on *in situ* characterizations of electrochemically intercalated transition metal dichalcogenides

Sajad Yazdani^{1,2}, Milad Yarali^{1,2}, and Judy J. Cha^{1,2,*}

¹ Yale University, USA

² Yale University West Campus, USA

2126–2139



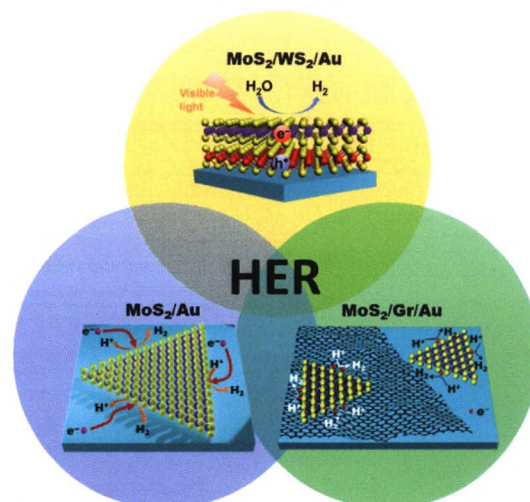
This review outlines the recent progress on the *in situ* studies of the electrochemical intercalation in transition metal dichalcogenides.

Microscopic insights into the catalytic mechanisms of monolayer MoS₂ and its heterostructures in hydrogen evolution reaction

Min Hong, Jianping Shi, Yahuan Huan, Qin Xie, and Yanfeng Zhang*

Peking University, China

2140–2149



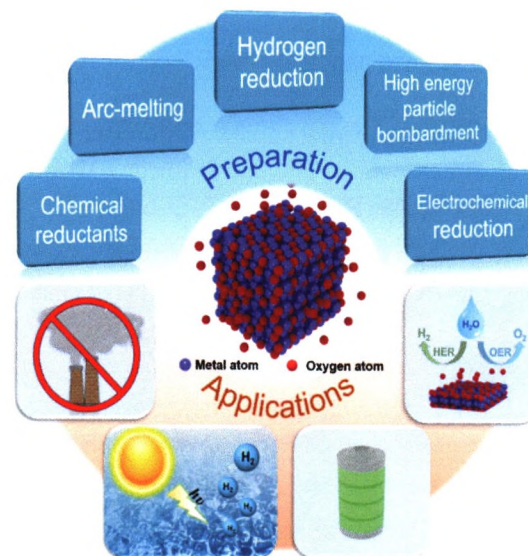
The model systems of MoS₂/Au, MoS₂/graphene (Gr)/Au and MoS₂/WS₂/Au constructed for hydrogen evolution reaction are comprehensively introduced. The underlying catalytic mechanisms based on the on-site scanning tunneling microscopy/spectroscopy investigations are also discussed.

Oxygen-deficient metal oxides: Synthesis routes and applications in energy and environment

Di Zu, Haiyang Wang, Sen Lin, Gang Ou, Hehe Wei, Shuqing Sun*, and Hui Wu*

Tsinghua University, China

2150–2163



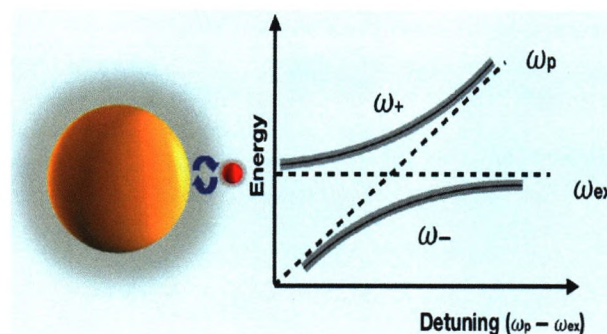
We have summarized recent progress of oxygen-deficient metal oxide nanomaterials in preparation methods and applications in energy and environment fields.

Plasmon-exciton interaction in colloiddally fabricated metal nanoparticle-quantum emitter nanostructure

Yi Luo and Jing Zhao*

University of Connecticut, USA

2164–2171



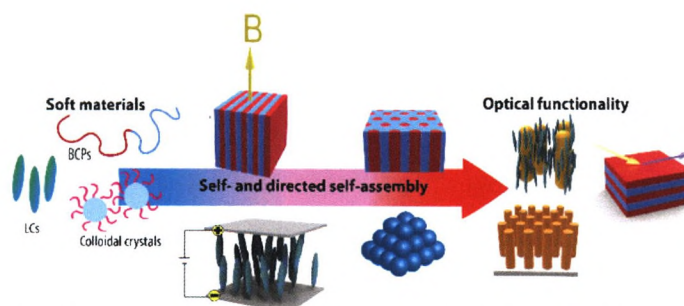
Colloidal methods have been applied to hybrid nanostructures composed of plasmonic nanoparticle and quantum emitters. Unique optical features of these nanostructures arise from the energy exchange between plasmons and excitons in the weak, semi-strong and strong coupling regimes.

Optical materials and metamaterials from nanostructured soft matter

Uri R. Gabinet and Chinedum O. Osuji*

University of Pennsylvania, USA

2172–2183



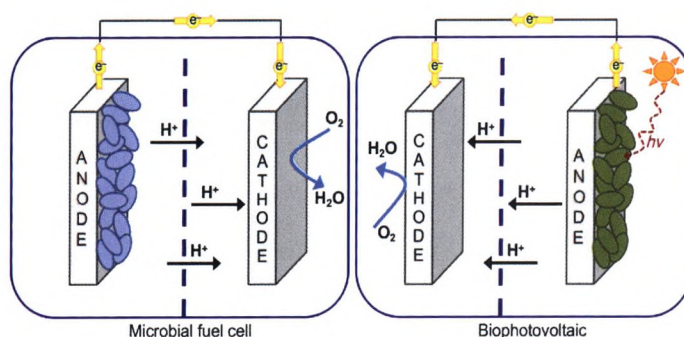
Self-assembly of soft matter leads to nanostructured materials. In this review we address how such systems can be utilized to advance myriad optical and metamaterial applications.

Enhancing bioelectricity generation in microbial fuel cells and biophotovoltaics using nanomaterials

Mohammed Mouhib¹, Alessandra Antonucci¹, Melania Reggente¹, Amirmostafa Amirjani^{1,2}, Alice J. Gillen¹, and Ardemis A. Boghossian^{1,*}

¹ Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland

² Amirkabir University of Technology (Tehran Polytechnic), Iran



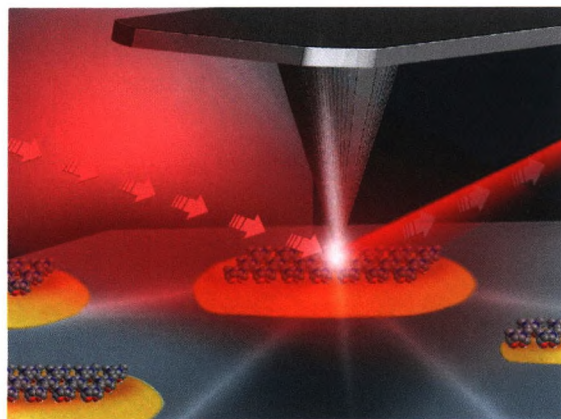
Interfacing biological parts with nanoparticles is a promising approach to increase the overall efficiency of microbial fuel cells and biophotovoltaics.

2184–2199

Challenges and opportunities in IR nanospectroscopy measurements of energy materials

Elad Gross*

The Hebrew University of Jerusalem, Israel



Infrared (IR) nanospectroscopy enables the extraction of detailed chemical information at the nanoscale. As described in this review paper, these measurements provide the capabilities to identify the ways by which local properties influence the global performances of energy materials, such as solar cells and heterogeneous catalysts.

2200–2210

Research Articles

Boosting the rate capability of multichannel porous TiO₂ nanofibers with well-dispersed Cu nanodots and Cu²⁺-doping derived oxygen vacancies for sodium-ion batteries

Ying Wu¹, Zengxi Wei², Rui Xu¹, Yue Gong³, Lin Gu^{3,4}, Jianmin Ma², and Yan Yu^{1,5,*}

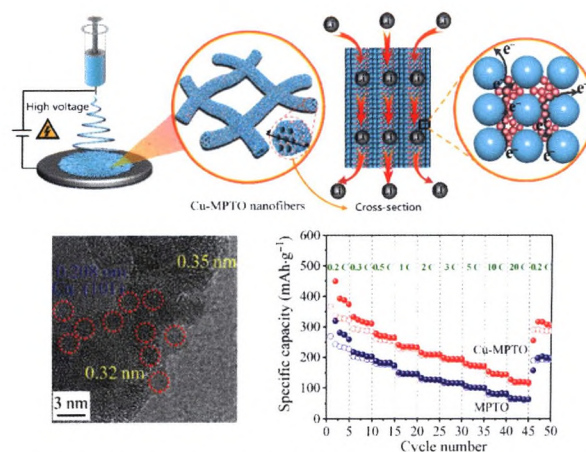
¹ University of Science and Technology of China, China

² Hunan University, China

³ Institute of Physics, Chinese Academy of Sciences, China

⁴ Collaborative Innovation Center of Quantum Matter, China

⁵ Dalian National Laboratory for Clean Energy, Chinese Academy of Sciences, China



The multichannel porous TiO₂ nanofibers with well-dispersed Cu nanodots and Cu²⁺-doping derived oxygen vacancies (denoted as Cu-MPTO) have been fabricated via electrospinning. When used as anode material for sodium ion batteries, an outstanding rate performance (120 mAh·g⁻¹ at 20 C) and a superior cycling stability for ultralong cycle life (120 mAh·g⁻¹ at 20 C and 96.5% retention over 2,000 cycles) could be obtained.

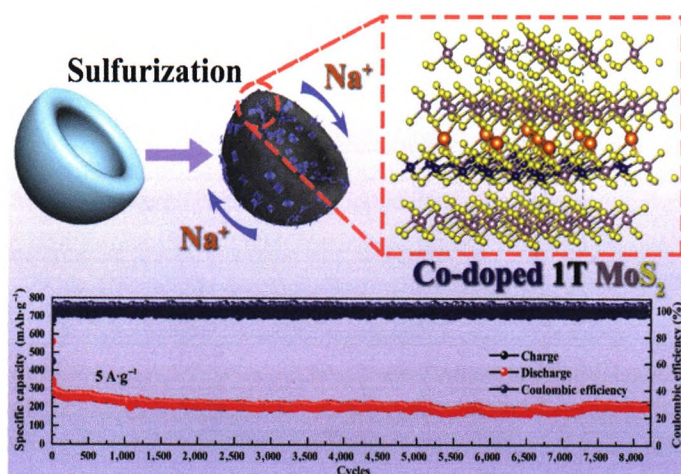
2211–2217

Co-doped 1T-MoS₂ nanosheets embedded in N, S-doped carbon nanobowls for high-rate and ultra-stable sodium-ion batteries

Peihao Li¹, Yong Yang¹, Sheng Gong², Fan Lv¹, Wei Wang¹, Yiju Li¹, Mingchuan Luo¹, Yi Xing¹, Qian Wang¹, and Shaojun Guo^{1,*}

¹ Peking University, China

² Massachusetts Institute of Technology, USA



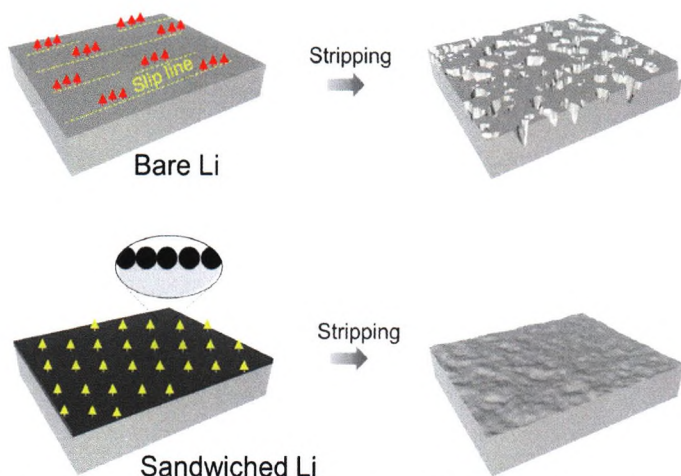
Co-doped 1T-MoS₂ nanosheets embedded in N, S-doped carbon nanobowls show extraordinary rate and cycling capability in sodium-ion batteries.

2218–2223

Dendrite-free sandwiched ultrathin lithium metal anode with even lithium plating and stripping behavior

Tao Li, Peng Shi, Rui Zhang, He Liu, Xin-Bing Cheng, and Qiang Zhang*

Tsinghua University, China



Sandwiched Li enables even Li stripping/plating morphologies through diminishing the metallurgical nonuniformity effects (slip lines) on stripping as well as by providing rich nucleation sites for Li plating.

2224–2229

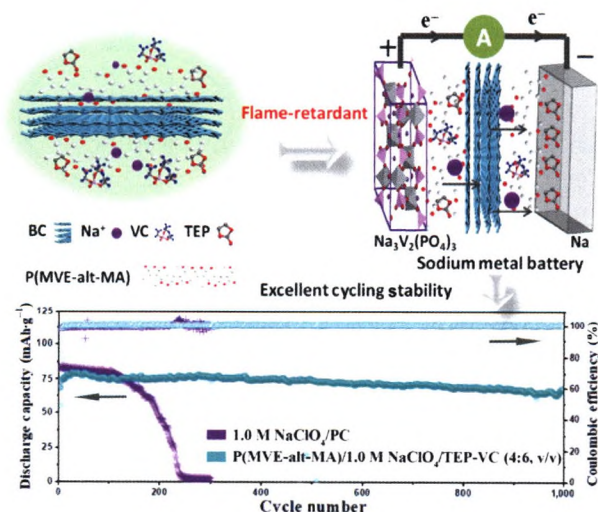
Flame-retardant quasi-solid polymer electrolyte enabling sodium metal batteries with highly safe characteristic and superior cycling stability

Jinfeng Yang^{1,2}, Min Zhang^{1,3}, Zheng Chen¹, Xiaofan Du¹, Suqi Huang^{1,3}, Ben Tang^{1,2}, Tiantian Dong¹, Han Wu¹, Zhe Yu¹, Jianjun Zhang^{1,*}, and Guanglei Cui^{1,*}

¹ Qingdao Institute of Bioenergy and Bioprocess Technology, Chinese Academy of Sciences, China

² University of Chinese Academy of Sciences, China

³ Qingdao University, China



The as-obtained flame-retardant quasi-solid polymer electrolyte consisted of poly(methyl vinyl ether-alt-maleic anhydride) (P(MVE-alt-MA)) as host, bacterial cellulose as reinforcement, and triethyl phosphate/vinylene carbonate/sodium perchlorate (TEP/VC/NaClO₄) as plasticizer, which endows Na₃V₂(PO₄)₃/Na metal batteries with superior long-term cycling stability.

2230–2237

Comprehensive study of a versatile polyol synthesis approach for cathode materials for Li-ion batteries

Hyeseung Chung¹, Antonin Grenier², Ricky Huang¹, Xuefeng Wang¹, Zachary Lebens-Higgins³, Jean-Marie Doux¹, Shawn Sallis⁴, Chengyu Song⁴, Peter Ercius⁴, Karena Chapman², Louis F. J. Piper³, Hyung-Man Cho¹, Minghao Zhang^{1,*}, and Ying Shirley Meng^{1,*}

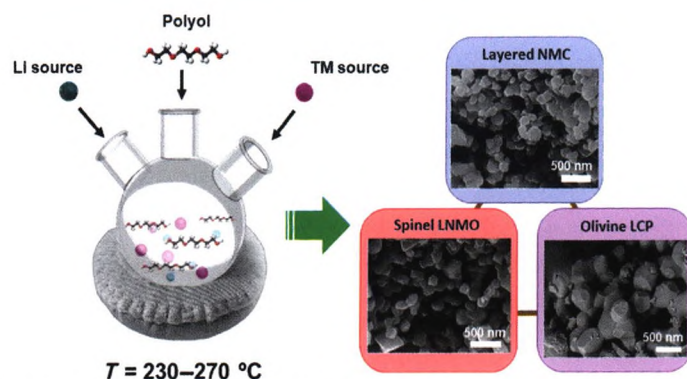
¹ University of California, San Diego, USA

² Stony Brook University, USA

³ Binghamton University, USA

⁴ Lawrence Berkeley National Laboratory, USA

2238–2249



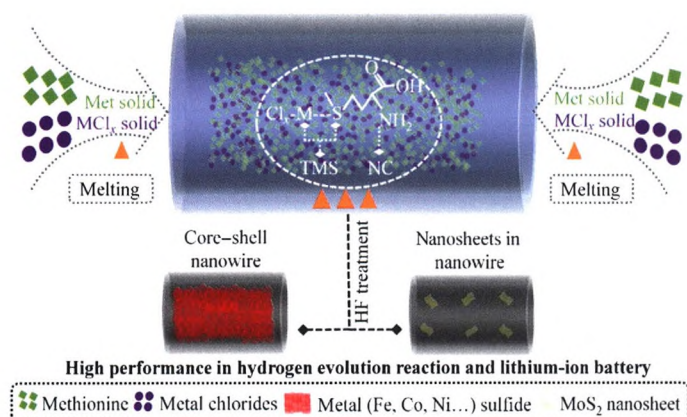
A novel polyol synthesis method has been developed for layered $\text{LiNi}_{0.4}\text{Mn}_{0.4}\text{Co}_{0.2}\text{O}_2$ (NMC), spinel $\text{LiNi}_{0.5}\text{Mn}_{1.5}\text{O}_4$ (LNMO), and olivine LiCoPO_4 (LCP) cathode materials. Reaction mechanism has been studied in detail with combination of *in situ* and *ex situ* techniques.

Solvent-free nanocasting toward universal synthesis of ordered mesoporous transition metal sulfide@N-doped carbon composites for electrochemical applications

Jiahui Zhu, Zhi Chen, Lin Jia, Yuqi Lu, Xiangru Wei, Xiaoning Wang, Winston Duo Wu, Na Han, Yanguang Li*, and Zhangxiong Wu*

Soochow University, China

2250–2258



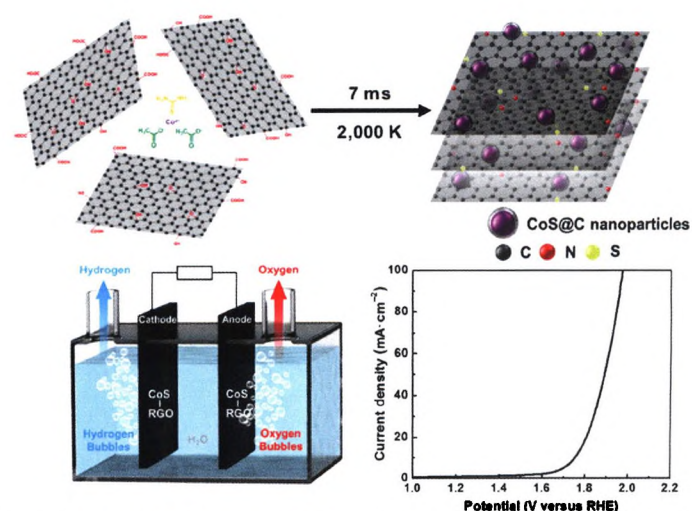
Ordered mesoporous transitional metal sulfide@N-doped carbon composites with ultrahigh surface areas, unique chemical stoichiometries and variable nano-architectures are synthesized by using a solvent-free nanocasting approach. The structure evolution over the synthesis process is depicted. The obtained materials are promising for electrochemical applications.

Millisecond synthesis of CoS nanoparticles for highly efficient overall water splitting

Yanan Chen, Shaomao Xu, Shuze Zhu, Rohit Jiji Jacob, Glenn Pastel, Yanbin Wang, Yiju Li, Jiaqi Dai, Fengjuan Chen, Hua Xie, Boyang Liu, Yonggang Yao, Lourdes G. Salamanca-Riba, Michael R. Zachariah, Teng Li, and Liangbing Hu*

University of Maryland, College Park, USA

2259–2267

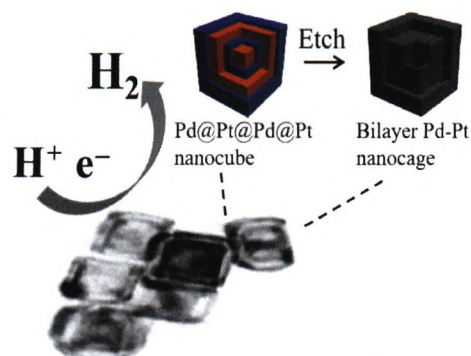


This work reports an ultrafast (~ 7 ms), *in-situ* synthesis technique for transition metal chalcogenides@ultrathin graphene core-shell electrocatalyst assisted by high temperature treatment. It is demonstrated that the cobalt sulfide (~ 20 nm in diameter)@ultrathin graphene (~ 2 nm in thickness) core-shell nanoparticles embedded in RGO nanosheets exhibit remarkable bifunctional electrocatalytic activity and stability for overall water splitting.

Fabrication of bilayer Pd-Pt nanocages with sub-nanometer thin shells for enhanced hydrogen evolution reaction

Yihe Wang, Lei Zhang, Congling Hu, Shengnan Yu, Piaoping Yang, Dongfang Cheng, Zhi-Jian Zhao, and Jinlong Gong*

Tianjin University, China



This paper describes the fabrication of bilayer Pd-Pt nanocages by etching away the Pd templates of multishelled nanocubes. These nanocages with high dispersion of the active atoms reduce hydrogen evolution reaction (HER) overpotentials and maintain long-term stability.

2268–2274

Towards maximized utilization of iridium for the acidic oxygen evolution reaction

Marc Ledendecker^{1,*}, Simon Geiger¹, Katharina Hengge¹, Joohyun Lim¹, Serhiy Cherevko³, Andrea M. Mingers¹, Daniel Göhl¹, Guilherme V. Fortunato^{1,5}, Daniel Jalalpoor², Ferdi Schüth², Christina Scheu¹, and Karl J. J. Mayrhofer^{1,3,4,*}

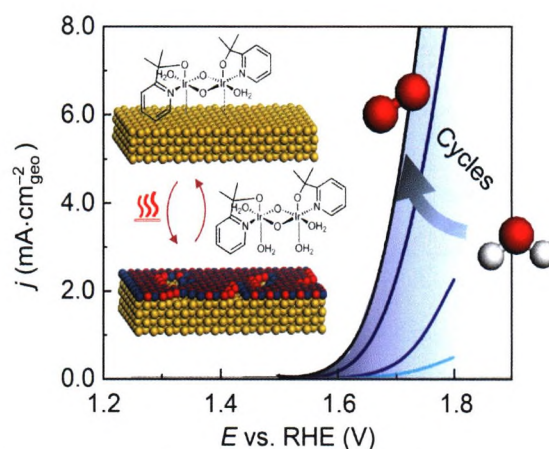
¹ Nanoanalytics and Interfaces Max-Planck-Institut für Eisenforschung GmbH, Germany

² Max-Planck-Institut für Kohlenforschung, Germany

³ Forschungszentrum Jülich, Germany

⁴ Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany

⁵ Universidade Federal de Mato Grosso do Sul, Brazil



Strategies how to obtain stable and active catalysts with maximized iridium utilization for the oxygen evolution reaction are discussed.

2275–2280

Ternary mesoporous cobalt-iron-nickel oxide efficiently catalyzing oxygen/hydrogen evolution reactions and overall water splitting

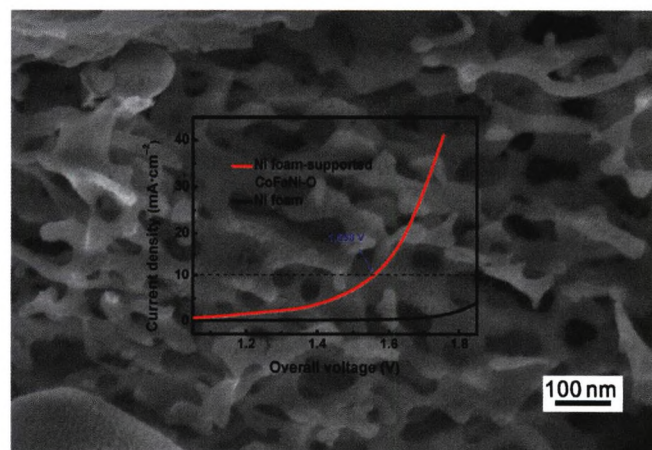
Lulu Han¹, Limin Guo^{2,3,*}, Chaoqun Dong¹, Chi Zhang⁴, Hui Gao¹, Jiazheng Niu¹, Zhangquan Peng^{3,4,*}, and Zhonghua Zhang^{1,4,*}

¹ Shandong University, China

² Jilin Engineering Normal University, China

³ Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, China

⁴ Wuyi University, China



CoFeNi-O with hierarchical bimodal channel structure was prepared via dealloying and it shows superior performance for oxygen evolution reaction (OER)/hydrogen evolution reaction (HER) with extremely low overpotentials. Overall water splitting is featured with a low voltage of 1.558 V@10 mA·cm⁻² for 25 h. Catalytic performance was enhanced because of the Co-Fe-Ni alloying effect and metallic Ni residual.

2281–2287

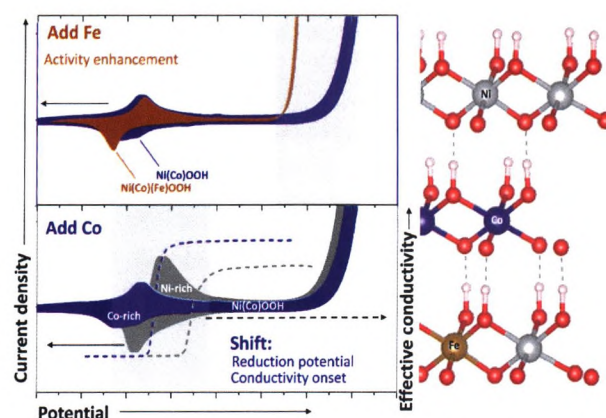
Ternary Ni-Co-Fe oxyhydroxide oxygen evolution catalysts: Intrinsic activity trends, electrical conductivity, and electronic band structure

Michaela Burke Stevens¹, Lisa J. Enman¹, Ester Hamal Korkus², Jeremie Zaffran², Christina D. M. Trang¹, James Asbury¹, Matthew G. Kast¹, Maytal Caspary Toroker^{2,*}, and Shannon W. Boettcher^{1,*}

¹ University of Oregon, USA

² Israel Institute of Technology, Israel

2288–2295



The electronic/electrochemical properties and activity of ternary Co-Ni-Fe oxyhydroxide oxygen evolution electrocatalysts are shown to be tunable based on composition. The addition of Co to Ni oxyhydroxide shifts the onset of electrical conductivity to more-negative potentials while the addition of Fe dramatically enhances activity. Calculations further show strong electronic hybridization between all the metal cations and oxygen at the valence band edge.

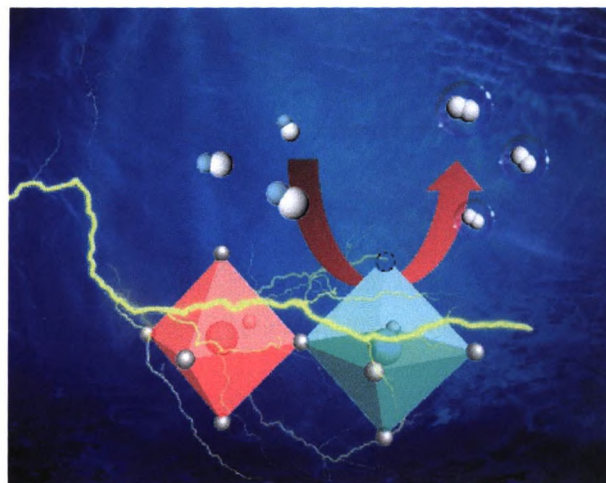
Room-temperature ligancy engineering of perovskite electrocatalyst for enhanced electrochemical water oxidation

Junchi Wu¹, Yuqiao Guo¹, Haifeng Liu², Jiyin Zhao¹, Haodong Zhou¹, Wangsheng Chu¹, and Changzheng Wu^{1,*}

¹ University of Science and Technology of China, China

² Southwest University of Science and Technology, China

2296–2301



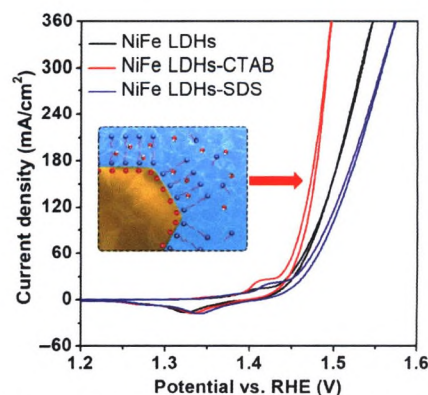
Ligancy engineering of perovskite electrocatalyst with ordered oxygen vacancies and excellent electric conductivity accelerates electrochemical evolution of O₂ in alkaline solution.

Enhancing oxygen evolution reaction by cationic surfactants

Qixian Xie, Daojin Zhou, Pengsong Li, Zhao Cai, Tianhui Xie, Tengfei Gao, Ruida Chen, Yun Kuang*, and Xiaoming Sun*

Beijing University of Chemical Technology, China

2302–2306



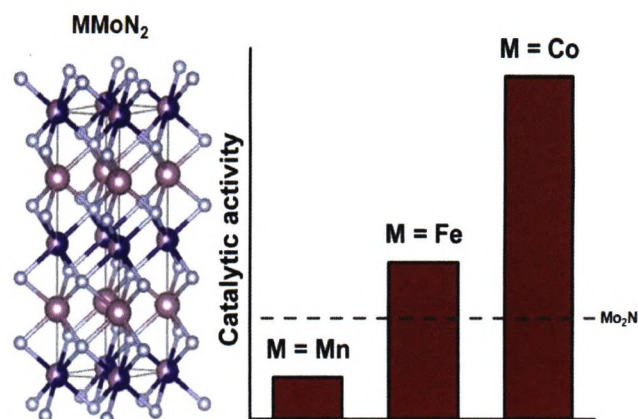
Superaerophobic nanoarray electrodes have shown their advantage in bubble releasing behavior in various gas evolution reactions. Herein we introduce cationic surfactants on the electrode surface to further enhance the water splitting performance, which pave a new way for better electrolysis system design.

Influence of 3d transition-metal substitution on the oxygen reduction reaction electrocatalysis of ternary nitrides in acid

Kevin E. Fritz¹, Yichen Yan¹, and Jin Suntivich^{1,2,*}

¹ Cornell University, USA

² Kavli Institute at Cornell for Nanoscale Science, USA



More electronegative 3d metals yield improved oxygen reduction reaction (ORR) activity in acidic environments for 3d metal substituted molybdenum and tungsten nitride catalysts.

2307–2312

Multiscale carbon foam confining single iron atoms for efficient electrocatalytic CO_2 reduction to CO

Zheng Zhang^{1,2}, Chao Ma³, Yunchuan Tu^{1,2}, Rui Si⁴, Jie Wei¹, Shuhong Zhang¹, Zhen Wang⁵, Jian-Feng Li¹, Ye Wang¹, and Dehui Deng^{1,2,*}

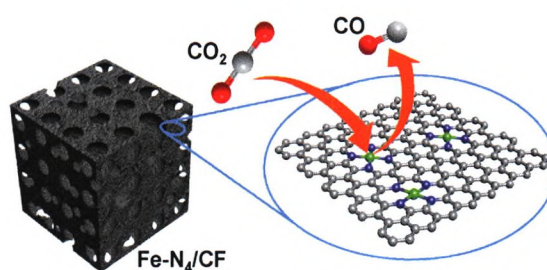
¹ Xiamen University, China

² Dalian Institute of Chemical Physics, Chinese Academy of Sciences, China

³ Hunan University, China

⁴ Shanghai Institute of Applied Physics, Chinese Academy of Sciences, China

⁵ Thermo Fisher Scientific, International Bioisland, China



A multiscale carbon foam confining single iron atoms was synthesized with the assistant of SiO_2 template. The optimized catalyst achieves a maximal CO Faradaic efficiency of 94.9% at a moderate potential of -0.5 V vs. RHE, and maintains stable over 60 h.

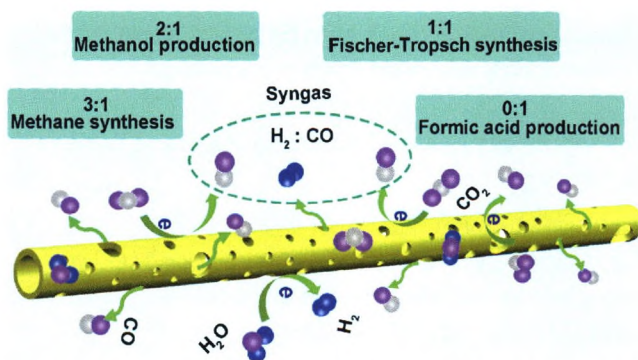
2313–2317

Highly efficient and selective CO_2 electro-reduction with atomic Fe-C-N hybrid coordination on porous carbon nematosphere

Haixia Zhong¹, Fanlu Meng^{1,2}, Qi Zhang¹, Kaihua Liu^{1,2}, and Xinbo Zhang^{1,*}

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

² Jilin University, China



Fe and N doping porous carbon nematosphere (FeNPCN) is developed as the excellent carbon dioxide reduction (CO_2RR) electrocatalyst in aqueous electrolyte, which possesses great potential application in CO_2 reduction and syngas related industry.

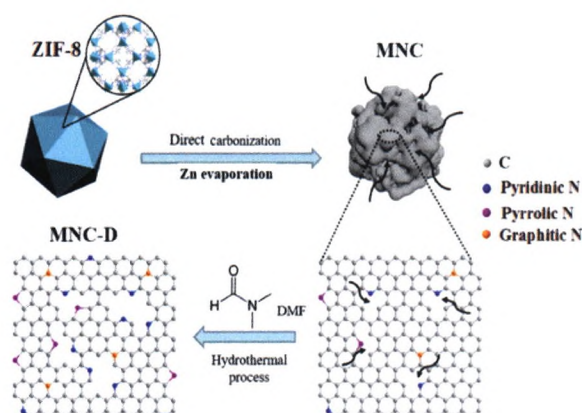
2318–2323

Enhanced N-doping in mesoporous carbon for efficient electrocatalytic CO₂ conversion

Min Kuang, Anxiang Guan, Zhengxiang Gu, Peng Han, Linping Qian, and Gengfeng Zheng*

Fudan University, China

2324–2329



We developed a facile strategy to generate mesoporous N-doped carbon frameworks with tunable configurations and contents of N dopants, by using a secondary doping process via the treatment of a N,N-dimethylformamide (DMF) solvent. After the DMF treatment, the obtained N-doped carbon catalyst possesses a much increased density of pyridinic N and defects, which enhance the activation and adsorption of CO₂ molecules, thus increasing the activity of CO₂ reduction reaction (CO₂RR).

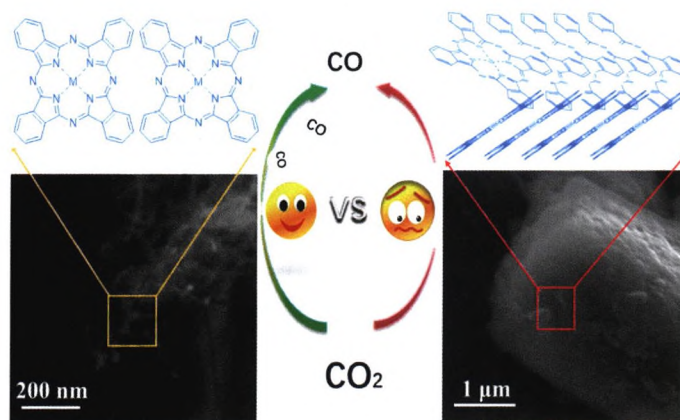
Revealing the hidden performance of metal phthalocyanines for CO₂ reduction electrocatalysis by hybridization with carbon nanotubes

Zhan Jiang^{1,2}, Yang Wang^{1,2,*}, Xiao Zhang², Hongzhi Zheng², Xiaojun Wang², and Yongye Liang^{2,*}

¹ Harbin Institute of Technology, China

² Southern University of Science and Technology, China

2330–2334



Metal phthalocyanine/carbon nanotube hybrids are prepared to study their catalytic performance for CO₂ electroreduction. These hybrids show higher activity, better stability and unambiguous performance compared to molecules directly loaded on electrode with significant aggregation.

Enhancing catalytic H₂ generation by surface electronic tuning of systematically controlled Pt-Pb nanocrystals

Bin E^{1,3,4}, Bolong Huang², Nan Zhang¹, Qi Shao¹, Yujing Li^{3,4}, and Xiaoqing Huang^{1,*}

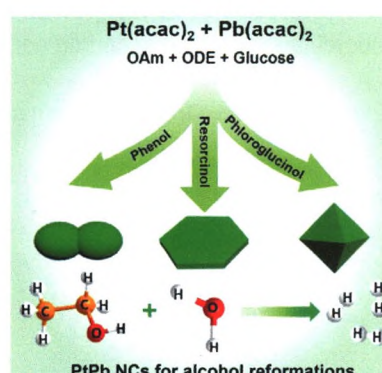
¹ Soochow University, China

² The Hong Kong Polytechnic University, Hong Kong, China

³ Beijing Institute of Technology, China

⁴ China University of Petroleum, China

2335–2340



Well-defined PtPb nanocrystals (NCs) have been selectively synthesized via an effective method, and the optimized PtPb octahedra nanocrystals (ONCs)/C is the most active catalyst for the ethanol reforming to H₂. X-ray photoelectron spectroscopy (XPS) reveals that the high Pt(0)/Pt(II) ratio in PtPb NCs/C enhances the alcohols reforming. The density functional theory (DFT) studies show the PtPb ONCs possess the highest surface averaged electronic occupation for unit Pt-atom, matching well with XPS results.

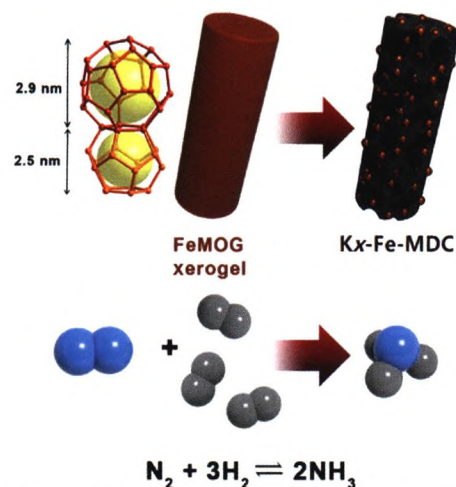
Highly efficient K-Fe/C catalysts derived from metal-organic frameworks towards ammonia synthesis

Pengqi Yan¹, Wenhan Guo¹, Zibin Liang¹, Wei Meng¹, Zhen Yin², Siwei Li¹, Mengzhu Li¹, Mengtao Zhang¹, Jie Yan¹, Dequan Xiao³, Ruqiang Zou^{1,*}, and Ding Ma^{1,*}

¹ Peking University, China

² Tianjin Polytechnic University, China

³ University of New Haven, USA



K-Fe/C catalyst developed by Fe-based metal-organic framework (MOF) gel shows high efficiency and thermal stability on ammonia synthesis. The promotion of potassium was studied.

2341–2347

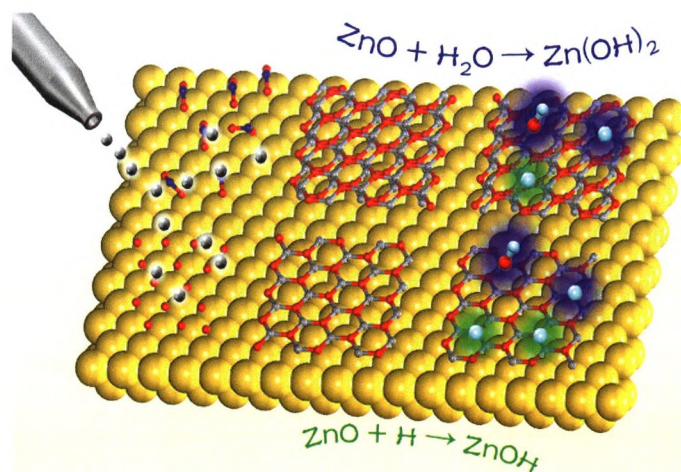
Controlled growth of uniform two-dimensional ZnO overlayers on Au(111) and surface hydroxylation

Hao Wu^{1,2}, Qiang Fu^{1,*}, Yifan Li^{1,2}, Yi Cui³, Rui Wang³, Nan Su^{1,2}, Le Lin¹, Aiyi Dong¹, Yanxiao Ning¹, Fan Yang¹, and Xinhe Bao^{1,2}

¹ Dalian Institute of Chemical Physics, Chinese Academy of Sciences, China

² University of Science and Technology of China, China

³ Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Sciences, China



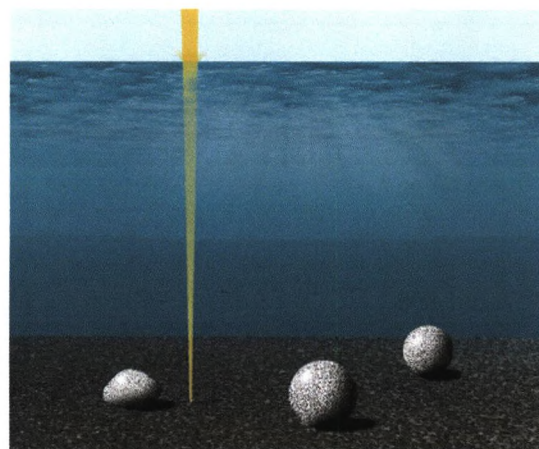
Controlled growth of uniform monolayer and bilayer ZnO nanostructures on Au(111) has been achieved using O_3 and NO_2 , respectively, and strong hydroxylation of the two-dimensional ZnO overlayers was observed in milli-bar water vapor or with atomic hydrogen species.

2348–2354

Assessment of oxide nanoparticle stability in liquid phase transmission electron microscopy

Mark J. Meijerink, Krijn P. de Jong, and Jovana Zečević*

Utrecht University, The Netherlands



Liquid phase transmission electron microscopy (LP-TEM) has a power to provide unique insight in nanoscale dynamic processes involving oxides nanomaterials, but material stability during imaging remains a challenge. Here we demonstrate that there is a correlation between oxide stability in LP-TEM and Gibbs free energy of hydration, which can aid in assessment of oxide suitability for LP-TEM.

2355–2363

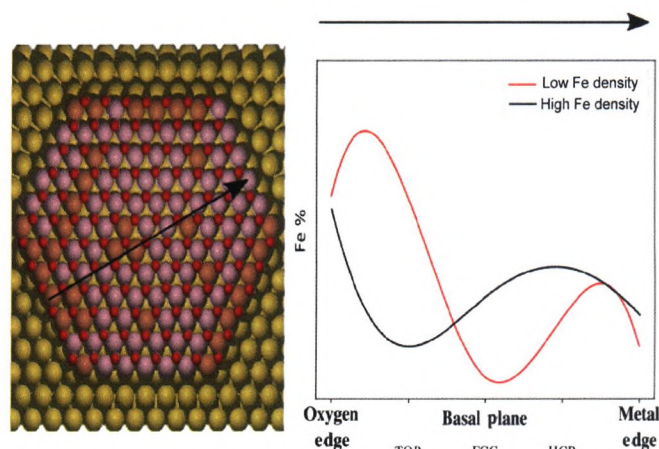
Anisotropic iron-doping patterns in two-dimensional cobalt oxide nanoislands on Au(111)

Anthony Curto¹, Zhaozong Sun², Jonathan Rodríguez-Fernández², Liang Zhang¹, Ayush Parikh¹, Ting Tan¹, Jeppe V. Lauritsen², and Aleksandra Vojvodic^{1,*}

¹ University of Pennsylvania, USA

² Aarhus University, Denmark

2364–2372



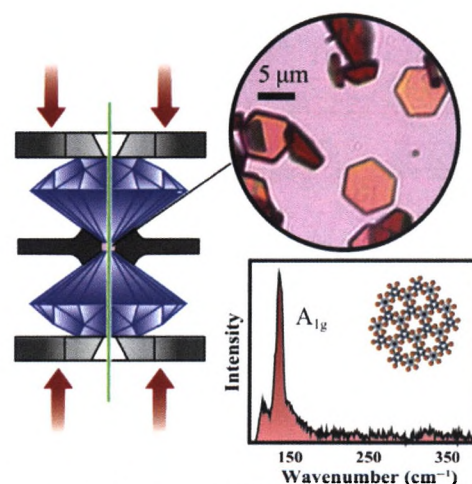
A combined density functional theory (DFT) and scanning tunneling microscopy (STM) approach is used to predict the Fe-dopant distribution and clustering of Fe-doped CoO nanoisland. We find an anisotropic Fe-dopant incorporation pattern throughout the nanoisland with the most favorable Fe incorporation site at the oxygen edge and a change in Fe incorporation site preference upon clustering occurring at high Fe-dopant densities.

Pressure-dependent phase transition of 2D layered silicon telluride (Si_2Te_3) and manganese intercalated silicon telluride

Virginia L. Johnson, Auddy Anilao, and Kristie J. Koski*

University of California, Davis, USA

2373–2377



Two-dimensional (2D) layered silicon telluride (Si_2Te_3) and Mn-intercalated Si_2Te_3 nanoplates were compressed to 12 GPa using diamond anvil cell techniques and Raman spectroscopy. A semiconductor to metal phase transition is identified.

Dependence of interface energetics and kinetics on catalyst loading in a photoelectrochemical system

Yumin He¹, Srinivas Vanka^{2,4}, Tianyue Gao¹, Da He¹, Jeremy Espano¹, Yanyan Zhao¹, Qi Dong¹, Chaochao Lang¹, Yongjie Wang², Thomas W. Hamann³, Zetian Mi², and Dunwei Wang^{1,*}

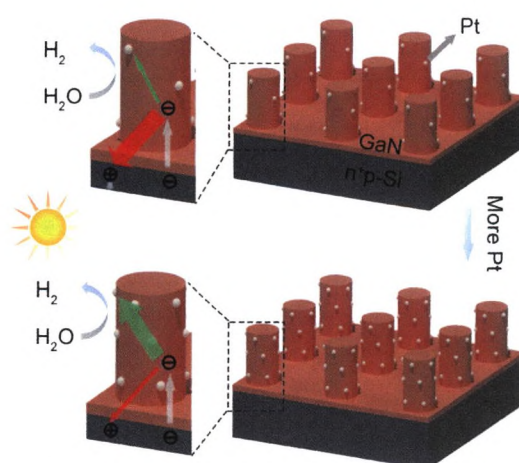
¹ Boston College, USA

² University of Michigan, USA

³ Michigan State University, USA

⁴ McGill University, Canada

2378–2384



Pt loading amount affects charge transfer and charge recombination at the Si/GaN interface in a GaN-protected Si photocathode with a buried junction.

Supramolecular precursor strategy for the synthesis of holey graphitic carbon nitride nanotubes with enhanced photocatalytic hydrogen evolution performance

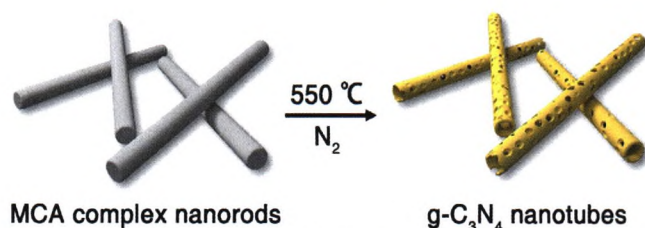
Xiaoshuai Wang^{1,3}, Chao Zhou¹, Run Shi¹, Qinqin Liu³, Geoffrey I. N. Waterhouse⁴, Lizhu Wu¹, Chen-Ho Tung¹, and Tierui Zhang^{1,2,*}

¹ Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, China

² University of Chinese Academy of Sciences, China

³ Jiangsu University, China

⁴ The University of Auckland, New Zealand



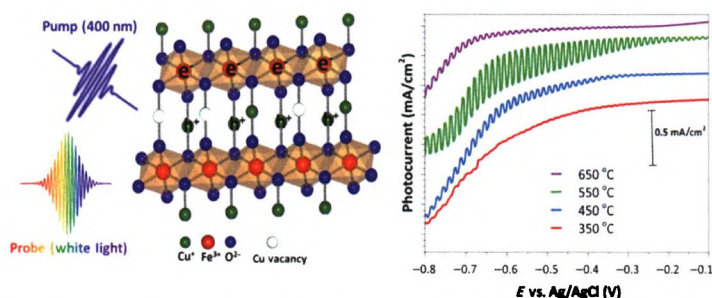
A simple one-step thermal polymerization method has been developed for synthesis of holey graphitic carbon nitride ($g\text{-C}_3\text{N}_4$) nanotubes, which showed enhanced photocatalytic H_2 production activity under visible-light irradiation compared to traditional $g\text{-C}_3\text{N}_4$ samples obtained by direct calcination of melamine or urea alone.

2385–2389

The role of phase impurities and lattice defects on the electron dynamics and photochemistry of CuFeO_2 solar photocathodes

Elizabeth A. Fugate, Somnath Biswas, Mathew C. Clement, Minkyu Kim, Dongjoon Kim, Aravind Asthagiri*, and L. Robert Baker*

The Ohio State University, USA



In this work we investigate the role of phase impurities and lattice defect states on the electron dynamics and photochemical efficiency of CuFeO_2 . Visible light transient absorption and density functional theory (DFT) calculations provide insight on effects of Cu vacancies, O interstitials, and CuO/CuFeO_2 heterostructures on the competition between charge separation and recombination dynamics in this material.

2390–2399

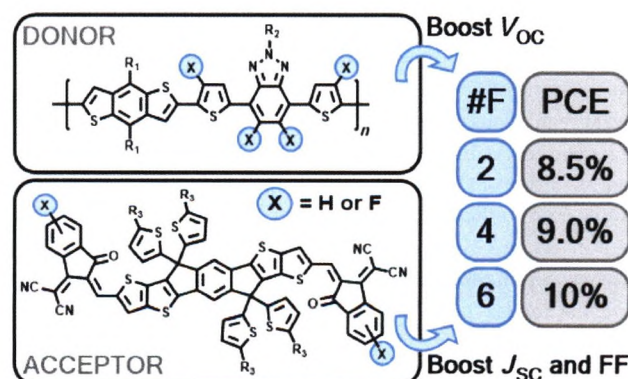
The impact of fluorination on both donor polymer and non-fullerene acceptor: The more fluorine, the merrier

Nicole Bauer¹, Qianqian Zhang¹, Jeromy James Rech¹, Shuixing Dai², Zhengxing Peng³, Harald Ade³, Jiayu Wang², Xiaowei Zhan², and Wei You^{1,*}

¹ University of North Carolina at Chapel Hill, USA

² Peking University, China

³ North Carolina State University, USA

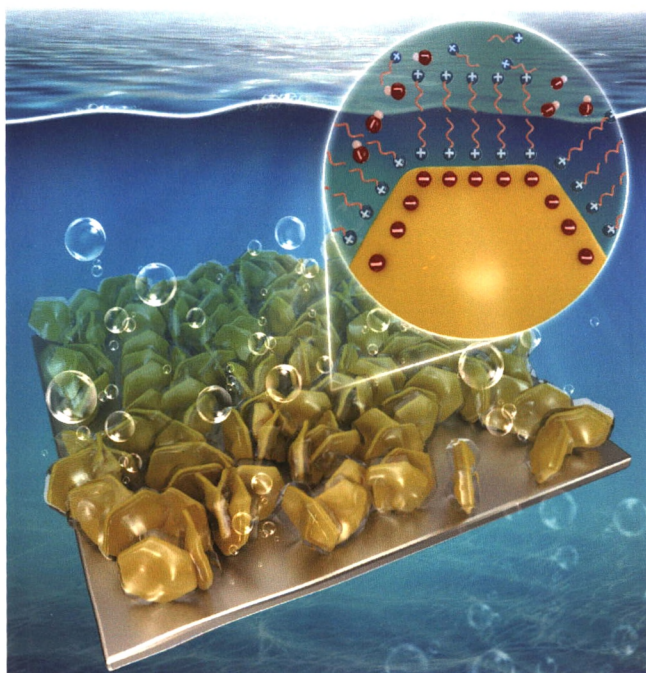


More fluorination leads to higher overall efficiency yet the trade-off between V_{oc} and J_{sc} still exists.

2400–2405

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