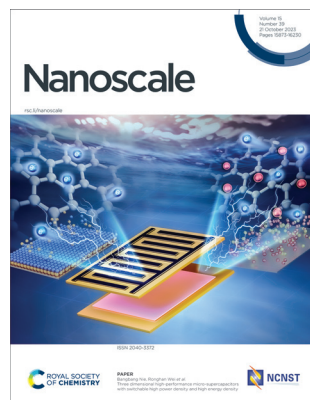


## IN THIS ISSUE

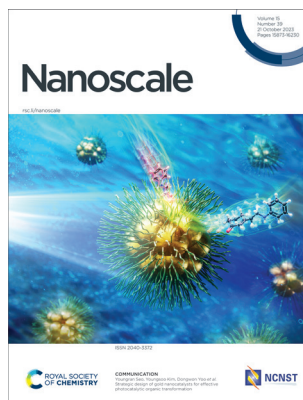
ISSN 2040-3372 CODEN NANOHL 15(39) 15873–16230 (2023)



### Cover

See Bangbang Nie, Ronghan Wei *et al.*, pp. 15956–15964.

Image reproduced by permission of Bangbang Nie and Ronghan Wei from *Nanoscale*, 2023, **15**, 15956.



### Inside cover

See Youngran Seo, Youngsoo Kim, Dongwon Yoo *et al.*, pp. 15950–15955.

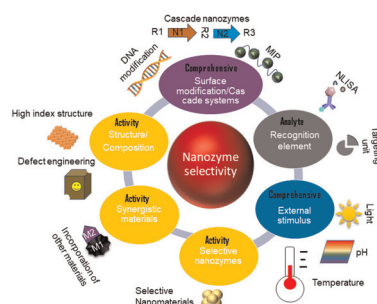
Image reproduced by permission of Dongwon Yoo from *Nanoscale*, 2023, **15**, 15950.

## REVIEWS

15885

### A comprehensive exploration of the latest innovations for advancements in enhancing selectivity of nanozymes for theranostic nanoplatforms

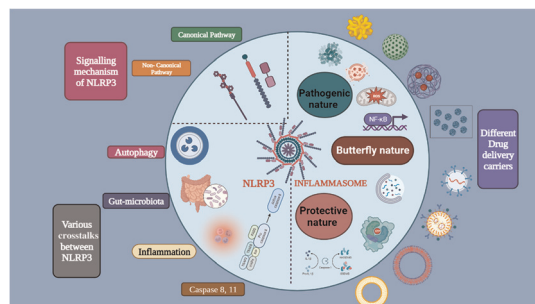
Dan Li,\* Tuocen Fan and Xifan Mei\*



15906

### Functionalized nanomaterials targeting NLRP3 inflammasome driven immunomodulation: Friend or Foe

Kanika and Rehan Khan\*



## Editorial Staff

### Executive Editor

Michaela Mühlberg

### Managing Editor

Heather Montgomery

### Editorial Production Manager

Jonathon Watson

### Senior Publishing Editor

Ella White

### Development Editor

Edward Gardner

### Publishing Editors

Matthew Blow, Chris Dias, Hemna Fathima, Juan Gonzalez, Eleanor Griffiths, Rob Hinde, Sam Howell, Clara Humann, Ash Hyde, Francesca Jacklin, Shruti Karmik, Sophie Koh, Tamara Kosikova, Evie Karkera, Brian Li, Sam Mansell, Carole Martin, Kirsty McRoberts, Tiffany Rogers, Cat Schofield, Charu Storr-Vijay, Manman Wang, Tom Williams

### Editorial Assistant

Elizabeth So

### Publishing Assistant

Lee Colwill

### Assistant Editor

Jie Gao, Yu Zhang

### Publisher

Sam Keltie

For queries about submitted papers, please contact Jonathon Watson, Editorial Production Manager in the first instance.

E-mail: [nanoscale@rsc.org](mailto:nanoscale@rsc.org)

For pre-submission queries please contact Michaela Mühlberg, Executive Editor. E-mail: [nanoscale-rsc@rsc.org](mailto:nanoscale-rsc@rsc.org)  
Nanoscale (electronic: ISSN 2040-3372) is published 48 times a year by the Royal Society of Chemistry, Thomas Graham House, Science Park, Milton Road, Cambridge, UK CB4 0WF.

All orders, with cheques made payable to the Royal Society of Chemistry, should be sent to the Royal Society of Chemistry Order Department, Royal Society of Chemistry, Thomas Graham House, Science Park, Milton Road, Cambridge, CB4 0WF, UK

Tel +44 (0)1223 432398; E-mail [orders@rsc.org](mailto:orders@rsc.org)

2023 Annual (electronic) subscription price: £1936/\$3155.

Customers in Canada will be subject to a surcharge to cover GST. Customers in the EU subscribing to the electronic version only will be charged VAT.

If you take an institutional subscription to any Royal Society of Chemistry journal you are entitled to free, site-wide web access to that journal. You can arrange access via Internet Protocol (IP) address at [www.rsc.org/ip](http://www.rsc.org/ip)  
Customers should make payments by cheque in sterling payable on a UK clearing bank or in US dollars payable on a US clearing bank.

Whilst this material has been produced with all due care, the Royal Society of Chemistry cannot be held responsible or liable for its accuracy and completeness, nor for any consequences arising from any errors or the use of the information contained in this publication. The publication of advertisements does not constitute any endorsement by the Royal Society of Chemistry or Authors of any products advertised. The views and opinions advanced by contributors do not necessarily reflect those of the Royal Society of Chemistry which shall not be liable for any resulting loss or damage arising as a result of reliance upon this material. The Royal Society of Chemistry is a charity, registered in England and Wales, Number 207890, and a company incorporated in England by Royal Charter (Registered No. RC000524), registered office: Burlington House, Piccadilly, London W1J 0BA, UK, Telephone: +44 (0) 207 4378 6556.

### Advertisement sales:

Tel +44 (0) 1223 432246; Fax +44 (0) 1223 426017;

E-mail [advertising@rsc.org](mailto:advertising@rsc.org)

For marketing opportunities relating to this journal, contact [marketing@rsc.org](mailto:marketing@rsc.org)

# Nanoscale

[rsc.li/nanoscale](http://rsc.li/nanoscale)

Nanoscale publishes experimental and theoretical work across the breadth of nanoscience and nanotechnology.



Published in collaboration with the National Centre for Nanoscience and Technology, Beijing, China

## Editorial Board

### Honorary Editor-in-chief

Chunli Bai, National Center for Nanoscience and Nanotechnology, China

### Editors-in-Chief

Dirk Guldi, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany

Yue Zhang, University of Science and Technology Beijing, China

### Associate Editors

Cinzia Casiraghi, University of Manchester, UK

Gianarelio Cuniberti, TU Dresden

(Technische Universität Dresden), Germany

Qing Dai, National Center for Nanoscience and Technology of China, China

Yves Dufrene, Université Catholique de Louvain, Belgium

Andrea Ferrari, University of Cambridge, UK

Dong Ha Kim, Ewha Womens University, South Korea

Christian Klinke, University of Rostock, Germany

Quan Li, The Chinese University of Hong Kong, Hong Kong

Zhiqun Lin, National University of Singapore, Singapore

Xiaogang Liu, National University of Singapore, Singapore

Renzhi Ma, National Institute for Materials Science, Japan

Janet Macdonald, Vanderbilt University, USA

Teresa Pellegrino, Istituto Italiano di Tecnologia, Italy

Elena Shevchenko, Argonne National Laboratory, USA

Jonathan Veinot, University of Alberta, Canada

Umesh Waghmare, Jawaharlal Nehru Centre for Advanced Scientific Research, India

Manzhou Zhu, Anhui University, China

Jin Zou, The University of Queensland, Australia

## Advisory Board

Zhenan Bao, Stanford University, USA

Amanda Barnard, Australian National University, Australia

Suryasarathi Bose, Indian Institute of Science Bangalore, India

Stephanie Brock, Wayne State University, USA

Raffaella Buonsanti, EPFL, Switzerland

Chunying Chen, National Center for Nanoscience and Technology of China, China

Jingyi Chen, University of Arkansas, USA

Wenlong Chen, Monash University, Australia

Xiaodong Chen, Nanyang Technological University, Singapore

Serena Cussen, University of Sheffield, UK

Mita Dasog, Dalhousie University, Canada

Mingdong Dong, Aarhus University, Denmark

Kristen Fichthorn, Penn State University, USA

Christy Haynes, University of Minnesota, USA

Niko Hildebrandt, Université de Rouen Normandie / Seoul National University, France / South Korea

Guohua Jia, Curtin University, Australia

Xingyu Jiang, Southern University of Science and Technology, China

Rongchao Jin, Carnegie Mellon University, USA

Song Jin, University of Wisconsin, USA

Jesse Jokerst, University of California San Diego, USA

Kourosh Kalantar-zadeh, The University of Sydney, Australia

Yamuna Krishnan, University of Chicago, USA

Katharina Landfester, Max Planck Institute for Polymer Research, Germany

Dattatray Late, CSIR National Chemical Laboratory, India

Pooi See Lee, Nanyang Technological University, Singapore

Graham Leggett, The University of Sheffield, UK

UK

Changming Li, Southwest University, China

Xing Yi Ling, Nanyang Technological University, Singapore

Jie Liu, Duke University, USA

Laura Na Liu, Max Planck Institute for Intelligent Systems, Germany

Yunqi Liu, Institute of Chemistry, Chinese Academy of Sciences, China

Wei Lu, University of Michigan, USA

Liberato Manna, Istituto Italiano di Tecnologia, Italy

Anna Fontcuberta i Morral, EPFL, Switzerland

Catherine Murphy, University of Illinois at Urbana-Champaign, USA

Kostya (Ken) Ostrikov, Queensland University of Technology, Australia

So-Jung Park, Ewha Womans University, Korea

T Pradeep, Indian Institute of Technology Madras, India

Lakshmi Polavarapu, University of Vigo, Spain

Narayan Pradhan, Indian Association for the Cultivation of Science, India

Dong Qin, Georgia Institute of Technology, USA

Paolo Samori, Université de Strasbourg, France

Michael Sailor, University of California, San Diego, USA

Zhigang Shuai, Tsinghua University, China

Sara Skrabalak, Indiana University, USA

Francesco Stellacci, EPFL, Switzerland

Hong-Bo Sun, Jilin University, China

Ling-Dong Sun, Peking University, China

Shouheng Sun, Brown University, USA

Xiaoming Sun, Beijing University of Chemical Technology, China

Dmitri Talapin, University of Chicago, USA

Zhiyong Tang, National Center for Nanoscience and Technology, China

Mauricio Terrones, The Pennsylvania State University, USA

Sarah Tolbert, University of California, Los Angeles, USA

Ventsislav Valev, University of Bath, UK

Miriam Vitiello, CNR Nano, Italy

Jianfang Wang, Chinese University of Hong Kong, Hong Kong SAR

Benjamin Wiley, Duke University, USA

Xiaoqun Wu, University of Science and Technology of China, China

Yujie Xiong, University of Science and Technology of China, China

Hongxing Xu, Wuhan University, China

Lin Xu, Nanjing Normal University, China

Ya Yang, Beijing Institute of Nanoenergy and Nanosystems, China

Jinhua Ye, National Institute for Materials Science, Japan

Xiao Cheng Zeng, University of Nebraska-Lincoln, USA

Gang Zhang, Agency for Science, Technology and Research, Singapore

Hua Zhang, City University of Hong Kong, China

Miqin Zhang, University of Washington, USA

Yuliang Zhao, National Center for Nanoscience and Technology, China

## Information for Authors

Full details on how to submit material for publication in Nanoscale are given in the Instructions for Authors (available from <http://www.rsc.org/authors>). Submissions should be made via the journal's homepage: [rsc.li/nanoscale](http://rsc.li/nanoscale)

Authors may reproduce/republish portions of their published contribution without seeking permission from the Royal Society of Chemistry, provided that any such republication is accompanied by an acknowledgement in the form: (Original Citation)–Reproduced by permission of the Royal Society of Chemistry.

This journal is © The Royal Society of Chemistry 2023. Apart from fair dealing for the purposes of research or private study for non-commercial purposes, or criticism or review, as permitted under the Copyright, Designs and Patents Act 1988 and the Copyright and Related Rights Regulation 2003, this publication may only be reproduced, stored or transmitted, in any form or by any means, with the prior permission in writing of the Publishers or in the case of reprographic reproduction in accordance with the terms of licences issued by the Copyright Licensing Agency in the UK. US copyright law is applicable to users in the USA.

Registered charity number: 207890

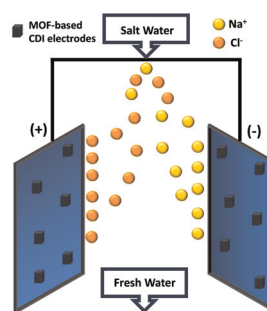


## MINIREVIEW

15929

## A mini review on metal–organic framework-based electrode materials for capacitive deionization

M. Shahnawaz Khan, Zhi Yi Leong, Dong-Sheng Li, Jianbei Qiu, Xuhui Xu and Hui Ying Yang\*

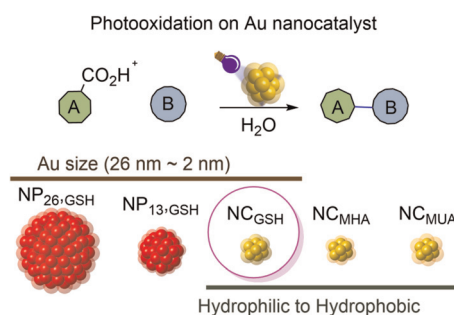


## COMMUNICATION

15950

## Strategic design of gold nanocatalysts for effective photocatalytic organic transformation

Jongchan Kim, Jeonghyeon Lee, Hyunwoo Choi, Juhee Ha, Minsoo Cheon, Youngran Seo,\* Youngsoo Kim\* and Dongwon Yoo\*

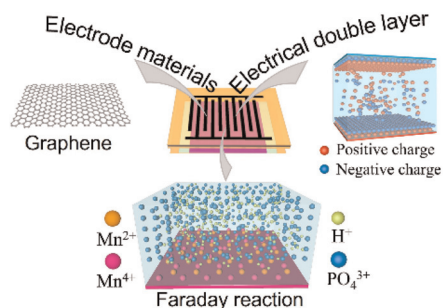


## PAPERS

15956

## Three dimensional high-performance micro-supercapacitors with switchable high power density and high energy density

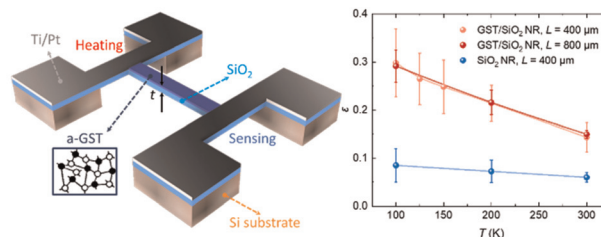
Kuangbing Wang, Bangbang Nie,\* Ni Su, Benkun Lv, Huiqian Song, Guochen Qi, Yudong Zhang, Jingjiang Qiu and Ronghan Wei\*



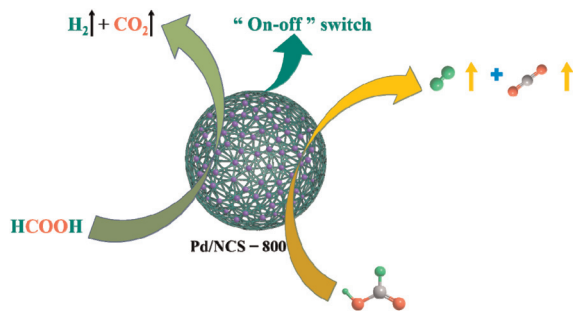
15965

## Enhanced far-field coherent thermal emission using mid-infrared bilayer metasurfaces

Sichao Li, Robert E. Simpson and Sunmi Shin\*



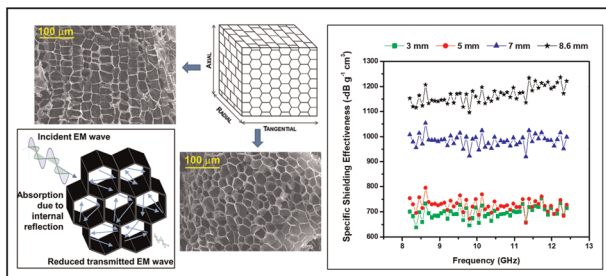
15975



### Selective and controlled $\text{H}_2$ generation upon additive-free $\text{HCOOH}$ dehydrogenation over a Pd/NCS nanocatalyst

Qing Zhang, Yanlan Wang, Xiaotao Jin and Xiang Liu\*

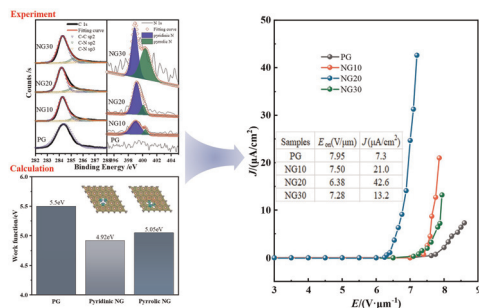
15982



### Ultra-light-weight microwave X-band EMI shielding or RAM material made from sustainable pyrolysed cork templates

Robert C. Pullar,\* Rui M. Novais, Ana. P. F. Caetano, K. A. Krishnakumar and Kuzhichalil P. Surendran

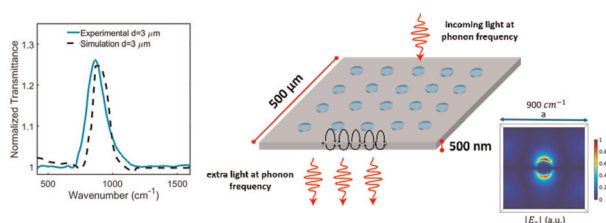
15994



### Tuneable effects of pyrrolic N and pyridinic N on the enhanced field emission properties of nitrogen-doped graphene

Guodong Meng,\* Fuzhi Zhan, Junyi She, Jinan Xie, Qinren Zheng, Yonghong Cheng and Zongyou Yin\*

16002



### Extraordinary optical transmittance generation on $\text{Si}_3\text{N}_4$ membranes

Salvatore Macis,\* Maria Chiara Paolozzi, Annalisa D'Arco, Federica Piccirilli, Veronica Stopponi, Marco Rossi, Fabio Moia, Andrea Toma and Stefano Lupi

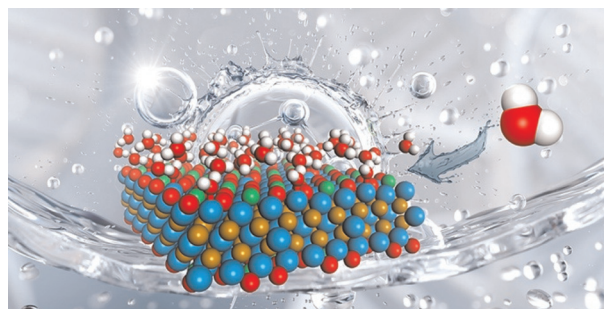


## PAPERS

16010

**First principles insights into stability of defected MXenes in water**

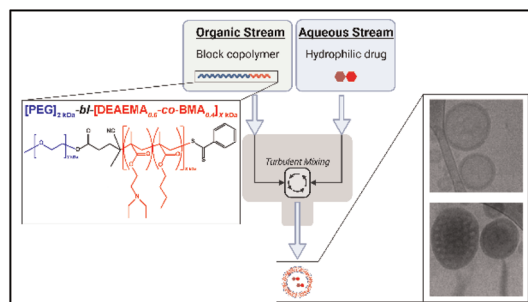
Haohong Song and De-en Jiang\*



16016

**Engineering endosomolytic nanocarriers of diverse morphologies using confined impingement jet mixing**

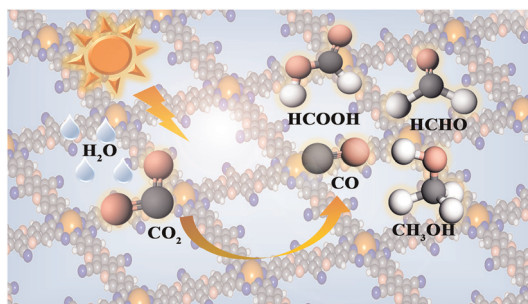
Hayden M. Pagendarm, Payton T. Stone, Blaise R. Kimmel, Jessalyn J. Baljon, Mina H. Aziz, Lucinda E. Pastora, Lauren Hubert, Eric W. Roth, Sultan Almunif, Evan A. Scott and John T. Wilson\*



16030

**Iron/cobalt/nickel regulation for efficient photocatalytic carbon dioxide reduction over phthalocyanine covalent organic frameworks**

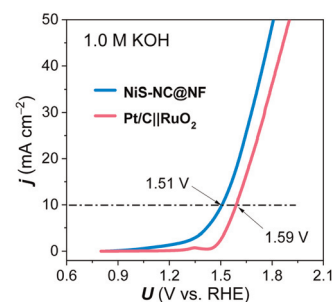
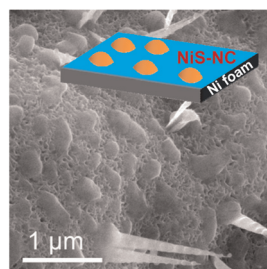
Qiqi Zhang, Meiyang Chen, Yanjie Zhang, Yuansong Ye, Diwen Liu,\* Chao Xu, Zuju Ma, BenYong Lou,\* Rusheng Yuan and Rongjian Sa\*



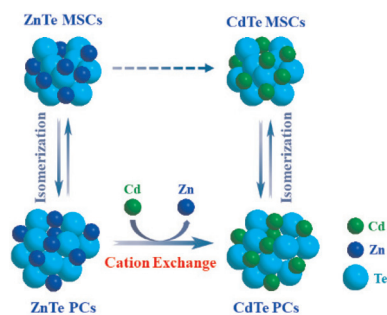
16039

**Constructing S-deficient nickel sulfide/N-doped carbon interface for improved water splitting activity**

Zhicheng Liu, Hongrui Jia, He Wang, Yaqun Wang\* and Guoxin Zhang\*



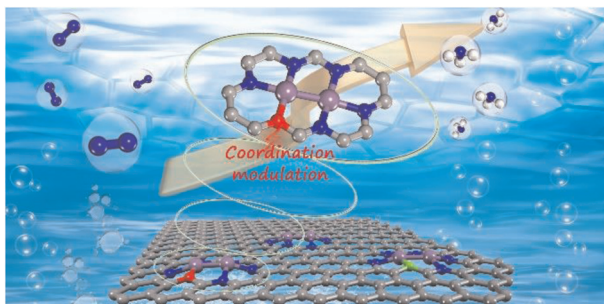
16049



### CdTe magic-size cluster synthesis *via* a cation exchange method and conversion mechanism

Zhuohan Lin, Xin Zhang, Xue Zhang, Qianqian Song and Yan Li\*

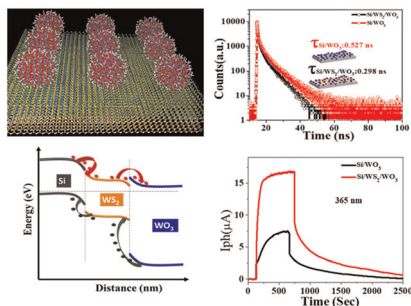
16056



### Tailoring the coordination environment of double-atom catalysts to boost electrocatalytic nitrogen reduction: a first-principles study

Jiarui Wu, Donghai Wu, Haobo Li, Yanhao Song, Wenjing Lv, Xiaohu Yu\* and Dongwei Ma\*

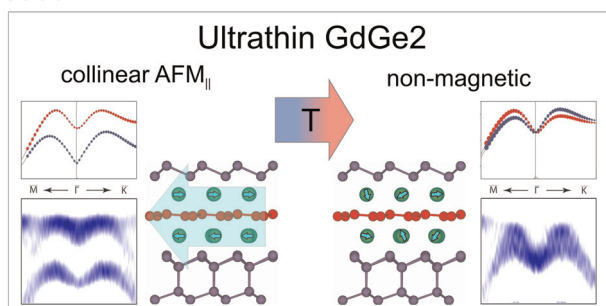
16068



### WO<sub>3</sub>-NP-activated WS<sub>2</sub> layered heterostructures for efficient broadband (254 nm–940 nm) photodetection

Sukhendu Maity, Krishnendu Sarkar and Praveen Kumar\*

16080



### Interplay between magnetic order and electronic band structure in ultrathin GdGe<sub>2</sub> metalloxyene films

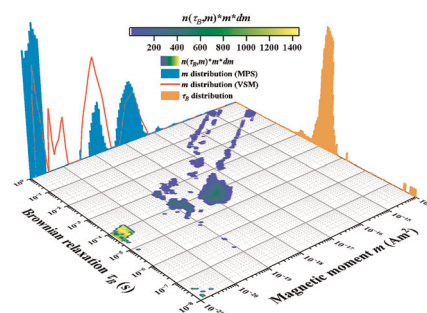
Andrey V. Matetskiy,\* Valeria Milotti, Polina M. Sheverdyeva, Paolo Moras, Carlo Carbone and Alexey N. Mihaluk



16089

### Simultaneous estimation of magnetic moment and Brownian relaxation time distributions of magnetic nanoparticles based on magnetic particle spectroscopy for biosensing application

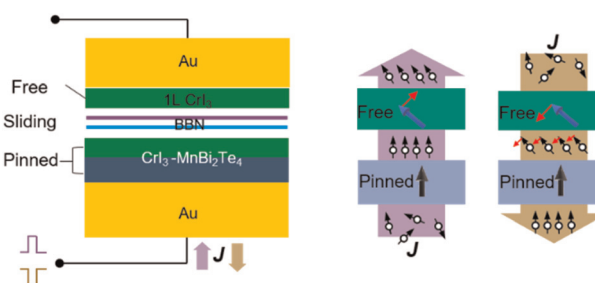
Yi Sun,\* Zhongzhou Du, Haochen Zhang, Haozhe Wang, Teruyoshi Sasayama and Takashi Yoshida



16103

### Full electrical control of multiple resistance states in van der Waals sliding multiferroic tunnel junctions

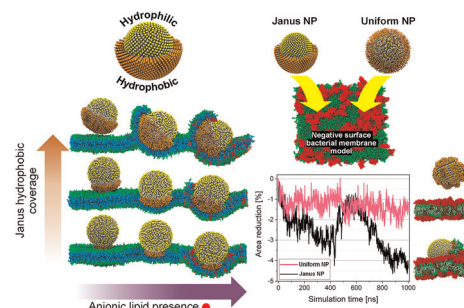
Jie Yang, Baochun Wu, Jun Zhou, Jing Lu,\* Jinbo Yang\* and Lei Shen\*



16112

### Computational investigation on lipid bilayer disruption induced by amphiphilic Janus nanoparticles: combined effect of Janus balance and charged lipid concentration

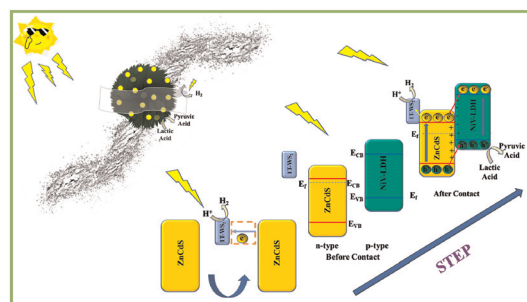
Danh Nguyen, James Wu, Patrick Corrigan and Ying Li\*



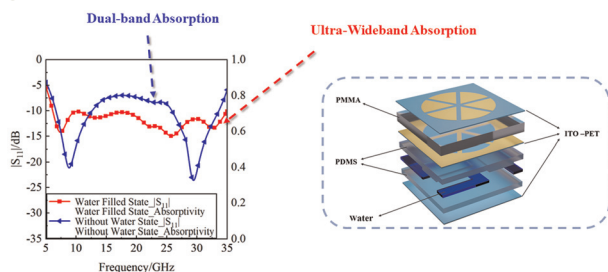
16131

### A 1T-WS<sub>2</sub> "electron pump" regulates charge transfer over ZnCdS/NiV-LDH p-n heterostructures for enhanced photocatalytic hydrogen evolution

Jingzhi Wang, Mei Li\* and Zhiliang Jin\*



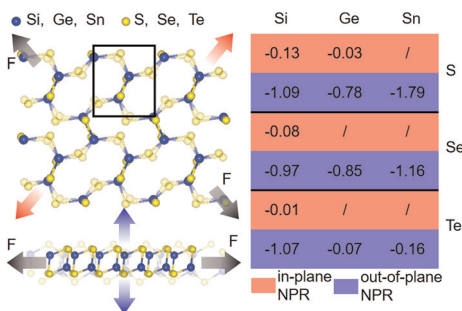
16144



### A reconfigurable ultra-broadband transparent absorber combined with ITO and structural water

Yang Wang, Helin Yang,\* Jiong Wu, Yuejie Yang, Jing Jin, Xuxing Geng and Xiaojun Huang\*

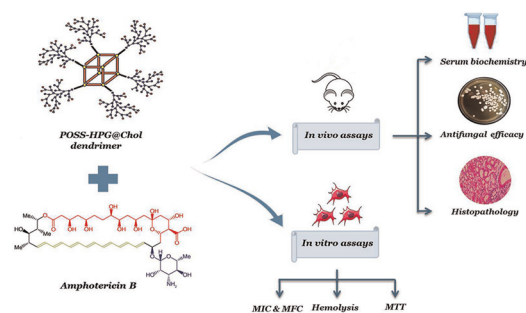
16155



### High out-of-plane negative Poisson's ratios and strong light harvesting in two-dimensional $\text{SiS}_2$ and its derivatives

Haidi Wang, Tao Li, Zhao Chen, Weiduo Zhu, Wei Lin, Huimiao Wang, Xiaofeng Liu\* and Zhongjun Li\*

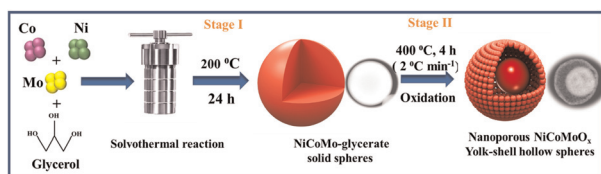
16163



### Dendritic hybrid materials comprising polyhedral oligomeric silsesquioxane (POSS) and hyperbranched polyglycerol for effective antifungal drug delivery and therapy in systemic candidiasis

Mahboobeh Jafari, Samira Sadat Abolmaali, Sedigheh Borandeh, Haniyeh Najafi, Zahra Zarehshabadi, Omid Koohi-Hosseinabadi, Negar Azarpira, Kamiar Zomorodian\* and Ali Mohammad Tamaddon\*

16178



### Fabrication of ternary $\text{NiCoMoO}_x$ with yolk-shell hollow structure as a positive electrode material for high-performance electrochemical capacitor applications

Fatemeh Heidari Gourji,\* Tharmakularasa Rajaramanan, Øyvind Frette and Dhayalan Velauthapillai\*

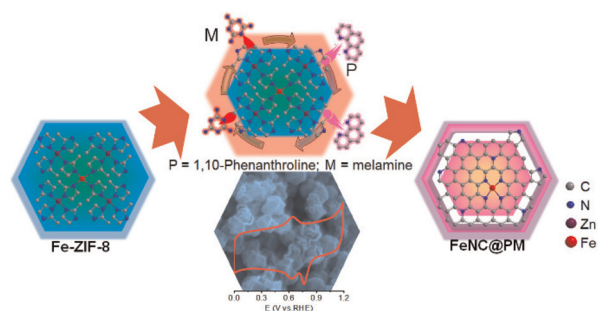


## PAPERS

16188

### Efficient yolk-shelled Fe–N–C oxygen reduction electrocatalyst via N-rich molecular-guided pyrolysis

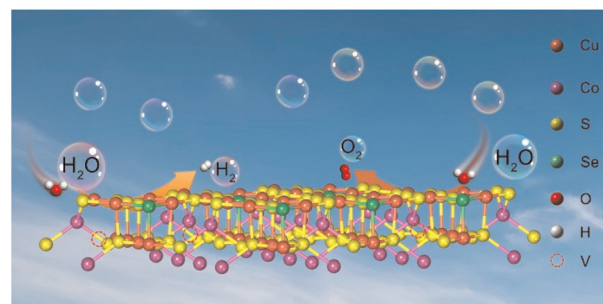
Qingxue Lai,\* Hongmei Zheng, Wanying Zhang, Yi Sheng, Luanjie Nie and Jing Zheng



16199

### Se-doping-induced sulfur vacancy engineering of $\text{CuCo}_2\text{S}_4$ nanosheets for enhanced electrocatalytic overall water splitting

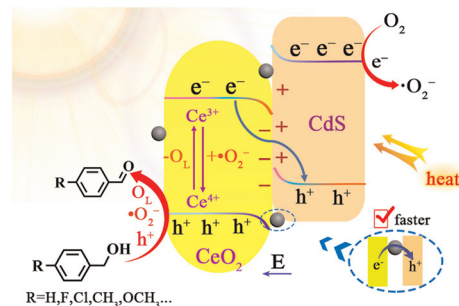
Bianli Zhang, Xingyue Qian, Hui Xu, Lin Jiang, Jiawei Xia, Haiqun Chen\* and Guangyu He\*



16209

### The Mars–Van Krevelen cycle and non-noble metal Ni jointly promoting Z-scheme charge transfer: a study on the photothermal synergy effect applied in selectively oxidizing aromatic alcohols

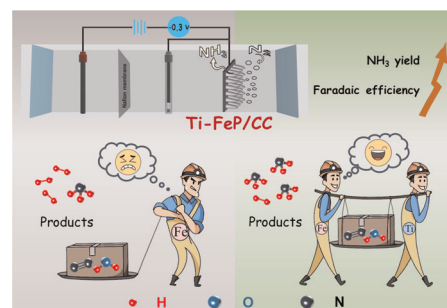
Gaoli Chen, Jing Li, Shu Gui, Ya Wang, Sujuan Zhang,\* Zhongliao Wang, Xiuzhen Zheng, Sugang Meng, Chaohui Ruan and Shifu Chen\*



16219

### Ti-doped iron phosphide nanoarrays grown on carbon cloth as a self-supported electrode for enhanced electrocatalytic nitrogen reduction

Senhao Wang, Yuan Wang,\* Tian C. Zhang, Xu Ji and Shaojun Yuan\*



## CORRECTION

16227

**Correction: Accelerating copolymer inverse design using monte carlo tree search**

Tarak K. Patra,\* Troy D. Loeffler and Subramanian K. R. S. Sankaranarayanan\*

