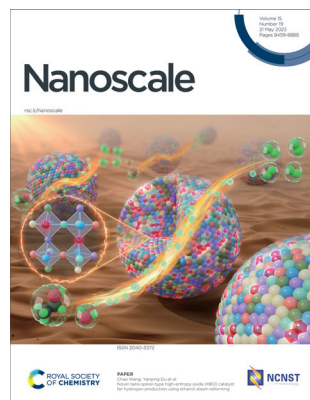


IN THIS ISSUE

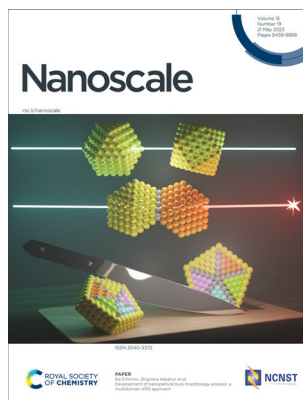
ISSN 2040-3372 CODEN NANOHL 15(19) 8459-8888 (2023)



Cover

See Chao Wang,
Yanping Du *et al.*,
pp. 8619–8632.

Image reproduced by permission of Dr./Assoc Prof. Chao Wang, School of Materials and Energy, Guangdong University of Technology from *Nanoscale*, 2023, **15**, 8619.



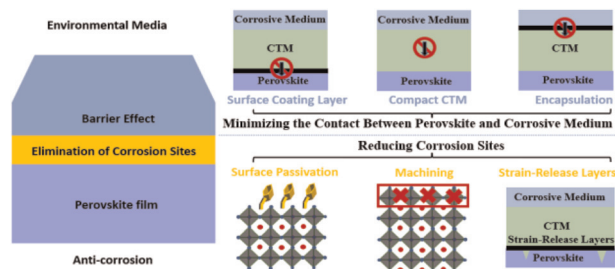
Inside cover

See Iliia Smirnov,
Zbigniew Kaszukur *et al.*,
pp. 8633–8642.

Image reproduced by permission of Iliia Smirnov from *Nanoscale*, 2023, **15**, 8633.

REVIEWS

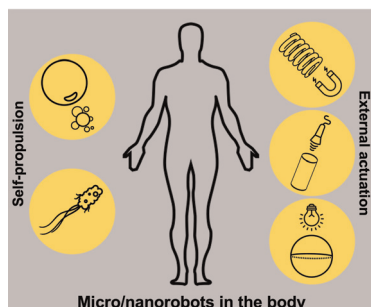
8473



Anti-corrosion strategy to improve the stability of perovskite solar cells

Liang Li, Zhenyu Guo, Rundong Fan and Huanping Zhou*

8491



In vivo applications of micro/nanorobots

Cagatay M. Oral and Martin Pumera*



Editorial Staff

Executive Editor

Michaela Mühlberg

Managing Editor

Heather Montgomery

Editorial Production Manager

Jonathon Watson

Senior Publishing Editor

Daniella Ferlucio

Development Editor

Edward Gardner

Publishing Editors

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

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

For pre-submission queries please contact Michaela Mühlberg, Executive Editor. E-mail: 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

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

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

For marketing opportunities relating to this journal, contact marketing@rsc.org

Nanoscale

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

Editors-in-Chief

Chunli Bai, National Centre for Nanoscience and Nanotechnology, China
Dirk Guldi, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany

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 Dufréne, Université Catholique de Louvain, Belgium

Andrea Ferrari, University of Cambridge, UK
Dong Ha Kim, Ewha Womens University, South Korea
Christian Klinker, University of Rostock, Germany
Quan Li, The Chinese University of Hong Kong, Hong Kong
Zhiqun Lin, National University of Singapore, Singapore
Xing Yi Ling, Nanyang Technological University, 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
Kristen Fichthorn, Penn State University, USA
Christy Haynes, University of Minnesota, USA
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
Pooi See Lee, Nanyang Technological University, Singapore
Graham Leggett, The University of Sheffield, UK
Changming Li, Southwest University, China
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
Zhiqiang 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
Xiaojun 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

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.

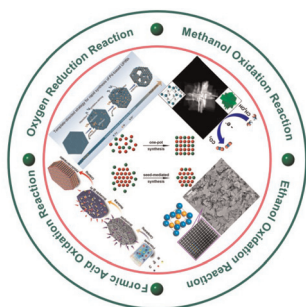
This journal is © The Royal Society of Chemistry 2023. Apart from fair dealing for the purposes of research or private study for non-commercial purposes, or criticism or review, as permitted under the Copyright, Designs and Patents Act 1988 and the Copyright and Related Rights Regulation 2003, this publication may only be reproduced, stored or transmitted, in any form or by any means, without 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



REVIEWS

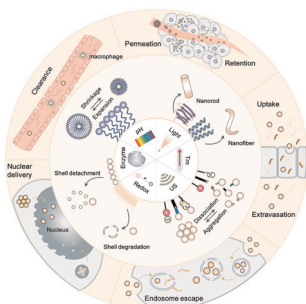
8508



Wet-chemistry synthesis of two-dimensional Pt- and Pd-based intermetallic electrocatalysts for fuel cells

Jingchun Guo,* Wei Liu, Xucheng Fu* and Shilong Jiao*

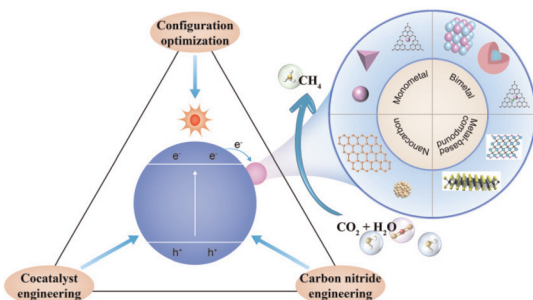
8532



Transformable nanodrugs for overcoming the biological barriers in the tumor environment during drug delivery

Xuejian Li, Zhenkun Huang, Zhihuan Liao, Aijie Liu* and Shuidong Huo*

8548

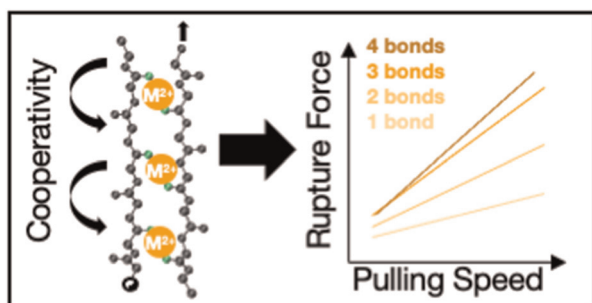


Recent progress of cocatalysts loaded on carbon nitride for selective photoreduction of CO₂ to CH₄

Rui-Tang Guo,* Zhen-Rui Zhang, Cheng Xia, Chu-Fan Li and Wei-Guo Pan

COMMUNICATIONS

8578



Bond clusters control rupture force limit in shear loaded histidine-Ni²⁺ metal-coordinated proteins

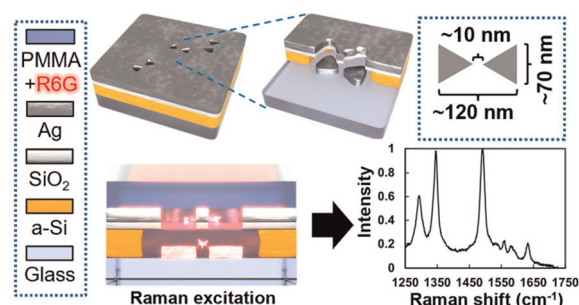
Eesha Khare, Darshdeep S. Grewal and Markus J. Buehler*



8589

Raman enhancement in bowtie-shaped aperture-particle hybrid nanostructures fabricated with DNA-assisted lithography

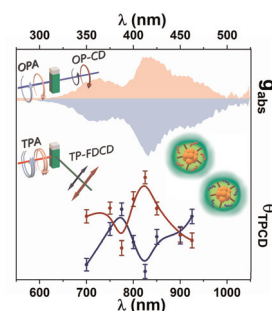
Kabusure M. Kabusure, Petteri Piskunen, Jiaqi Yang, Veikko Linko* and Tommi K. Hakala*



8597

Strong fluorescence-detected two-photon circular dichroism of chiral gold nanoclusters

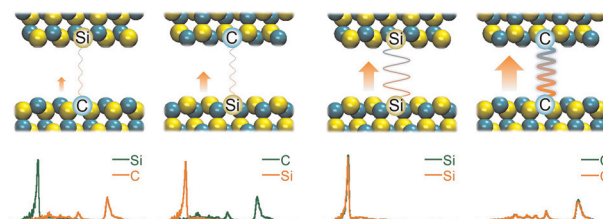
Anna Pniakowska, Marek Samoć and Joanna Olesiak-Bańska*



8603

Interfacial thermal resonance in an SiC–SiC nanogap with various atomic surface terminations

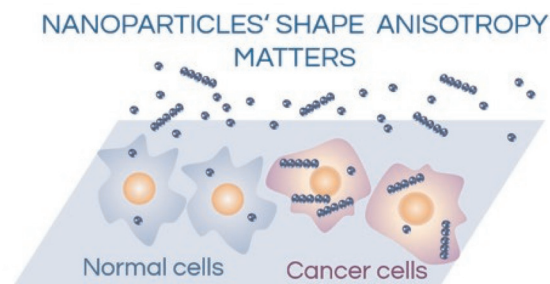
Xiangrui Li, Wentao Chen and Gyoko Nagayama*



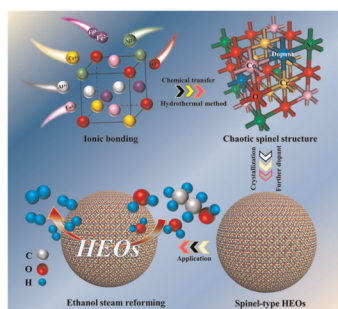
8611

The shape anisotropy of magnetic nanoparticles: an approach to cell-type selective and enhanced internalization

Tanja Potrč, Slavko Kralj,* Sebastjan Nemeč, Petra Kocbek and Mateja Erdani Kreft*



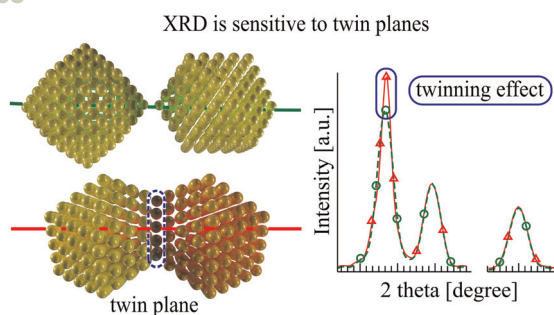
8619



Novel nano spinel-type high-entropy oxide (HEO) catalyst for hydrogen production using ethanol steam reforming

Chao Wang,* Wei Liu, Mingzheng Liao, Jiahong Weng, Jian Shen, Ying Chen and Yanping Du*

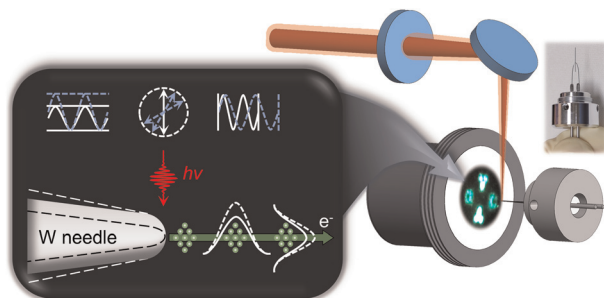
8633



Development of nanoparticle bulk morphology analysis: a multidomain XRD approach

Iliia Smirnov,* Zbigniew Kaszukur* and Armin Hoell

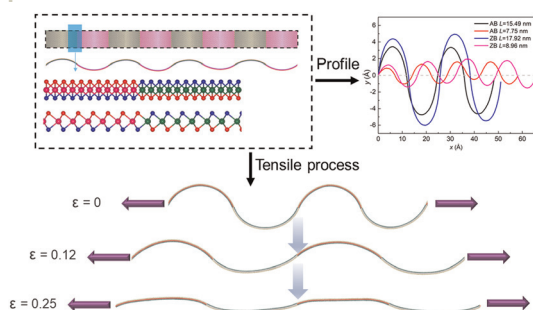
8643



A tunable photo-electric co-excited point electron source: low-intensity excitation emission and structure-modulated spectrum-selection

Yinyao Chen, Shuai Tang, Yan Shen,* Huanjun Chen and Shaozhi Deng

8654



Ultraflexible two-dimensional Janus heterostructure superlattice: a novel intrinsic wrinkled structure

Kai Ren,* Guoqiang Zhang, Lifa Zhang, Huasong Qin* and Gang Zhang*

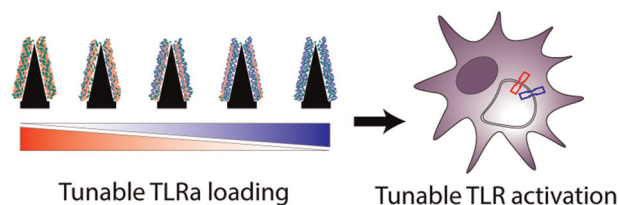


PAPERS

8662

Tuning innate immune function using microneedles containing multiple classes of toll-like receptor agonists

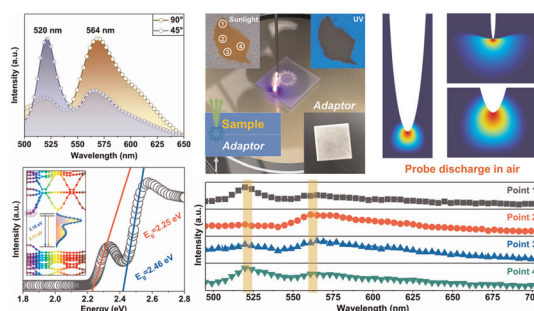
Camilla Edwards, Robert S. Oakes and Christopher M. Jewell*



8675

Structural, vibrational, photoelectrochemical, and optical properties of two-dimensional Ruddlesden–Popper perovskite BA_2PbI_4 crystals

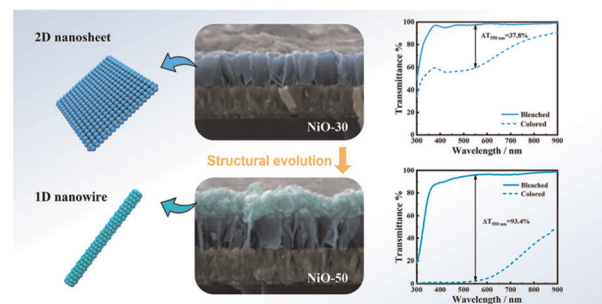
Aochen Du, Debing Shen, Wenxiao Zhao, Yongzhen Liu, Xinzhi Qin, Zexi Lin, Yun Ye,* Enguo Chen,* Sheng Xu and Tailing Guo



8685

A layer-stacked NiO nanowire/nanosheet homostructure for electrochromic smart windows with ultra-large optical modulation

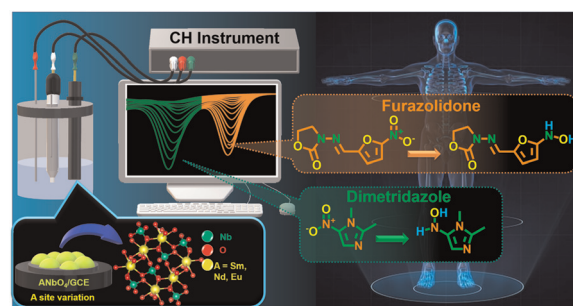
Yi Gao, Pengyang Lei, Siyu Zhang, Huanhuan Liu, Chengyu Hu, Zhu Kou, Jinhui Wang* and Guofa Cai*



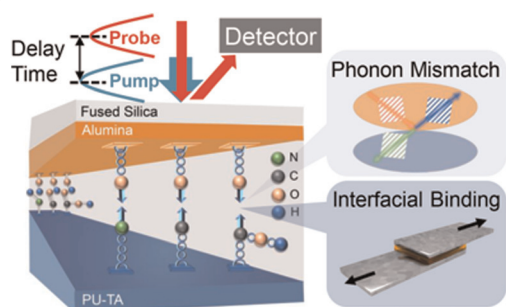
8693

Fergusonite-type rare earth niobates ANbO_4 (A = Nd, Sm, and Eu) as electrode modifiers: deep insights into A site variations towards bifunctional electrochemical sensing applications

I. Jenisha Daisy Priscilla and Sea-Fue Wang*



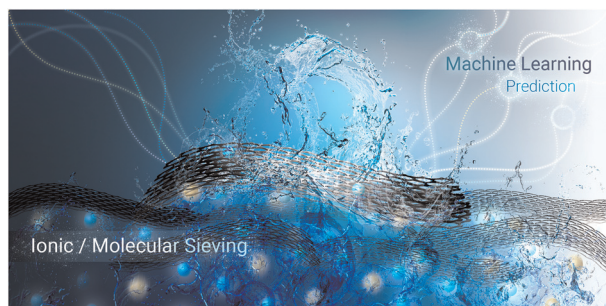
8706



Molecular design of a highly matched and bonded interface achieves enhanced thermal boundary conductance

Shuting Wang, LinLin Ren, Meng Han, Wei Zhou, Chunyu Wong, Xue Bai, Rong Sun and Xiaoliang Zeng*

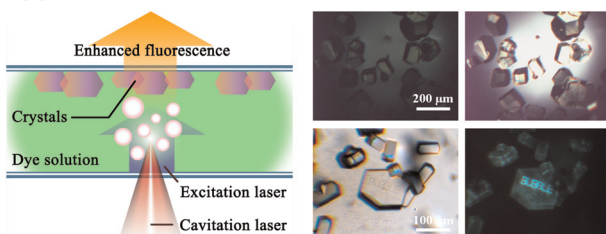
8716



Ultrahigh stable laminar graphene membranes for effective ionic and molecular nanofiltration with a machine learning-assisted study

Poonsawat Paechotrattanakul, Kulpavee Jitapunkul, Pawin Iamprasertkun, Pannaree Srinoi, Weekit Sirisaksoontorn* and Wisit Hirunpinoyas*

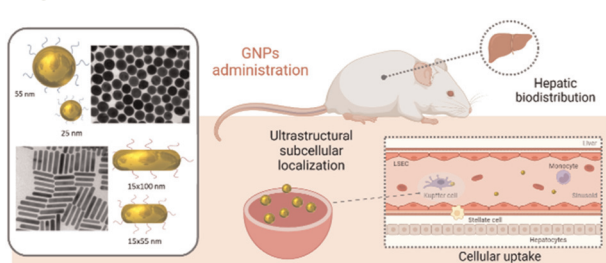
8730



Fluorescence enhancement of organic dyes by femtosecond laser-induced cavitation bubbles for crystal imaging

Jiachen Yu, Jianfeng Yan, Lan Jiang,* Jiaqun Li, Heng Guo, Ming Qiao and Liangti Qu

8740



Long-term retention of gold nanoparticles in the liver is not affected by their physicochemical characteristics

Jennifer Fernandez Alarcon, Mahmoud Soliman, Tanja Ursula Lüdtkke, Eva Clemente, Marko Dobricic, Martina B. Violatto, Alessandro Corbelli, Fabio Fiordaliso, Chiara Cordiglieri, Laura Talamini, Giovanni Sitia, Sergio Moya, Paolo Bigini* and Marco P. Monopoli*

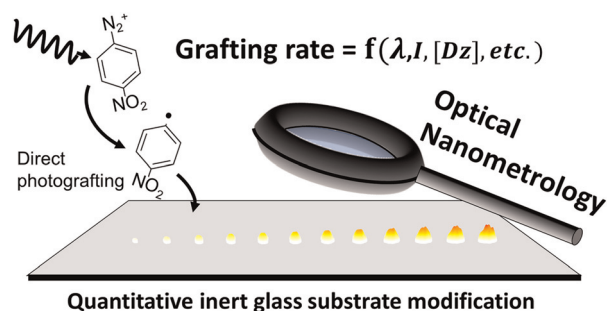


PAPERS

8754

Operando surface optical nanometrology reveals diazonium salts' visible photografting mechanism

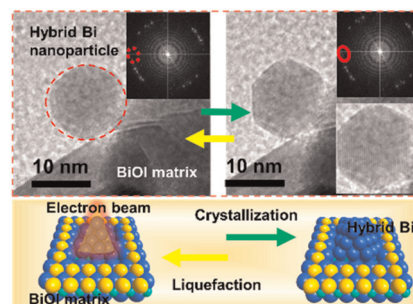
Baptiste Maillot, Madelyn Johnson, Jean-Frédéric Audibert, Fabien Miomandre and Vitor Brasiense*



8762

In situ TEM investigation of nucleation and crystallization of hybrid bismuth nanodiamonds

Sihan Ma, Yipeng Li, Dewang Cui, Gang Yang, Lin Wang* and Guang Ran*

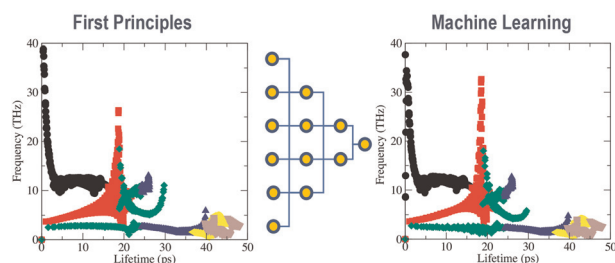


8772

Gaussian approximation potentials for accurate thermal properties of two-dimensional materials

Tuğbey Kocabaş,* Murat Keçeli,* Álvaro Vázquez-Mayagoitia* and Cem Sevik*

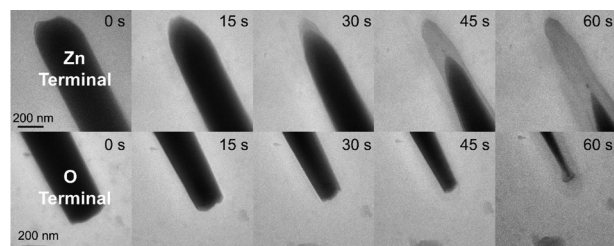
ML Potentials for Thermal Conductivity of 2D Materials



8781

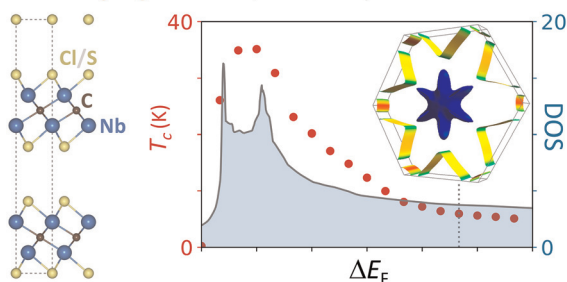
In situ study of wet chemical etching of ZnO nanowires with different diameters and polar surfaces by LCTEM

Jiamin Tian, Mei Sun, Mengyu Hong,* Bocheng Yu, Menglan Li, Yu Geng, Shuo Li, Yue Zhang, Zhihong Li and Qing Chen*



8792

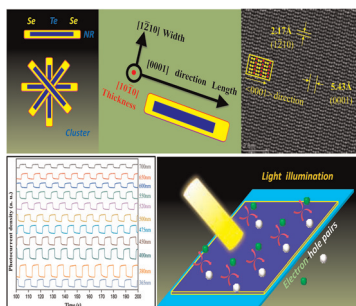
Strain- and gating-enhanced superconductivity in functionalized MXenes



Superconductivity in functionalized niobium-carbide MXenes

Cem Sevik, Jonas Bekaert and Milorad V. Milošević

8800

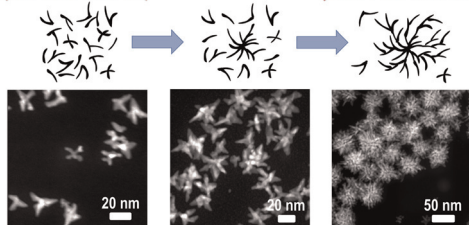


One-dimensional TeSe nano-heterojunction: formation, calculations, carrier dynamics, and application in broad-spectrum photodetectors

Chenyang Xing, Zihao Li, Jian Bang, Songrui Wei* and Zhengchun Peng*

8814

Nanopods (8.8-76.3 At% Pt) → Nanodendrites (25.5-76.3 At% Pt)

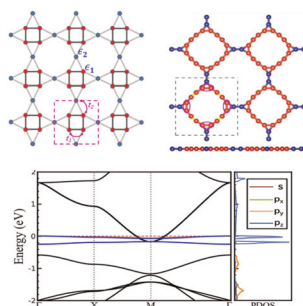


Selectively Manipulate Morphology and Composition

Manipulating morphology and composition in colloidal heterometallic nanopods and nanodendrites

Siyi Ming and Andrew E. H. Wheatley*

8825



Coupling double flat bands in a quadrangular-star lattice

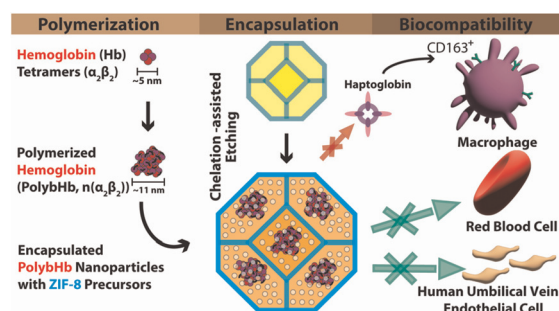
Jun Jiang, Wen Jiang, Song Zhang, Yuee Xie* and Yuanping Chen*



8832

ZIF-8 metal organic framework nanoparticle loaded with tense quaternary state polymerized bovine hemoglobin: potential red blood cell substitute with antioxidant properties

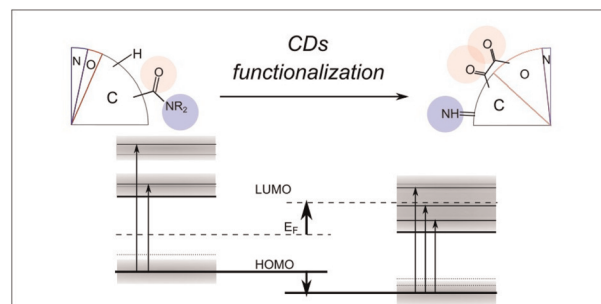
Xiangming Gu, Megan Allyn, Katelyn Swindle-Reilly and Andre F. Palmer*



8845

Energy-level engineering of carbon dots through a post-synthetic treatment with acids and amines

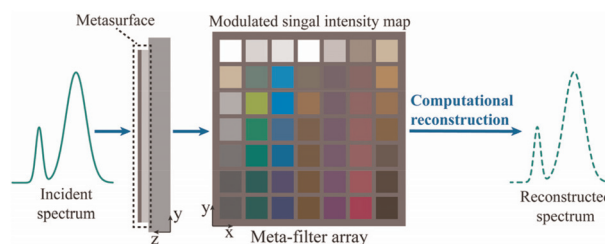
Kseniia D. Kosolapova, Aleksandra V. Koroleva, Irina A. Arefina, Mikhail D. Miruschenko, Sergei A. Cherevko, Igor G. Spiridonov, Evgeniy V. Zhizhin, Elena V. Ushakova* and Andrey L. Rogach



8854

Computational hyperspectral devices based on quasi-random metasurface supercells

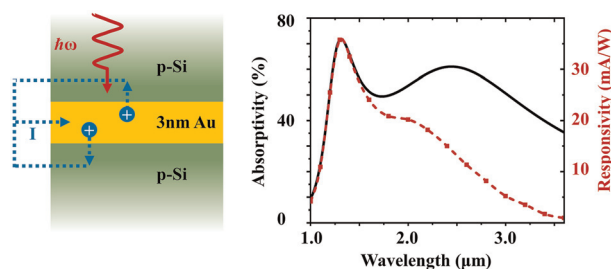
Cong Chen, Xiaoyin Li, Gang Yang, Xiaohu Chen, Shoupeng Liu, Yinghui Guo* and Hui Li*



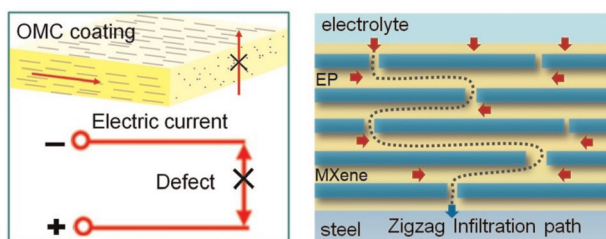
8863

Ultrabroadband hot-hole photodetector based on ultrathin gold film

Jun-Rong Zheng, En-Ming You,* Yuan-Fei Hu, Jun Yi* and Zhong-Qun Tian*



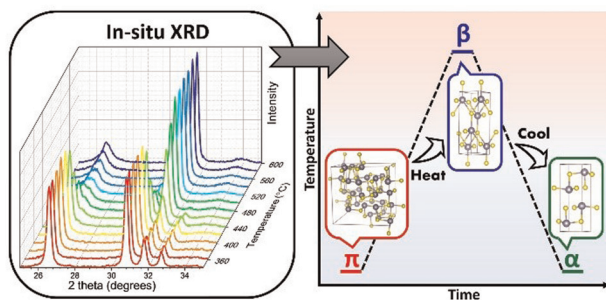
8870



High-compact MXene-based coatings by controllable interfacial structures

Jiheng Ding, Hao Wang, Hongran Zhao, Mohammad Raza Miah, Jingtang Wang* and Jin Zhu

8881



Real-time monitoring of phase transitions in π -SnS nanoparticles

Helena Fridman, Nir Barsheshet, Sofiya Kulusheva, Taleb Mokari,* Shmuel Hayun and Yuval Golan*

