# **Nanoscale**

# rsc.li/nanoscale

The Royal Society of Chemistry is the world's leading chemistry community. Through our high impact journals and publications we connect the world with the chemical sciences and invest the profits back into the chemistry community.

# IN THIS ISSUE

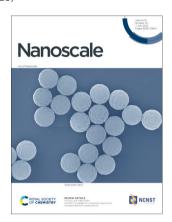
ISSN 2040-3372 CODEN NANOHL 15(25) 10467-10844 (2023)



### Cover

See Colin Lambert, Paul J. Low *et al.*, pp. 10573–10583.

Image reproduced by permission of Elena Gorenskaia from Nanoscale, 2023, **15**, 10573.



#### Inside cover

See Hua Zou and Yuhang Ren, pp. 10484–10497.

Image reproduced by permission of Hua Zou from *Nanoscale*. 2023. **15**. 10484.

# **EDITORIAL**

#### 10480

# Introduction to nanomaterials for printed electronics

Cinzia Casiraghi,\* Oana D. Jurchescu,\* Shlomo Magdassi\* and Wenming Su\*

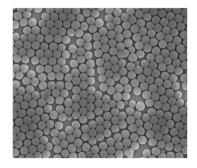


# **REVIEWS**

# 10484

# Synthetic strategies for nonporous organosilica nanoparticles from organosilanes

Hua Zou\* and Yuhang Ren



#### **Editorial Staff**

**Executive Editor** 

Michaela Mühlberg

**Managing Editor** 

Heather Montgomery

**Editorial Production Manager** 

Ionathon Watson

Senior Publishing Editor

Daniella Ferluccio

Development Editor

Edmand Candara

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 240-3372) 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 0WE UK

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

2023 Annual (electronic) subscription price: £1936/S3155.
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 Gianaurelio Cuniberti, TU Dresden (Technische Universität Dresden), Germany Qing Dai, National Center for Nanoscience and Technology of China, China Yves Duffene, 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 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, Annhui 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 Kristen Pichthorn, Penn State University, USA Christy Haynes, University of Minnesota, USA Guohua Jia, Curtin University, Australia Xingyu Jiang, Southern University of Science and Technolog, 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 Samorì, Université de Strasbourg, France

Paolo Samon, Universite de Strasbourg, Fran 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 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, 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



# **REVIEWS**

#### 10498

# Advancements in theoretical and experimental investigations on diamane materials

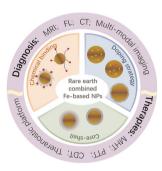
Bowen Liu, Emilia Emmanuel, Tao Liang\* and Bin Wang\*



#### 10513

# The development of rare-earth combined Fe-based magnetic nanocomposites for use in biological theranostics

Hao Peng, Guiping Ren, Norbert Hampp, Aiguo Wu and Fang Yang\*



### 10529

# Surface ligand-assisted synthesis and biomedical applications of metal-organic framework nanocomposites

Lihua Wang, Zhiheng Li, Yingqian Wang, Mengyue Gao, Ting He, Yifang Zhan\* and Zhihao Li\*

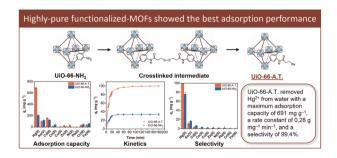


# **COMMUNICATIONS**

#### 10558

# Towards the fastest kinetics and highest uptake of post-functionalized UiO-66 for Hg<sup>2+</sup> removal from water

Iris Tsz Yan Lam, Yufei Yuan, Ki-Taek Bang, Seon-Jin Choi, Dong-Myeong Shin, Dong Lu and Yoonseob Kim\*



# **COMMUNICATIONS**

#### 10567



# Manufacture of a modular fog harvesting system combining 3D printing and wettability-contrasting patterns

Jie Guo, Zhiguang Guo\* and Weimin Liu\*

# **PAPERS**

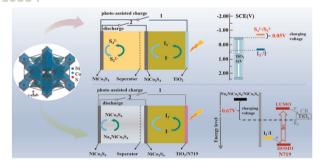
#### 10573



# Exploring relationships between chemical structure and molecular conductance: from $\alpha, \omega$ -functionalised oligoynes to molecular circuits

Elena Gorenskaia, Jarred Potter, Marcus Korb, Colin Lambert\* and Paul J. Low\*

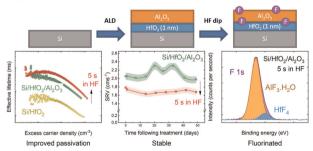
# 10584



# Dual-duty NiCo<sub>2</sub>S<sub>4</sub> nanosheet-based solar rechargeable batteries toward multi-scene solar energy conversion and storage

Xiaohong Ma, Jie Fu, Linning Gao, Junzheng Zhang, Sheng Tao, Wenqing Guo, Xuefei Liu, Beibei Yang and Jun Lu\*

# 10593



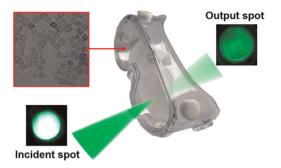
# Stable chemical enhancement of passivating nanolayer structures grown by atomic layer deposition on silicon

Sophie L. Pain,\* Edris Khorani, Tim Niewelt, Ailish Wratten, Marc Walker, Nicholas E. Grant and John D. Murphy\*

#### 10606

# Flexible optical limiters based on Cu<sub>3</sub>VSe<sub>4</sub> nanocrystals

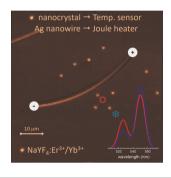
Xin-Ping Zhai, Bo Ma, Ming-Jun Xiao, Wen Shang, Zhi-Cong Zeng, Qiang Wang\* and Hao-Li Zhang\*



#### 10614

# Single up-conversion nanocrystal as a local temperature probe of electrically heated silver nanowire

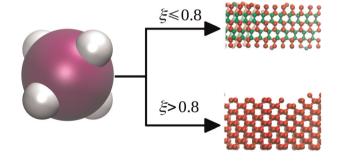
K. Wiwatowski, K. Sulowska, R. Houssaini, A. Pilch-Wróbel, A. Bednarkiewicz, A. Hartschuh, S. Maćkowski and D. Piątkowski\*



#### 10623

# Pursuing colloidal diamonds

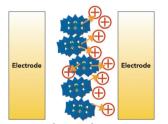
Łukasz Baran,\* Dariusz Tarasewicz, Daniel M. Kamiński and Wojciech Rżysko



# 10634

Experimental observation of the role of countercations in modulating the electrical conductance of Preyssler-type polyoxometalate nanodevices

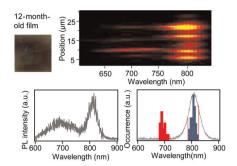
Cécile Huez, Séverine Renaudineau, Florence Volatron, Anna Proust\* and Dominique Vuillaume\*



High conductance

Low conductance

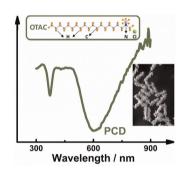
#### 10642



# Air-stable mixed cation lead halide perovskite films and microscopic study of their degradation process

Anubha Agarwal, Shun Omagari and Martin Vacha\*

#### 10651



# Modulation of plasmonic chiral shell growth on gold nanorods via nonchiral surfactants

Xinshuang Gao, Qiang Zheng, Hanbo Li, Chenqi Zhang, Rui Cai, Yinglu Ji, Zhijian Hu and Xiaochun Wu\*

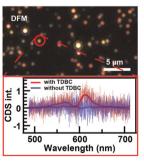
# 10661 sco High spin Low spin

# Proposal of spin crossover as a reversible switch of catalytic activity for the oxygen evolution reaction in two dimensional metal-organic frameworks

Min Ren, Xiangyu Zhu, Qiquan Luo,\* Xingxing Li\* and Jinglong Yang

### 10667





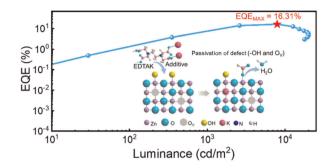
# Trace detection of chiral J-aggregated molecules adsorbed on single Au nanorods

Xingyue Lin, Yuhan Zhou, Xinyang Pan, Qin Zhang, Ningneng Hu, Hao Li, Le Wang, Qi Xue, Wei Zhang and Weihai Ni\*

#### 10677

Defect passivation and electron band energy regulation of a ZnO electron transport layer through synergetic bifunctional surface engineering for efficient quantum dot light-emitting diodes

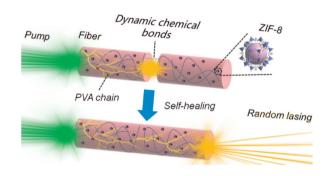
Fensha Cai, Yufei Tu, Dadi Tian, Yan Fang, Bo Hou, Muhammad Ishaq, Xiaohong Jiang, Meng Li, Shujie Wang\* and Zuliang Du\*



#### 10685

# Metal—organic framework-based self-healing hydrogel fiber random lasers

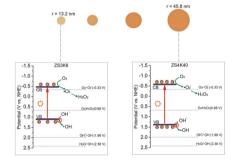
Dexiang Zhu, Zhouyuanhang Wang, Jun Xie, Guangyin Qu, Qi Yu, Yan Kuai, Benli Yu, Jianzhong Zheng, Zhijia Hu\* and Siqi Li\*



#### 10693

Size-controlled growth of ZnSe nanocrystals for high-performance photocatalytic  $\rm H_2O_2$  production in pure water

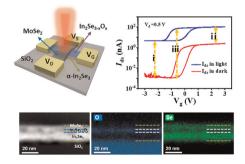
Peng Zhang,\* Jiankang Wang, Jinyu Hu, Zhibo Tong, Yajing Wang, Songli Liu,\* Shimin Ding and Youqing Yu



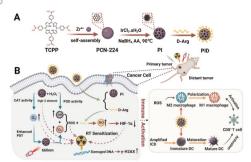
### 10705

An all-two-dimensional Fe-FET retinomorphic sensor based on the novel gate dielectric  $In_2Se_{3-x}O_x$ 

Xuhong Li, Xiaoqing Chen,\* Wenjie Deng, Songyu Li, Boxing An, Feihong Chu, Yi Wu, Famin Liu\* and Yongzhe Zhang\*



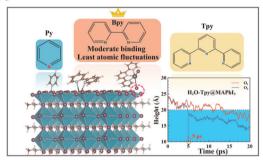
# 10715



Reprogramming of the tumor microenvironment using a PCN-224@IrNCs/D-Arg nanoplatform for the synergistic PDT, NO, and radiosensitization therapy of breast cancer and improving anti-tumor immunity

Yi-Ming Zou, Rong-Tian Li, Lei Yu, Ting Huang, Jian Peng, Wei Meng, Bin Sun, Wen-Hua Zhang, Zhi-Hong Jiang, Jun Chen\* and Jin-Xiang Chen\*

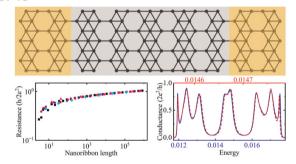
# 10730



A moderate intensity ligand works best: a theoretical study on passivation effects of pyridine-based molecules for perovskite solar cells

Na Chen, Weiyi Zhang and Quan-Song Li\*

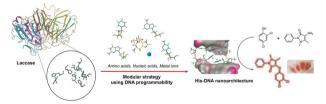
#### 10740



# Enhanced electron transport and self-similarity in quasiperiodic borophene nanoribbons with line defects

Pei-Jia Hu, Jin-Ting Ding, Zeng-Ren Liang, Tie-Feng Fang, Ai-Min Guo\* and Qing-Feng Sun

# 10749



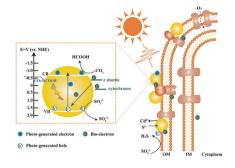
# Histidine-DNA nanoarchitecture as laccase mimetic DNAzymes

Ji Hye Yum, Tomotaka Kumagai, Daisuke Hori, Hiroshi Sugiyama\* and Soyoung Park\*

#### 10755

# Enhanced photocatalytic CO<sub>2</sub> reduction on biomineralized CdS via an electron conduit in bacteria

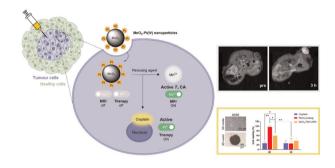
Juan Liu, Xiaoxiao Guo, Liuyang He, Li-Ping Jiang,\* Yang Zhou\* and Jun-Jie Zhu\*



### 10763

# Redox double-switch cancer theranostics through Pt(IV) functionalised manganese dioxide nanostructures

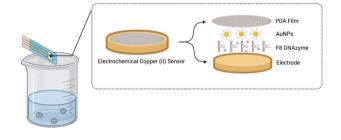
Beatriz Brito, Maria Rosaria Ruggiero, Thomas W. Price, Milene da Costa Silva, Núria Genicio, Annah J. Wilson, Olga Tyurina, Veronika Rosecker, Thomas R. Eykyn, Manuel Bañobre-López, Graeme J. Stasiuk and Juan Gallo\*



# 10776

# Activity-enhanced DNAzyme for design of label-free copper(II) biosensor

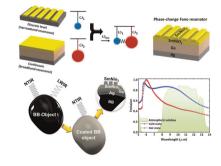
William Etheridge, Frederic Brossard, Sitan Zheng, Svenja Moench, Suraj Pavagada, Róisín M. Owens and Ljiljana Fruk\*



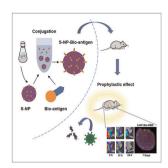
# 10783

# Phase-change Fano resonator for active modulation of thermal emission

Bahram Khalichi,\* Amir Ghobadi,\* Ataollah Kalantari Osgouei, Zahra Rahimian Omam, Hasan Kocer and Ekmel Ozbay\*

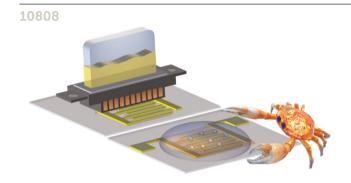


#### 10794



# Production of a promising modular proteinaceous self-assembled delivery system for vaccination

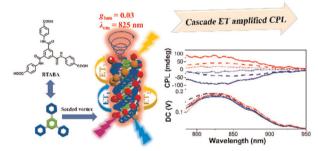
Chao Pan, Jingqin Ye, Sen Zhang, Xiang Li, Yixin Shi, Yan Guo, Kangfeng Wang, Peng Sun, Jun Wu,\* Hengliang Wang\* and Li Zhu\*



# Chitosan-gated organic transistors printed on ethyl cellulose as a versatile platform for edible electronics and bioelectronics

Alina S. Sharova, Francesco Modena, Alessandro Luzio, Filippo Melloni, Pietro Cataldi, Fabrizio Viola, Leonardo Lamanna, Nicolas F. Zorn, Mauro Sassi, Carlotta Ronchi, Jana Zaumseil, Luca Beverina, Maria Rosa Antognazza and Mario Caironi\*

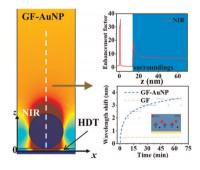
# 10820



# Cascade energy transfer boosted near-infrared circularly polarized luminescence of nanofibers from an exclusively achiral system

Chen Xiao, Chengxi Li, Kang Huang, Pengfei Duan\* and Yafei Wang\*

### 10826



# Sensitivity investigation of a biosensor with resonant coupling of propagating surface plasmons to localized surface plasmons in the near infrared region

Huimin Wang, Tao Wang,\* Simei Zhong, Jinyan Zhang, Ruoqin Yan, Peng Xu, Yu-hui Zhang, Xinzhao Yue, Lu Wang, Yuandong Wang, Xuyang Yuan, Jinwei Zeng and Jian Wang\*

# 10834

Evaluating strain and doping of Janus MoSSe from phonon mode shifts supported by *ab initio* DFT calculations

Jennifer Schmeink, Vladislav Musytschuk, Erik Pollmann, Stephan Sleziona, André Maas, Peter Kratzer and Marika Schleberger\*

