# Nanoscale Horizons

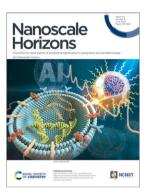
The home for rapid reports of exceptional significance in nanoscience and nanotechnology

# rsc.li/nanoscale-horizons

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 2055-6756 CODEN NHAOAW 8(6) 707-844 (2023)



#### Cover

See Alain Wuethrich, Matt Trau, Jing Wang et al., pp. 746-758. Image reproduced by permission of Jing Wang from Nanoscale Horiz... 2023, 8, 746.



### Inside cover

See Muhammad Zubair. Muhammad Qasim Mehmood, Yehia Massoud, Junsuk Rho et al., pp. 759-766. Image reproduced by permission of Prof. Dr Yehia Massoud from Nanoscale Horiz., 2023, 8, 759.

## **EDITORIAL**

714

Introduction to new horizons in materials for energy conversion, optics and electronics

Jinlan Wang,\* Yuanjian Zhang,\* Seeram Ramakrishna\* and Guihua Yu\*

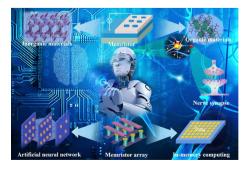


## **REVIEW**

716

# Memristor-based neural networks: a bridge from device to artificial intelligence

Zelin Cao, Bai Sun,\* Guangdong Zhou, Shuangsuo Mao, Shouhui Zhu, Jie Zhang, Chuan Ke, Yong Zhao and Jinyou Shao\*



#### **Editorial Staff**

**Executive Editor** 

Michaela Mühlberg

#### Managing Editor

Heather Montgomery

**Editorial Production Manager** 

Ionathon Watson

Senior Publishing Editor

Alex Metherell

**Development Editor** 

Matthew Blow, Chris Dias, Rob Hinde, Ash Hyde, Evie Karkera, Tamara Kosikova, Carole Martin, Kirsty McRoberts, Cat Schofield, Ella White, Tom Williams

#### Editorial Assistant

Elizabeth So

Assistant Editors 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: nanoscalehorizons@rsc.org

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

E-mail: nanoscalehorizons-rsc@rsc.org

Nanoscale Horizons (print: ISSN 2055-6756 electronic: ISSN 2055-6764) is published 12 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: £2727; \$4500. 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 Horizons

### rsc.li/nanoscale-horizons

Nanoscale Horizons is the home for urgent short reports of exceptionally high quality & innovative nanoscience & nanotechnology



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

#### **Editorial Board**

Katharina Landfester Max Planck Institute for Polymer Research, Germany

#### Scientific Editors

Katsuhiko Ariga, National Institute for Materials Science (NIMS), Japan Wenlong Cheng, Monash University,

Miaofang Chi, Oak Ridge National Laboratory, USA Yves Dufrêne, Université Catholique de

Louvain, Belgium Anna Fontcuberta i Morral, École polytechnique fédérale de Lausanne, Switzerland

Switzernand Dirk Guldi, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany Jin-Hong Park, Pohang University of Science and Technology, South Korea Zhiyong Tang, National Center for Nanoscience and Technology, China Jinlan Wang, Southeast University, China

Members Michael Sailor, University of California, San Diego, USA Sarah Tolbert, University of California,

Miqin Zhang, University of Washington, USA

#### Advisory Board

Chunli Bai, Chinese Academy of Sciences,

Uri Banin, Hebrew University of Jerusalem,

Frank Caruso, University of Melbourne, Australia

Cinzia Casiraghi, The University of Manchester, UK

Paola Ceroni, University of Bologna, Italy Chunying Chen, National Center for Nanoscience and Technology, China Xiaodong Chen, Nanyang Technological

University, Singapore Serena Cussen, University of Sheffield, UK Harold Craighead, Cornell University, USA Oing Dai, National Center for Nanoscience and Technology, China Shuai Dong, Southeast University, China

Laura Fabris, Rutgers University, USA Andrea Ferrari, University of Cambridge, UK Raju Kumar Gupta, Indian Institute of Technology Kanpur, India Xingyu Jiang, Southern University of Science and Technology, China Rongchao Jin, Carnegie Mellon University,

Dong Ha Kim, Ewha Womans University, South Korea Jang-Kyo Kim, University of New South Wales,

Kostas Kostarelos, University of Manchester,

Yamuna Krishnan, University of Chicago,

Tai Wei David Leong, National University of Singapore, Singapore Quan Li, Chinese University of Hong Kong,

Quan L, Climese University of Hong F Hong Kong Xing Yi Ling, Nanyang Technological University, Singapore Jie Liu, Duke University, USA Xiaogang Liu, National University of Clington Climentons In Proceedings of the Proceedings of the Part of the P

Singapore, Singapore Renzhi Ma, National Institute for Materials

Science, Japan Stefan Maier, Ludwig-Maximilians-Universität München, Germany Liberato Manna, Istituto Italiano di

Tecnologia, Italy Chad Mirkin, Northwestern University, USA Paul Mulvaney, University of Melbourne,

Catherine Murphy, University of Illinois at Urbana-Champaign, USA Valeria Nicolosi, Trinity College Dublin,

Dong Qin, Georgia Institute of Technology,

Sandra Rosenthal, Vanderbilt University, USA Paolo Samorì, Université de Strasbourg, France

Ester Segal, Technion - Israel Institute of

Technology, Israel Elena Shevchenko, Argonne National Laboratory, USA

Hisanori Shinohara, Nagoya University, Japan Zuzanna Siwy, University of California, Irvine, USA

Sara Skrabalak, Indiana University, USA Francesco Stellacci, École polytechnique fédérale de Lausanne, Switzerland Ling-Dong Sun, Peking University, China Shouheng Sun, Brown University, USA Jonathan Veinot, University of Alberta,

Umesh Waghmare, Jawaharlal Nehru Centre for Advanced Scientific Research, India Jianfang Wang, Chinese University of Hong

Kong, Hong Kong SAR Sharon Weiss, Vanderbilt University, USA Benjamin Wiley, Duke University, USA Stefan Zauscher, Duke University, USA Xiao Cheng Zeng, University of Nebraska-Lincoln, USA

Hongjie Zhang, Changchun Institute of Applied Chemistry, China Hua Zhang, City University of Hong Kong,

Manzhou Zhu, Anhui University, China Jin Zou, University of Queensland, Australia

#### Community Board

Serena Carrara, CNRS Aix-Marseille

Université, France Arun Richard Chandrasekaran, The RNA Institute, University at Albany, SUNY, USA Ying Diao, University of Illinois at Urbana-

Champaign, USA
Qingchen Dong, Shanghai University, China
Yuanxing Fang, Fuzhou University, China
Azhar Fakharuddin, Interuniversity Microelectronics Centre, Belgium Calum T. J. Ferguson, Max Planck Institute

for Polymer Research, Germany Lucas Güniat, EPFL, Switzerland Marilena Hadjidemetriou, University of Manchester, UK

Shumeng Hao, Georgia Institute of Technology, USA Samuel S. Hinman, Berkeley Lights, Inc, USA Nobuhiko Hosono, University of Tokyo, Japan

Jundie Hu, Suzhou University of Science and Technology, China

Shuaidong Huo, Xiamen University, China Ignacio Insua, University of Santiago de Compostela, Spain Debrina Jana, Indian Institute of Science

Education and Research Mohali, India

Ruibin Jiang, Shaanxi Normal University, Yih Hong Lee, Nanyang Technological

University, Singapore Sarah Lerch, Chalmers University of Technology, Sweden Li Li, Northeastern University, USA

Zhiyuan Liu, Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences,

Saeed Nazemidashtarjandi, The University of Texas at Austin, USA

Sabina Alexandra Nicolae, Queen Mary University of London/Imperial College London, UK

Anamaria Orza, Emory University, USA Pepita Pla-Vilanova, University of Lleida,

Spain Amirali Popat, The University of Queensland, Australia Kalyan Raidongia, Indian Institute of

Technology Guwahati, India Satyajit Ratha, Indian Institute of Technology Bhubaneswar, India Nathaniel Richey, Stanford University, USA

Jungki Ryu, Ulsan National Institute of Science and Technology, Korea Lei Shao, Beijing Computational Science Research Center, China Pengzhan Sun, University of Manchester, UK

Jing Tang, The University of Queensland, Australia Yanlong Wang, Dalian Institute of Chemical Physics, China

Jiangjiexing Wu, Tianjin University, China Tong Wu, Qingdao University,China Wenzhuo Wu, Purdue University, USA Xiuqiang Xie, Hunan University, China Liguang Xu, Jiangnan University, China Yikai Xu, Queen's University Belfast, UK Nobuhiro Yanai, Kyushu University, Japan Fei Zhang, Tianjin University , China Zishuai Zhang, The University of British Columbia, Canada

Ya Zhou, Advanced Micro-Fabrication Equipment Inc., China Kai Zhu, Harbin Engineering University,

Xiaolu Zhuo, CICbiomagnue, Spain

# Information for Authors

Full details on how to submit material for publication in Nanoscale Horizons 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-horizons

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

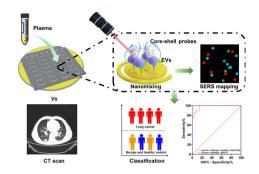


#### **COMMUNICATIONS**

#### 746

# Plasma extracellular vesicle phenotyping for the differentiation of early-stage lung cancer and benign lung diseases

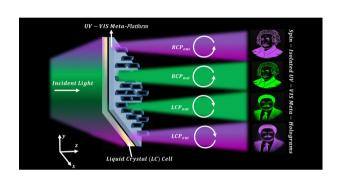
Liwen Yuan, Yanpin Chen, Longfeng Ke, Quan Zhou, Jiayou Chen, Min Fan, Alain Wuethrich,\* Matt Trau\* and Jing Wang\*



#### 759

# Spin-isolated ultraviolet-visible dynamic meta-holographic displays with liquid crystal modulators

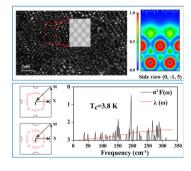
Agsa Asad, Joohoon Kim, Hafiz Saad Khalig, Nasir Mahmood, Jehan Akbar, Muhammad Tariq Saeed Chani, Yeseul Kim, Dongmin Jeon, Muhammad Zubair,\* Muhammad Qasim Mehmood,\* Yehia Massoud\* and Junsuk Rho\*



### 767

# A novel two-dimensional superconducting Ti layer: density functional theory and electron-beam irradiation

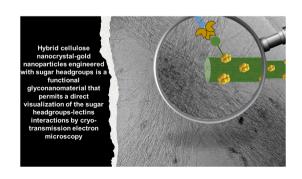
Xiao-Min Zhang, Jiawei Tang, Jing Zhang, Jin Yu, Litao Sun, Zhiqing Yang,\* Ke Xia\* and Weiwei Sun\*



#### 776

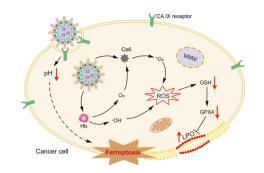
# Simple engineering of hybrid cellulose nanocrystal-gold nanoparticles results in a functional glyconanomaterial with biomolecular recognition properties

Giacomo Biagiotti, Gianluca Toniolo, Martin Albino, Mirko Severi, Patrizia Andreozzi, Marcello Marelli, Hana Kokot, Giancarlo Tria, Annalisa Guerri, Claudio Sangregorio, Javier Rojo, Debora Berti, Marco Marradi, Stefano Cicchi, Iztok Urbančič, Yvette van Kooyk, Fabrizio Chiodo\* and Barbara Richichi\*



#### **COMMUNICATIONS**

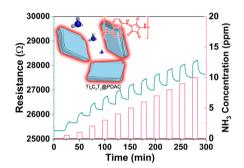
783



# Carbonic anhydrase IX-targeted nanovesicles potentiated ferroptosis by remodeling the intracellular environment for synergetic cancer therapy

Nian Liu, Qian Lin, Wenbao Zuo, Weibin Chen, Shan Huang, Yinshu Han, Xing-Jie Liang,\* Xuan Zhu\* and Shuaidong Huo\*

794

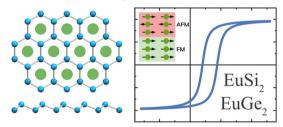


# An ultra-sensitive NH<sub>3</sub> gas sensor enabled by an ion-in-conjugated polycroconaine/Ti<sub>3</sub>C<sub>2</sub>T<sub>x</sub> core-shell composite

Jin Zhou, Seyed Hossein Hosseini Shokouh, Linfan Cui, Topias Järvinen, Olli Pitkänen, Zhong-Peng Lv\* and Krisztian Kordas\*

803

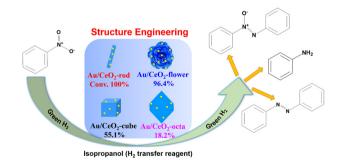
# exchange bias state



# Intrinsic exchange bias state in silicene and germanene materials EuX<sub>2</sub>

Dmitry V. Averyanov, Ivan S. Sokolov, Alexander N. Taldenkov, Oleg E. Parfenov, Igor A. Karateev, Oleg A. Kondratev, Andrey M. Tokmachev and Vyacheslav G. Storchak\*

812



# Structure engineering of CeO<sub>2</sub> for boosting the Au/CeO<sub>2</sub> nanocatalyst in the green and selective hydrogenation of nitrobenzene

Junqing Ye, Meizan Jing, Yu Liang, Wenjin Li, Wanting Zhao, Jianying Huang, Yuekun Lai,\* Weiyu Song, Jian Liu and Jian Sun\*

# COMMUNICATIONS

827

# A light-operated integrated DNA walker-origami system beyond bridge burning

Xiao Rui Liu, long Ying Loh, Winna Siti, Hon Lin Too, Tommy Anderson and Zhisong Wang\*

