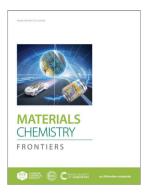
# **MATERIALS** CHEMISTRY

# **FRONTIERS**

# rsc.li/frontiers-materials

### IN THIS ISSUE

ISSN 2052-1537 CODEN MCFAC5 7(12) 2289-2498 (2023)



#### Cover

See Sen Xin et al., pp. 2405-2410. Image reproduced by permission of Sen Xin from Mater. Chem. Front., 2023, 7, 2405.



#### Inside cover

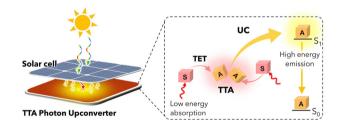
See Pankaj Bharmoria, Kasper Moth-Poulsen et al., pp. 2297-2315. Image reproduced by permission of Pankaj Bharmoria from Mater. Chem. Front., 2023, 7, 2297.

#### **REVIEWS**

# 2297

# Triplet-triplet annihilation mediated photon upconversion solar energy systems

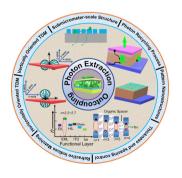
Lukas Naimovičius, Pankaj Bharmoria\* and Kasper Moth-Poulsen\*



#### 2316

Light outcoupling strategies in oriented perovskite light-emitting-diodes: recent trends, opportunities, and challenges toward innovation

Muhammad Imran Saleem, Rino Choi\* and Jeong-Hwan Lee\*



#### **EDITORIAL STAFF**

**Executive Editor** 

Wenjun Liu

Kailin Deng

Cheng Du

**Editorial Production Manager** 

Helen Saxton

Senior Publishing Editor

Becky Webb

Kirstine Anderson, Matthew Bown, Laura Cooper, Emily Cuffin-Munday, Hannah Fielding, Clare Fitzgerald, Anoushka Handa, Claire Harding, Alan Holder, Donna Smith, Laura Smith

Jie Gao, Yu Zhang

Publisher

Jeanne Andres

For queries about submitted papers, please contact Helen Saxton, Editorial Production Manager, in the first instance. E-mail: MaterChemFrontiersPROD@rsc.org

For pre-submission queries please contact Wenjun Liu, Executive Editor. Email: MaterChemFrontiersED@rsc.org

Materials Chemistry Frontiers (electronic: ISSN 2052-1537) is published 24 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 RSC 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: £1,369; US\$2,247. 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 W1I 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



# **MATERIALS** CHEMISTRY

# FRONTIFRS

An international, high impact journal for cutting-edge researches from all disciplines of materials chemistry.





#### rsc.li/frontiers-materials

Published in collaboration with the Chinese Chemical Society and Institute of Chemistry, Chinese Academy of Sciences

#### Editor-in-Chief

Shu-Hong Yu, University of Science and Technology of China, China

#### Associate Editors

Shu Seki, Kvoto University, Japan Andrea Tao, University of California, San Diego, USA

Dan Wang, Institute of Process Engineering, Chinese Academy of Sciences, China Guillaume Wantz, Université de Bordeaux,

Huanghao Yang, Fuzhou University, China

#### Members

Feihe Huang, Zhejiang University, China Zhen Li, Wuhan University, China Marina A. Petrukhina, University at Albany, USA Emilie Ringe, University of Cambridge, UK

Kazuo Tanaka, Kyoto University, Japan

#### **Advisory Board**

Takuzo Aida, The University of Tokyo, Japan J Paul Attfield, University of Edinburgh, UK Guillermo C Bazan, UC Santa Barbara, USA Liming Ding, National Center for Nanoscience and Technology, China

Xinliang Feng, Technische Universität Dresden, Germany

Jiaxing Huang, Northwestern University, USA Parameswar K. Iyer, Indian Institute of Technology Guwahati, India Samson Jenekhe, University of Washington,

Hua Kuang, Jiangnan University, China Mario Leclerc, Université Laval, Canada Xingjie Liang, National Center for Nanoscience John Reynolds, Georgia Institute of and Techonolgy, China

Bin Liu, National University of Singapore, Singapore

Dongsheng Liu, Tsinghua University, China Shaoqin Liu, Harbin Institute of Technology,

Xianjun Loh, Institute of Materials Research

and Engineering, Singapore Mark J MacLachlan, University of British Columbia, Canada

Krzysztof Matyjaszewski, Carnegie Mellon University, USA Klause Müllen, Max Planck Institute for

Polymer Research, Germany Thuc Quyen Nguyen, University of California,

Santa Barbara, USA Kyoko Nozaki, The University of Tokyo, Japan Aniun Oin, South China University of Technology, China

Olof Ramström, University of Massachusetts Lowell, USA

Technology, USA Ullrich Scherf, University of Wuppertal,

Germany Patrick Théato, Karlsruhe Institute of Technology, Germany

Christoph Weder, University of Fribourg, Switzerland

Karen L. Wooley, Texas A&M University, USA James Wuest, Université de Montréal, Canada Dongsheng Xu. Peking University, China Jiannian Yao, Institute of Chemistry, Chinese Academy of Sciences, China

Juyoung Yoon, Ewha Womans University, South Korea

Jihong Yu, Jilin University, China Deqing Zhang, Institute of Chemistry, Chinese Academy of Sciences, China

Hua Zhang, City University of Hong Kong. Qichun Zhang, City University of Hong Kong,

China Tierui Zhang, Technical Institute of Physics

and Chemistry, China Xi Zhang, Tsinghua University, China Yuliang Zhao, National Center for Nanoscience

and Technology, China Weihong Zhu, East China University of Science & Technology, China

Tayebeh Ameri, University of Munich, Germany

Derva Baran, King Abdullah University of Science and Technology, Saudi Arabia Xiaoyu Cao, Xiamen University, China Changle Chen, University of Science and Technology of China, China Sijie Chen, Karolinska Institutet, Hong Kong,

Dan Ding, Nankai University, China Kenneth Graham, University of Kentucky, USA Xinggui Gu, Beijing University of Chemical Technology, China Yuning Hong, La Trobe University, Australia

Zhong'an Li, Huazhong University of Science and Technology, China

Yingying Lu, Zhejiang University, China T. N. Narayanan, Tata Institute of Fundamental Research, India

Shohei Saito, Kyoto University, Japan Youhong Tang, Flinders University, Australia Takaya Terashima, Kyoto University, Japan Reji Varghese, Indian Institute of Science Education and Research, India

Jiangyan Wang, Institute of Process Engineering, Chinese Academy of Sciences, China

Yan Wei, Peking University School and Hospital of Stomatology, China Haihua Xiao, Institute of Chemistry, Chinese Academy of Sciences, China Yurui Xue, Shandong University, China Jing Yu, Nanyang Technological University, Singapore

Guoqing Zhang, University of Science and Technology of China, China

### Information for Authors

Full details on how to submit material for publication in Materials Chemistry Frontiers are given in the Instructions for Authors (available  $from \ \textbf{http://www.rsc.org/authors}). Submissions should be made via the \\ for non-commercial purposes, or criticism or review, as permitted \\ for non-commercial purposes, or criticism or review, as permitted \\ for non-commercial purposes, or criticism or review, as permitted \\ for non-commercial purposes, or criticism or review, as permitted \\ for non-commercial purposes, or criticism or review, as permitted \\ for non-commercial purposes, or criticism or review, as permitted \\ for non-commercial purposes, or criticism or review, as permitted \\ for non-commercial purposes, or criticism or review, as permitted \\ for non-commercial purposes, or criticism or review, as permitted \\ for non-commercial purposes, or criticism or review, as permitted \\ for non-commercial purposes, or criticism or review, as permitted \\ for non-commercial purposes, or criticism or review, as permitted \\ for non-commercial purposes, or criticism or review, as permitted \\ for non-commercial purposes, or criticism or review, as permitted \\ for non-commercial purposes, or criticism or review, as permitted \\ for non-commercial purposes, or criticism or review, as permitted \\ for non-commercial purposes, or criticism or review, as permitted \\ for non-commercial purposes, or criticism or review, as permitted \\ for non-commercial purposes, or criticism or review, as permitted \\ for non-commercial purposes, or criticism or review, as permitted \\ for non-commercial purposes, or criticism or review, as permitted \\ for non-commercial purposes, or criticism or review, as permitted \\ for non-commercial purposes, or criticism or review, as permitted \\ for non-commercial purposes, or criticism or review, as permitted \\ for non-commercial purposes, or criticism or review, as permitted \\ for non-commercial purposes, or criticism or review, as permitted \\ for non-commercial purposes, or criticism or review \\ for non-commercial purposes, or criticism or review \\ for non-commercial purposes, or criticism or review \\ for non-commercial purposes, or critic$ journal's homepage: rsc.li/frontiers-materials

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 Partner Organisations 2023.

Apart from fair dealing for the purposes of research or private study 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**

#### 2337

# Recent advances in electrochromic materials and devices for camouflage applications

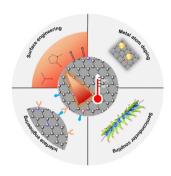
Haichang Fu, Ling Zhang, Yujie Dong, Cheng Zhang\* and Weijun Li\*



#### 2359

# Tuning the photothermal properties of carbon dots in the deep-red to near-infrared wavelength regions for tumor therapy

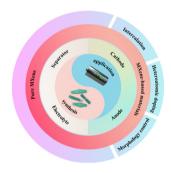
Tesen Zhang, Jun Wu, Zikang Tang\* and Songnan Qu\*



# 2373

# Recent advances in two-dimensional MXenes for zinc-ion batteries

Yunfei Shen, Heng Lv and Long Chen\*

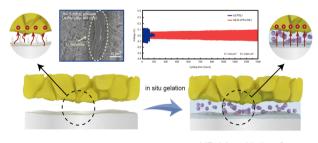


#### **RESEARCH ARTICLES**

#### 2405

# Fast and stable charge transfer at the lithiumsulfide (electrolyte) interface via an in situ solidified Li<sup>+</sup>-conductive interlayer

Ya-Hui Wang, Xu-Sheng Zhang, Cai-Cai Li, Hao Zeng, Zhe Chen, Liang Zhang, Jin-Chi Zheng, Yuan Luo, Sen Xin\* and Yu-Guo Guo

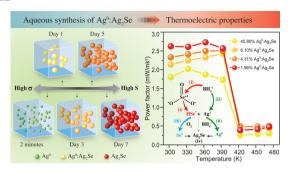


Unstable interface

LiF-rich stable interface

#### RESEARCH ARTICLES

#### 2411



# Compositionally tuned hybridization of n-type Ag<sup>0</sup>: Ag<sub>2</sub>Se under ambient conditions towards excellent thermoelectric properties at room temperature

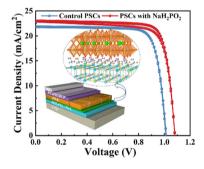
Si Yin Tee,\* Daniel Ponsford, Xian Yi Tan, Xiaobai Wang, Chee Leng Lay, Coryl Jing Jun Lee, Xi Ping Ni, Debbie Hwee Leng Seng, Warintorn Thitsartarn, Guijian Guan and Ming-Yong Han\*

#### 2419



# 3,4-Ethylenedithio thiophene donor for NIR-II fluorophores with improved quantum yields

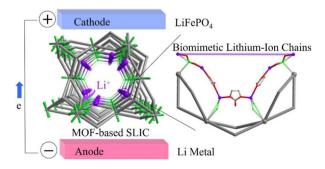
Chunchen Liu, Xinyuan Wang, Xingfu Zhu, Rui Ma, Qihui Lin\* and Yongye Liang\*



# Interlayer engineering via alkaline hypophosphates for efficient and air-stable perovskite solar cells

Jin Peng, Qiaofeng Wu, Hongming Hou, Taotao Hu, Yue Huang, Xudong Cai, Wenjie Luo, Xin Chen and Hua Yu\*

#### 2436



# Pseudo single lithium-ion conductors enabled by a metal-organic framework with biomimetic lithium-ion chains for lithium metal batteries

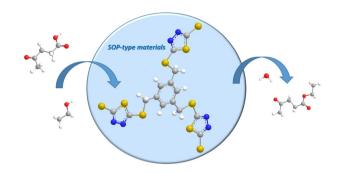
Jian-Qiang Shen, Ying-Li Song, Chun-Ting He, Chen Zhang, Xing Lu, Zhikai Qi, Yunfeng Lu\* and Xian-Ming Zhang\*

### **RESEARCH ARTICLES**

#### 2443

Sulfide organic polymers as novel and efficient metal-free heterogeneous Lewis acid catalysts for esterification reactions

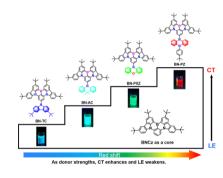
M. Melero, U. Díaz\* and F. X. Llabrés i Xamena\*



#### 2454

Red-shift emission and rapid up-conversion of B,N-containing electroluminescent materials *via* tuning intramolecular charge transfer

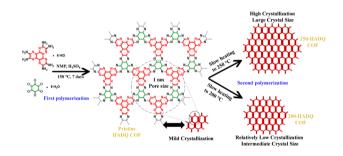
Yi-Hui He, Feng-Ming Xie,\* Hao-Ze Li, Kai Zhang, Yang Shen, Feng Ding, Cheng-Yuan Wang, Yan-Qing Li\* and Jian-Xin Tang\*



#### 2464

Boosting the crystallinity of novel two-dimensional hexamine dipyrazino quinoxaline-based covalent organic frameworks for electrical double-layer supercapacitors

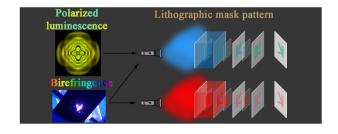
Rashid Iqbal,\* Muhammad Kashif Majeed, Arshad Hussain, Aziz Ahmad, Muhammad Ahmad, Bushra Jabar, Abdul Rehman Akbar, Sajjad Ali, Sajid Rauf and Adil Saleem\*



#### 2475

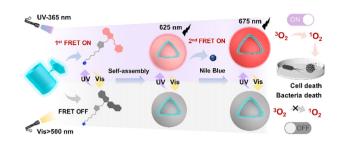
Birefringence and polarized luminescence of a manganese(II) chloride—triphenylphosphine oxide compound: application in LEDs and photolithography

Alexey Berezin



#### **RESEARCH ARTICLES**

#### 2484



A novel photoswitchable AIE-active supramolecular photosensitizer with synergistic enhancement of ROS-generation ability constructed by a two-step sequential FRET process

Xueqi Tian, Shengke Li, Krishnasamy Velmurugan, Zhihang Bai, Qian Liu, Kaiya Wang, Minzan Zuo\* and Xiao-Yu Hu\*

#### **CORRECTION**

#### 2493

Correction: Fluorescence resonance energy transfer enhanced photothermal and photodynamic antibacterial therapy post a single injection

Lei Xue, Qing Shen, Tian Zhang, Yibin Fan, Xiaogang Xu, Jinjun Shao,\* Dongliang Yang, Wenli Zhao, Xiaochen Dong\* and Xiaozhou Mou\*