

# Journal of Materials Chemistry C

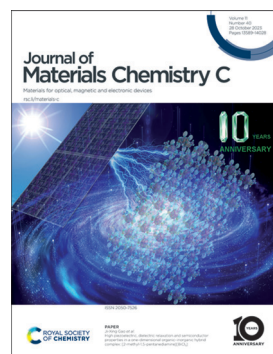
Materials for optical, magnetic and electronic devices

[rsc.li/materials-c](https://rsc.li/materials-c)

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 2050-7526 CODEN JMCCCC 11(40) 13589–14028 (2023)



### Cover

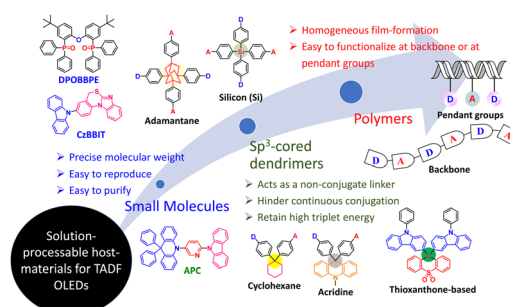
See Ji-Xing Gao  
et al., pp. 13675–13680.  
Image reproduced  
by permission of  
Ji-Xing Gao from  
*J. Mater. Chem. C*,  
2023, **11**, 13675.

## REVIEWS

### 13603

#### Recent endeavors and perspectives in developing solution-processable host materials for thermally activated delayed fluorescence organic light-emitting diodes

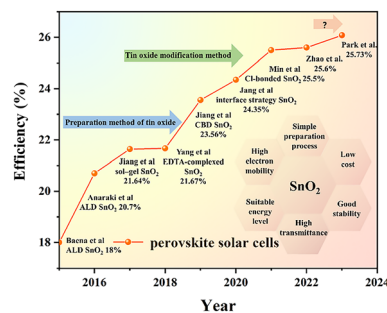
Purusottam Reddy Bommireddy,  
Chandra Sekhar Musalikunta, Young-Woong Lee,  
Youngsuk Suh, Malleshm Godumala\* and Si-Hyun Park\*



### 13625

#### Robust electron transport layers of SnO<sub>2</sub> for efficient perovskite solar cells: recent advances and perspectives

Bin Du,\* Kun He, Gangqi Tian, Xiang Che and Lin Song\*



## Editorial Staff

### Executive Editor

Michaela Mühlberg

### Deputy Editor

Geraldine Hay

### Editorial Production Manager

Jonathon Watson

### Senior Publishing Editor

Fiona Iddon

### Development Editor

Rose Wedgbury

### Publishing Editors

Matthew Blow, Sam Howell, Evie Karkera, Carole Martin,

Kirsty McRoberts

### Editorial Assistant

Daniel Smith

### Publishing Assistant

Jane Paterson

### Publisher

Sam Keltie

For queries about submitted papers, please contact Jonathon Watson, Editorial Production Manager in the first instance. E-mail: [materialsC@rsc.org](mailto:materialsC@rsc.org)

For pre-submission queries please contact

Michaela Mühlberg, Executive Editor.

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

Journal of Materials Chemistry C (electronic: ISSN 2050-7534) is published 48 times a year by the Royal Society of Chemistry, Thomas Graham House, Science Park, Milton Road, Cambridge, UK CB4 0WE.

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](mailto:orders@rsc.org)

2023 Annual (electronic) subscription price: £2521; \$4046.

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)

# Journal of Materials Chemistry C

[rsc.li/materials-C](http://rsc.li/materials-C)

*Journal of Materials Chemistry A, B & C* cover high quality studies across all fields of materials chemistry. The journals focus on those theoretical or experimental studies that report new understanding, applications, properties and synthesis of materials.

*Journal of Materials Chemistry C* covers materials with applications in optical, magnetic and electronic devices.

## Editorial Board

### Editor-in-Chief

Natalie Stingelin, Georgia Institute of Technology, USA

### Associate Editors

A. S. Achalkumar, Indian Institute of

Technology, India

Rachel Crespo-Otero, University College

London, UK

Renaud Demadrille, Interdisciplinary

Research Institute of Grenoble, France

Antonio Facchetti, Northwestern University,

USA

Unjong Jeong, POSTECH, South Korea

Oana Jurchescu, Wake Forest University, USA

Mingzhu Li, Technical Institute of Physics

and Chemistry, Chinese Academy of

Sciences, China

Martyn McLachlan, Imperial College

London, UK

Kasper Moth-Poulsen, Chalmers University

of Technology, Sweden

Ana Nogueira, University of Campinas, Brazil

Erin Ratcliff, University of Arizona, USA

Federico Rosei, University of Trieste, Italy

Yana Vayznof, Technical University of

Dresden, Germany

Maia Vergniory, Max Planck Institute for

Chemical Physics of Solids, Germany

Ni Zhao, Chinese University of Hong Kong,

Hong Kong

Zhiguo Xia, South China University of

Technology, China

Hao-Li Zhang, Lanzhou University, China

## Advisory Board

C. Bai, Chinese Academy of Sciences, China

E. Bittner, University of Houston, USA

T. Bunning, Air Force Research Laboratory,

USA

J. Casado, University of Malaga, Spain

R. Chandrasekar, University of Hyderabad,

India

Y.-J. Cheng, National Chiao Yung University,

Taiwan

M. Chhowalla, Rutgers - The State University

of New Jersey, USA

C. Chi, National University of Singapore,

Singapore

L. Chua, National University of Singapore,

Singapore

D. Evans, Beijing University of Chemical

Technology, China

M. Green, King's College London, UK

E. von Hauf, VU Amsterdam, Netherlands

L. Hueso, CIC nanoGUNE, Spain

C. S. Hwang, Seoul National University, Korea

M. Kanatzidis, Northwestern University, USA

T. Kato, The University of Tokyo, Japan

J. Kido, Yamagata University, Japan

H. Kuang, Jiangnan University, China

T. Kusamoto, Institute for Molecular Science,

Japan

M. Jeffries-EL, Boston University, USA

M. Lira-Cantú, Catalan Institute of

Nanoscience and Nanotechnology, Spain

S. Marder, University of Colorado Boulder,

USA

I. McCulloch, University of Oxford, UK

H. Mori, University of Tokyo, Japan

J. Ouyang, National University of Singapore,

Singapore

N. Robertson, University of Edinburgh, UK

P. Samori, Université de Strasbourg, France

R. Seshadri, University of California,

Santa Barbara, USA

R. Sessoli, University of Florence, Italy

Z. Shuai, Tsinghua University, China

C. Silva, Georgia Institute of Technology, USA

J. Snyder, Northwestern University, Illinois,

USA

C. Weder, University of Fribourg, Switzerland

G. Welch, University of Calgary, Canada

W. Wong, Hong Kong Polytechnic University,

Hong Kong

P. Woodward, Ohio State University, USA

Y. Yin, UC Riverside, USA

A. Zayats, King's College London, UK

X. Zhan, Peking University, China

Q. Zhang, City University of Hong Kong,

Hong Kong

## Information for Authors

Full details on how to submit material for publication in Journal of Materials Chemistry C 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/materials-c](http://rsc.li/materials-c). Submissions: The journal welcomes submissions of manuscripts for publication as Full Papers, Communications, Reviews, Highlights and Applications. Full Papers and Communications should describe original work of high quality and impact which must highlight the novel properties or applications (or potential properties/applications) of the materials studied.

Additional details are available from the Editorial Office or <http://www.rsc.org/authors>

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

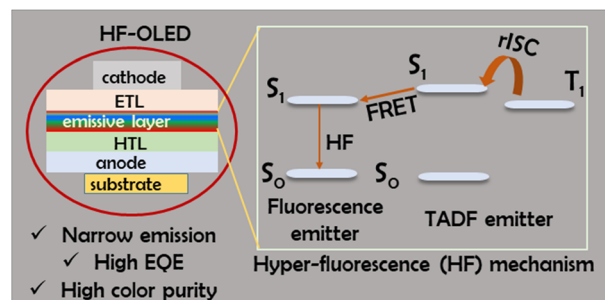


## REVIEWS

13647

**Emerging hyperfluorescent emitters for solid-state lighting**

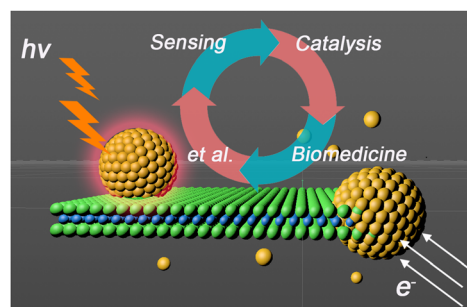
Santosh Kumar Behera\* and Rubén D. Costa\*



13657

**Molybdenum disulfide nanostructures coupled with metal plasmonics for improved electronic and photonic performances**

Na Zhang, Ying Jie Zheng, Liang Rui Zhu, Hao Lin Zou, Hong Qun Luo, Nian Bing Li and Bang Lin Li\*

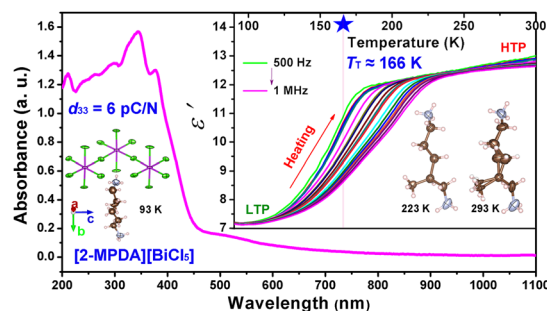


## PAPERS

13675

**High piezoelectric, dielectric relaxation and semiconductor properties in a one-dimensional organic–inorganic hybrid complex: [2-methyl-1,5-pentanediamine][BiCl<sub>5</sub>]**

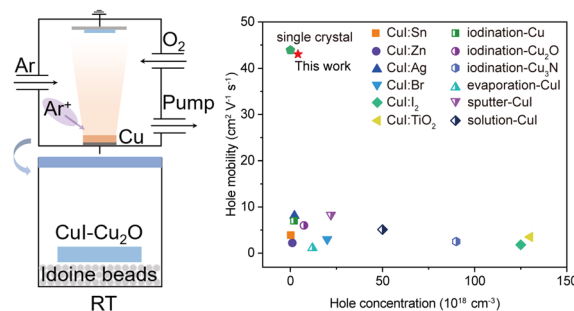
Zheng-Hui Hu, Xin-Yu Liu, Shu-Qi Sun, Chen Gong, Nuo Liu and Ji-Xing Gao\*



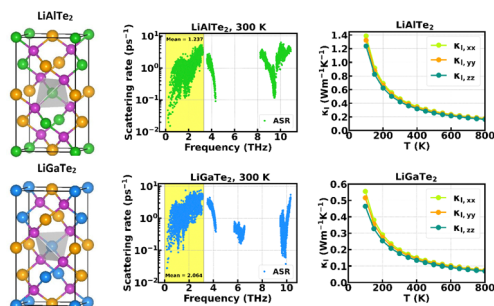
13681

**High-performance p-type transparent conducting CuI–Cu<sub>2</sub>O thin films with enhanced hole mobility, surface, and stability**

Ruibin Xue, Gang Gao,\* Lei Yang, Liangge Xu, Yumin Zhang\* and Jiaqi Zhu



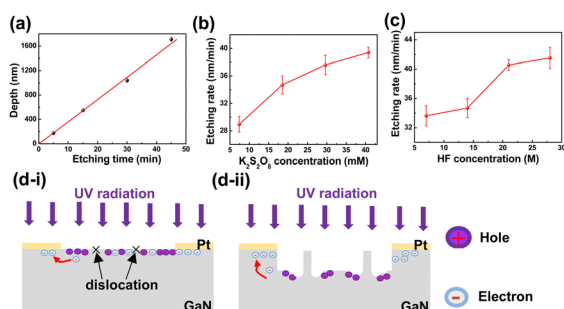
13691



### Physical insights into the ultralow lattice thermal conductivity and high thermoelectric performance of bulk LiMTe<sub>2</sub> (M = Al, Ga)

Sampad Mandal and Pranab Sarkar\*

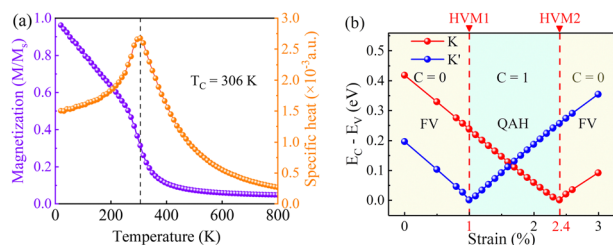
13707



### Plasma-free metal-assisted chemical etching producing three-dimensional gallium nitride structures

Yikai Liao, You Jin Kim, Shu An and Munho Kim\*

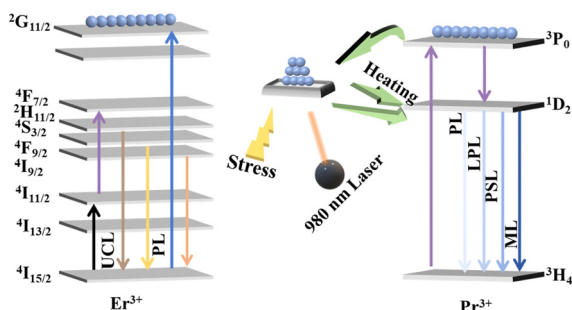
13714



### Ferrovalley and topological phase transition behavior in monolayer Ru(OH)<sub>2</sub>

Yanzhao Wu, Li Deng, Junwei Tong, Xiang Yin, Fubo Tian, Gaowu Qin and Xianmin Zhang\*

13725



### Achieving dynamic quintuple-mode luminescence in Ca<sub>3</sub>Ti<sub>2</sub>O<sub>7</sub>:Pr<sup>3+</sup>,Er<sup>3+</sup> phosphor for anti-counterfeiting applications

Jian Zhang, Xin You, Ting Wang,\* Yiyu Cai, Chao Wang, Xin Li, Zhichao Liu, Heng Dai, Alexey Nikolaevich Yakovlev, Xuhui Xu and Jie Yu\*

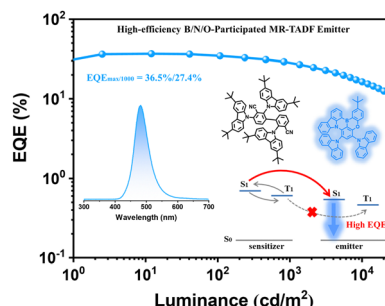


## PAPERS

13733

# B/N/O-participated multi-resonance TADF emitters by a simple peripheral decoration strategy enable high-efficiency electroluminescence with EQEs up to 36.5%

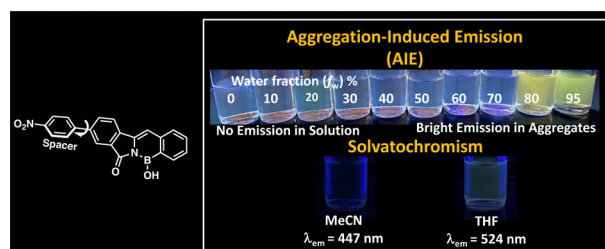
Yulin Xu, Jianmei Han, Nengquan Li,\* Zhongyan Huang, Jingsheng Miao and Chuluo Yang\*



13740

# Solvatochromic and aggregation-induced emission active nitrophenyl-substituted pyrrolidinone-fused-1,2-azaborine with a pre-twisted molecular geometry

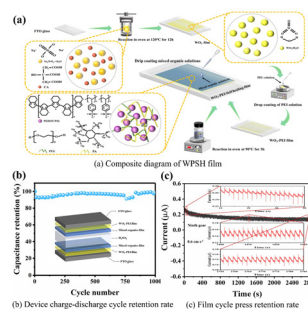
Albert D. Campbell Jr., Kaia Ellis, Lyric K. Gordon, Janiyah E. Riley, VuongVy Le, Kimberly K. Hollister, Stephen O. Ajagbe, Samer Gozem, Robert B. Hughley, Adeline M. Boswell, Ophelia Adjei-sah, Prioska D. Baruah, Ra'Nya Malone, Logan M. Whitt, Robert J. Gilliard Jr. and Carl Jacky Saint-Louis\*



13752

# Self-healing electrochromic energy storage devices based on PEDOT:PSS

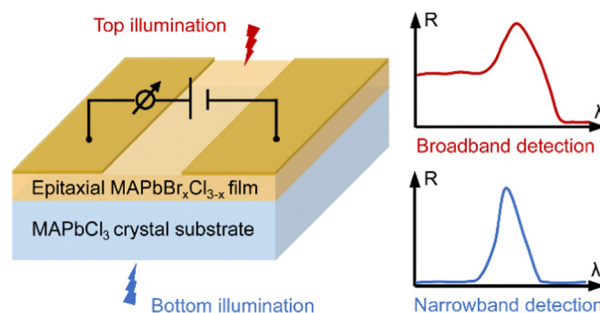
Yuanze Meng, Jialun Li, Xijia Yang, Yang Gao, Xuesong Li, Liying Wang\* and Wei Lü\*



13763

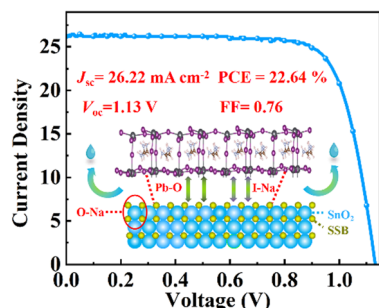
# Epitaxy growth of MAPbBr<sub>x</sub>Cl<sub>3-x</sub> single-crystalline perovskite films toward spectral selective detection in both broadband and narrowband ranges

Yuzhu Pan, Xin Wang,\* Yubing Xu, Shunjie Chai, Jie Wu, Zhiwei Zhao, Qing Li, Jun Wu, Jing Chen, Zhuoya Zhu, Byung Seong Bae, Omolola Esther Fayemi, Jianming Zhou, Ying Zhu and Wei Lei\*





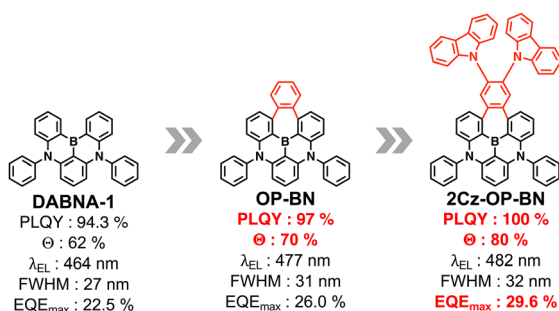
13774



### Small molecule-incorporated SnO<sub>2</sub> layer for efficient perovskite solar cells

Xin Zhou, Rui Kong, Rong Liu,\* Ying Liu,\* Mao Liang,\* Zhitao Shen, Fumin Li, Mengqi Jin, Dong Yang, Shengmin Wang, Huilin Li, Ruirui Cao and Chong Chen\*

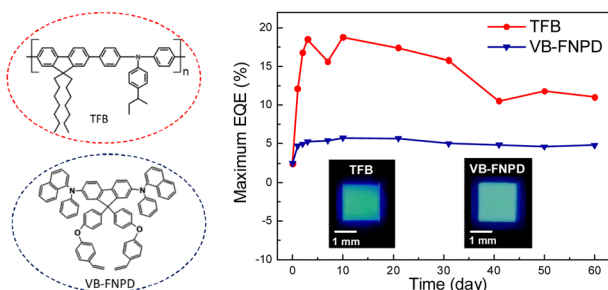
13782



### Phenylene-bridged cyclic multi-resonance TADF emitters for high-efficiency and high-color-purity sky-blue OLEDs with EQE of 30%

Kengo Kumada, Hisahiro Sasabe,\* Misaki Matsuya, Naoto Yoshida, Keigo Hoshi, Takeru Nakamura, Haruki Nemma and Junji Kido\*

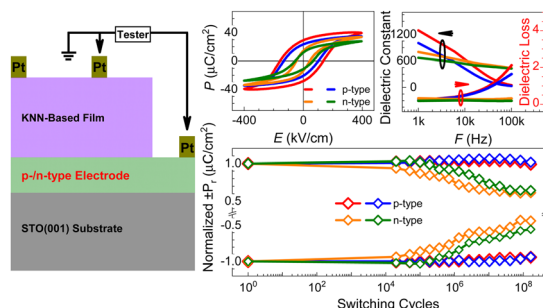
13788



### Long-term spontaneous negative aging behavior of encapsulated blue quantum dot light emitting devices: the influence of the hole transport material

Junfei Chen,\* Atefeh Ghorbani, Fatemeh Samaeifar, Peter Chun, Quan Lyu, Giovanni Cotella, Dandan Song, Zheng Xu and Hany Aziz

13794



### Buffer electrode layers tuned electrical properties, fatigue behavior and phase transition of KNN-based lead-free ferroelectric films

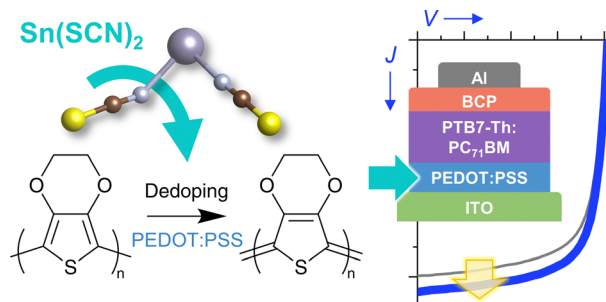
Liqiang Xu, Beibei Zhu, Song Dai, Kun Han, Pingfan Chen, Ke Wang, Zhen Huang,\* Wenbin Wu and Feng Chen\*



13803

### Sn(SCN)<sub>2</sub> as an additive for improving the hole transport properties of PEDOT:PSS in organic photovoltaics

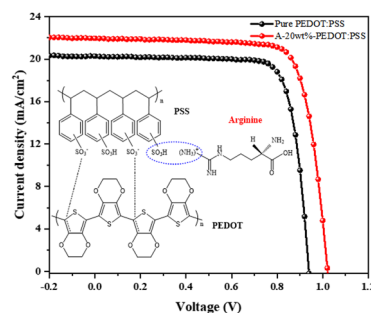
Jidapa Chaopaknam, Taweesak Sudyoadsuk, Vinich Promarak, Akinori Saeki and Pichaya Pattanasattayavong\*



13814

### Application of arginine-doped PEDOT:PSS as a hole transfer layer in perovskite solar cells

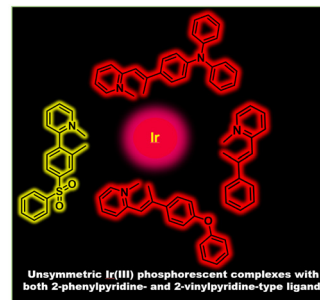
Yuanlin Yang, Yanqing Yao, Ying Li, Xusheng Zhao, Wan Cheng, Banghui Chen, Lijia Chen,\* Ping Li\* and Shuhui Tang



13824

### Unsymmetric Ir(III) phosphorescent complexes with both 2-phenylpyridine(ppy)- and 2-vinylpyridine(vpy)-type ligands bearing functional groups and their optoelectronic properties

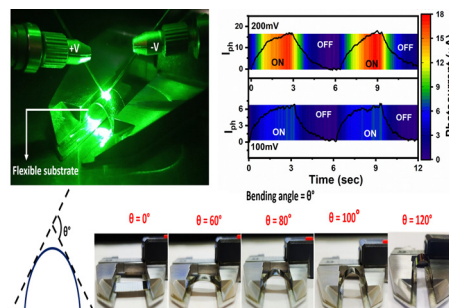
Siqi Liu, Zhao Feng, Hongyan Wang, Huaiteng Hang, Daokun Zhong, Xiaolong Yang, Yuanhui Sun, Bochao Su, Xianbin Xu, Zhen Feng, Guijiang Zhou\* and Bo Jiao

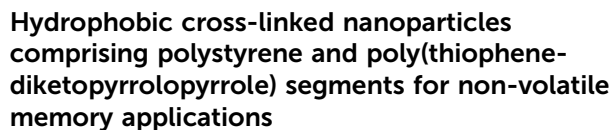


13838

### Strain-induced photocurrent enhancement in thin films of topological insulators (Bi<sub>2</sub>Te<sub>3</sub>)

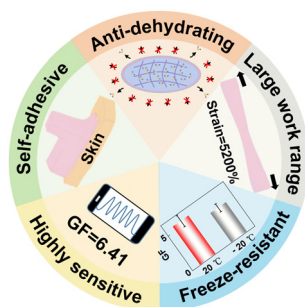
Animesh Pandey, Sanjay Sharma, Amit Kumar Gangwar, Mandeep Kaur, Preetam Singh and Sudhir Husale\*





Yueh-Chun Huang, Tomoya Yahagi, Zi-En Chiang,  
Qun-Gao Chen, Wen-Ya Lee\* and Tomoya Higashihara\*

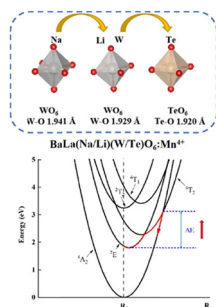
13857



## Conductive hydrogels with core-shell structures to realize super-stretchable, highly sensitive, anti-dehydrating, non-freezing and self-adhesive capabilities

Wentang Wang, Xinyue Deng, Jinlong Lu and Chunhui Luo\*

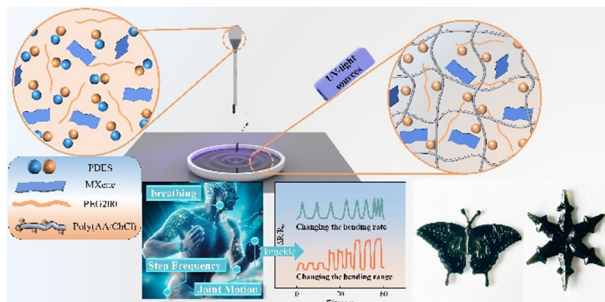
13865



# Insights into luminescence thermal quenching of Mn<sup>4+</sup>-doped BaLa(Na/Li)(W/Te)O<sub>6</sub> double perovskite red phosphors

Mengyao Zhai, Qiufeng Shi,\* Konstantin V. Ivanovskikh,  
Jianwei Qiao, Lei Wang, Haijie Guo, Ping Huang and  
Xiao-Jun Wang

13874



## Dual conductive network sensors based on an MXene/PDES supramolecular elastomer and their performance

Haoze Yuan, Peixing Li, Xinyu Wang, Cheng Yu,  
Xin Wang and Jutao Sun\*

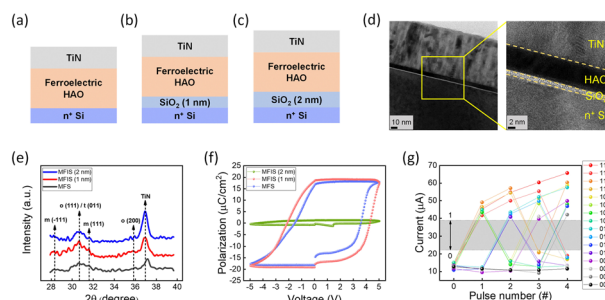


## PAPERS

13886

# Effect of interfacial SiO<sub>2</sub> layer thickness on the memory performances in the HfAlO<sub>x</sub>-based ferroelectric tunnel junction for a neuromorphic system

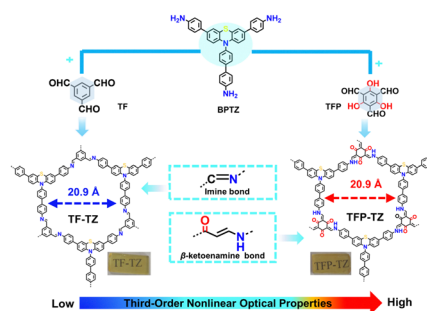
Yongjin Park, Jihyung Kim, Sunghun Kim, Dahye Kim, Wonbo Shim\* and Sungjun Kim\*



13897

# Phenothiazine-based donor–acceptor covalent–organic frameworks with keto–enol irreversible tautomerism as a promising third-order nonlinear optics material

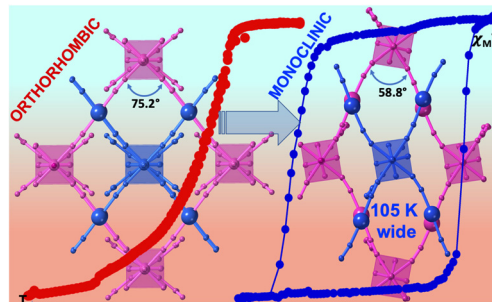
Mingyan Li, Tingting Li, Chengtao Gong, Debo Ding, Jiawei Du, Xiangxiang Zhou, Yinglin Song, Yun-Fang Yang, Yuanbin She\* and Jianhong Jia\*



13905

# Guest-controlled polymorphism and exceptionally marked bi-stability in a spin crossover 3D porous amino-functionalized coordination polymer

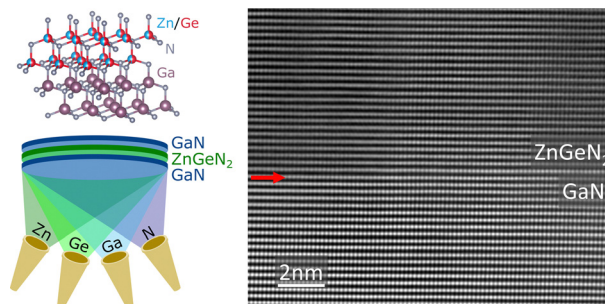
Alejandro Orellana-Silla, Manuel Meneses-Sánchez, Rubén Turo-Cortés, Víctor Rubio-Giménez, Giel Arnauts, M. Carmen Muñoz, Rob Ameloot, Carlos Bartual-Murgui\* and José Antonio Real\*



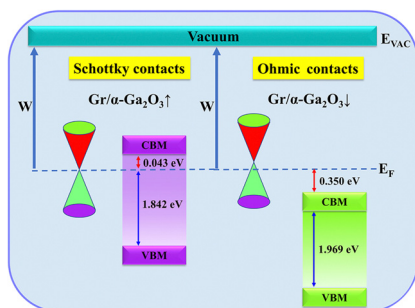
13917

# Structure, defects, and optical properties of commensurate GaN/ZnGeN<sub>2</sub>/GaN double heterojunctions

M. Brooks Tellekamp,\* M. K. Miller, Lin Zhou and Adele Tamboli



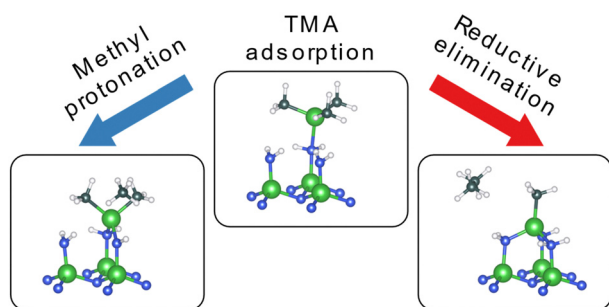
13924



### Electric field and strain engineering tuning of 2D Gr/ $\alpha$ -Ga<sub>2</sub>O<sub>3</sub> van der Waals heterostructures

Xiangyu Wu, Zhiyang Xie, Yu Zhang, Xuefei Liu,\*  
Jinshun Bi,\* Wentao Wang, Zhaofu Zhang and  
Ruyue Cao\*

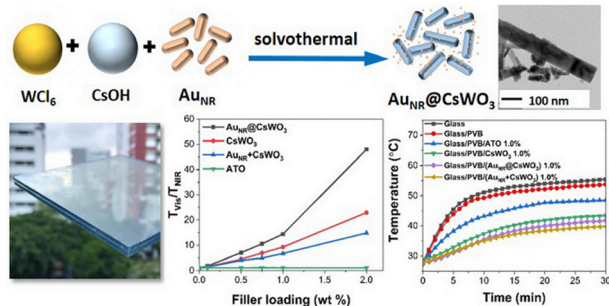
13935



### Surface chemical mechanisms of trimethyl aluminum in atomic layer deposition of AlN

Karl Rönby,\* Henrik Pedersen and Lars Ojamäe

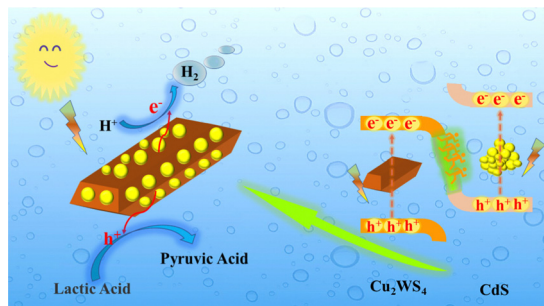
13946



### NIR shielding performance and spectral selectivity of PVB interlayer films loaded with composite fillers derived from CsWO<sub>3</sub> coupled with Au nanorods

Chanakarn Piwunuan, Jatuphorn Wootthikanokkhan\* and  
Chivarat Muangphat

13957



### Activating the (101) facets of Cu<sub>2</sub>WS<sub>4</sub> in the CdS/Cu<sub>2</sub>WS<sub>4</sub> S-scheme heterojunction to enhance the photocatalytic hydrogen evolution activity

Tian Wang and Zhiliang Jin\*

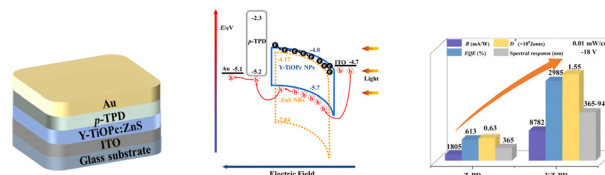


## PAPERS

13971

# High-performance UV-Vis-NIR photomultiplier detectors assisted by interfacial trapped-electrons

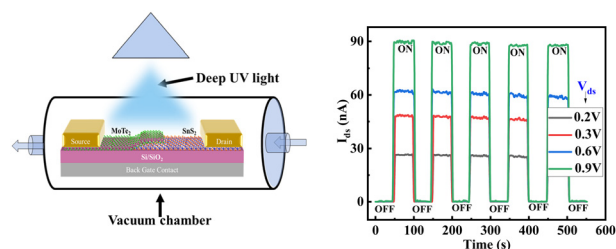
Xiaolong Li, Yulu Tang, Chenyu Wang, Tianzhu Wei, Dongjun Lv, Mingyuan Guo, Yongning Ma and Yuhao Yang\*



13981

# Gate-tunable rectification and photoresponse in a MoTe<sub>2</sub>/SnS<sub>2</sub> van der Waals heterostructure based P–N diode

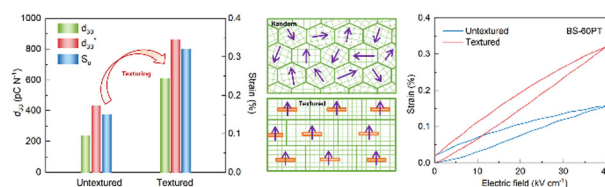
Ehsan Elahi,\* Muhammad Asghar Khan, Jaeho Jeon, Sahng-Kyoon Jerng, Abdullah A. Al-Kahtani and Hwayong Noh\*



13991

# Texture technique to achieve enhanced piezoelectric response in BiScO<sub>3</sub>–PbTiO<sub>3</sub> high-temperature piezoelectric ceramics

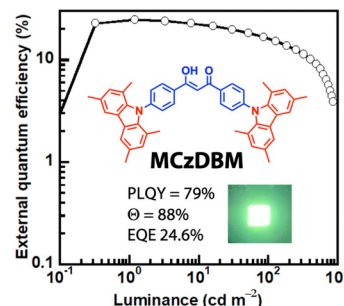
Xiaodan Ren, Mingyang Tang, Xin Liu, Yike Wang, Zhuo Xu\* and Yongke Yan\*



14002

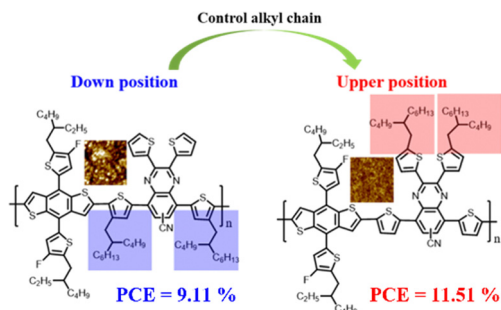
# Bluish-green-to-green thermally activated delayed fluorescent emitters based on $\beta$ -diketone derivatives exhibiting a horizontal emission dipole orientation ratio of 88% and an external quantum efficiency of nearly 25%

Keigo Hoshi, Hisahiro Sasabe,\* Ryoma Sato, Naoto Yoshida, Misaki Matsuya, Yudai Chiba and Junji Kido



## PAPERS

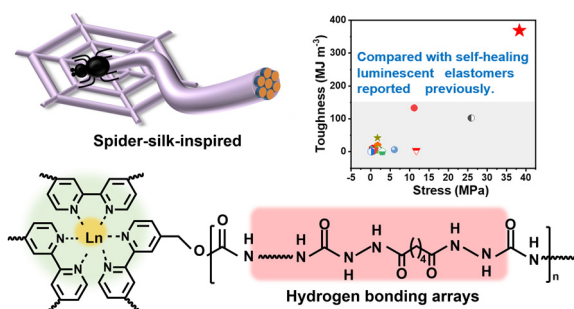
14009



### Positional effects of alkyl chains on the photovoltaic performances of quinoxaline-based polymers

Dinda Fariesta Nugraha, Yifan Yu, Jung Won Yoon, Hyungju Ahn, Juan Anthony Prayogo, Dong Ryeol Whang, Jihoon Lee,\* Hyosung Choi\* and Dong Wook Chang\*

14018



### A super-tough and self-healing biomimetic luminescent elastomer enabled by hydrogen bonding arrays and lanthanide-bipyridine moieties

Di Zhao, Chunmei Yue, Qianrui Li, Lei Guo and Huanrong Li\*

## CORRECTION

14025

### Correction: A multicolor carbon dot doped nanofibrous membrane for unclonable anti-counterfeiting and data encryption

Shunfei Qiang, Ke Yuan, Yanyan Cheng, Guoqiang Long, Wenkai Zhang,\* Xiaofeng Lin, Xiuli Chai,\* Xiaomin Fang and Tao Ding

