Open Access Article. Published on 03 January 2024. Downloaded on 12/9/2025 1:58:47 AM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

Journal of Materials Chemistry A

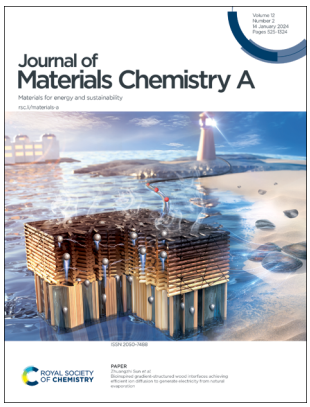
Materials for energy and sustainability

rsc.li/materials-a

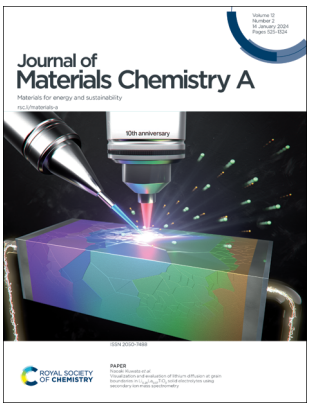
The Royal Society of Chemistry is the world's leading chemistry community. Through our high impact journals and publications we connect the world with the chemical sciences and invest the profits back into the chemistry community.

IN THIS ISSUE

ISSN 2050-7488 CODEN JMCAET 12(2) 525–1324 (2024)



Cover
See Zhuangzhi Sun *et al.*, pp. 723–730. Image reproduced by permission of Zhuangzhi Sun from *J. Mater. Chem. A*, 2024, **12**, 723.



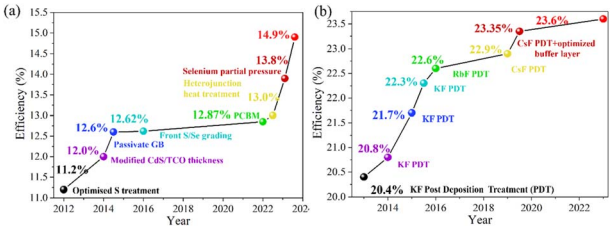
Inside cover
See Naoaki Kuwata *et al.*, pp. 731–738. Image reproduced by permission of Naoaki Kuwata from *J. Mater. Chem. A*, 2024, **12**, 731.

REVIEWS

545

A critical review of solution-process engineering for kesterite thin-film solar cells: current strategies and prospects

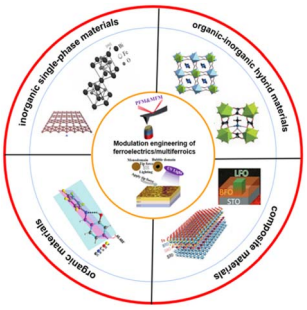
Junjie Fu,* Jin Yang, Weiwei Dong, Shu Ren, Haonan Zhu, Yusen Wang, Jianchao Hao, Jinhu Wu, Rongzhi Wang, Dandan Zhao,* Yange Zhang and Zhi Zheng*



567

Advances in the modulation engineering of ferroelectrics and multiferroics with non-chemical agents and factors: a review

Xinqiu Deng, Yuying Wu,* Zhangran Gao and Gang Zhou*



ROYAL SOCIETY OF CHEMISTRY

Royal Society of Chemistry approved training courses

Explore your options.
Develop your skills.
Discover learning that suits you.

Courses in the classroom, the lab, or online

Find something for every stage of your professional development. Search our database by:

- subject area
- location
- event type
- skill level

Members **get at least 10% off**

Visit **rsc.li/cpd-training**

SAVE 10%

Registered charity number: 207890

This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

Open Access Article. Published on 03 January 2024. Downloaded on 12/9/2025 1:58:47 AM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

REVIEWS

592

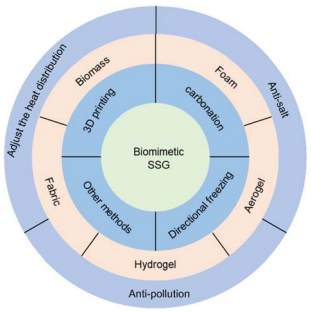
Recent advances in metal-free electrocatalysts for the hydrogen evolution reaction

Mingjie Cai, Lei Xu, Jinjia Guo, Xiaobin Yang, Xuexia He* and Peng Hu*

613

Nature-inspired sustainable solar evaporators for seawater desalination

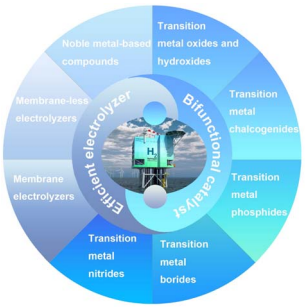
Xiang Song, Lianghao Jia, Zhengen Wei, Tao Xiang* and Shaobing Zhou



634

Recent advances of bifunctional electrocatalysts and electrolyzers for overall seawater splitting

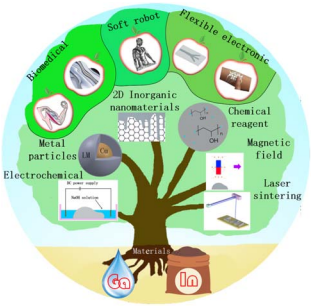
Xiaoyan Wang, Meiqi Geng, Shengjun Sun, Qian Xiang, Shiyuan Dong, Kai Dong, Yongchao Yao, Yan Wang, Yingchun Yang, Yongsong Luo, Dongdong Zheng, Qian Liu, Jianming Hu,* Qian Wu,* Xuping Sun* and Bo Tang*



657

Recent progress in eutectic gallium indium (EGaIn): surface modification and applications

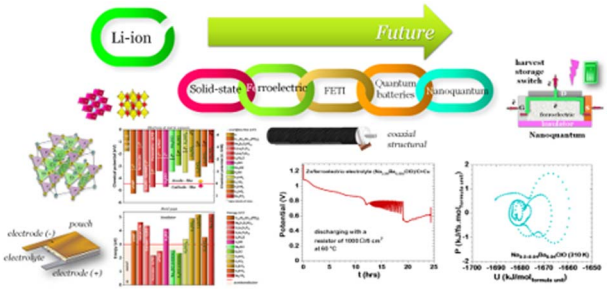
Wensong Ge, Rui Wang, Xiaoyang Zhu,* Houchao Zhang, Luanfa Sun, Fei Wang, Hongke Li, Zhenghao Li, Xinyi Du, Huangyu Chen, Fan Zhang, Huifa Shi, Huiqiang Hu, Yongming Xi, Jiankang He, Liang Hu* and Hongbo Lan*



Open Access Article. Published on 03 January 2024. Downloaded on 12/9/2025 1:58:47 AM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

PERSPECTIVE

690

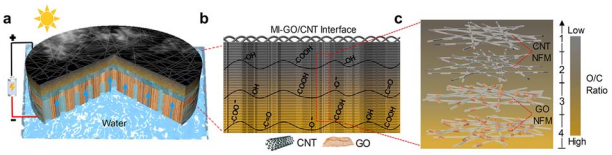


A perspective on the building blocks of a solid-state battery: from solid electrolytes to quantum power harvesting and storage

Beatriz Moura Gomes, J. Francisco Ribeiro Moutinho and Maria Helena Braga*

PAPERS

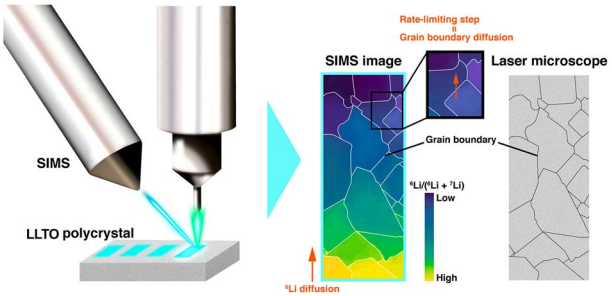
723



Bioinspired gradient-structured wood interfaces achieving efficient ion diffusion to generate electricity from natural evaporation

Chuanlong Han, Ziqi Bai, Huihong Sun, Lintao Mi and Zhuangzhi Sun*

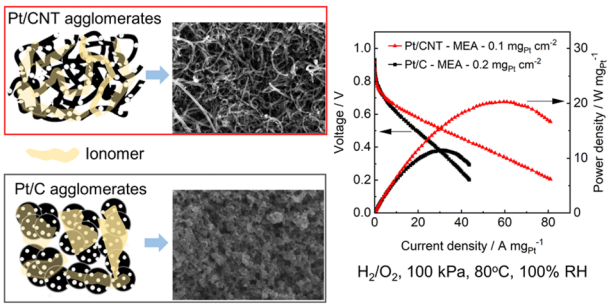
731



Visualization and evaluation of lithium diffusion at grain boundaries in $Li_{0.29}La_{0.57}TiO_3$ solid electrolytes using secondary ion mass spectrometry

Gen Hasegawa, Naoaki Kuwata,* Tsuyoshi Ohnishi and Kazunori Takada

739



Controllable construction of Pt/CNT catalyst layers to improve Pt utilization in PEMFCs

Yabiao Pei, Weikang Zhu, Runfei Yue, Lianqin Wang, Ran Li,* Junfeng Zhang* and Yan Yin*

This journal is © The Royal Society of Chemistry 2024

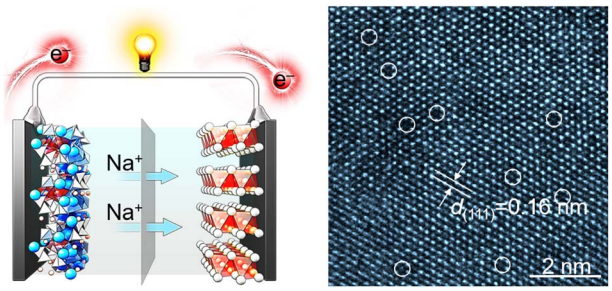
Open Access Article. Published on 03 January 2024. Downloaded on 12/9/2025 1:58:47 AM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

PAPERS

748

Defect and interlayer spacing engineering of vanadium selenide for boosting sodium-ion storage

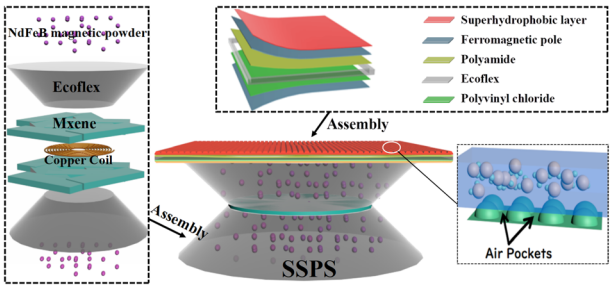
Wang Feng, Xia Wen, Yanan Peng, Luying Song, Xiaohui Li, Ruofan Du, Junbo Yang, Yulin Jiang, Hui Li, Hang Sun, Ling Huang, Jun He and Jianping Shi*



758

Design of a self-powered and superhydrophobic-pressure sensor with stable human motion monitoring

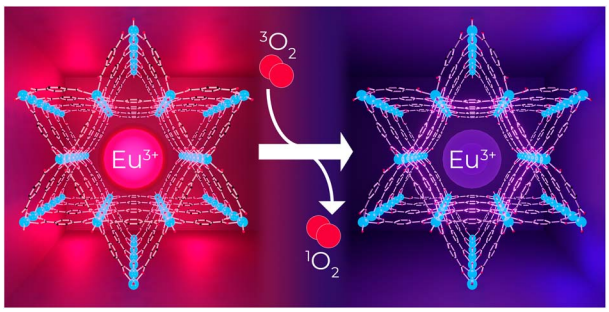
Xujie Cheng, Zhengrui Li, Haoyang Song, Junchi Ma, Siyu Gao and Yongquan Qing*



769

On the validity of rapid optical sensing of dioxygen by means of sensitivity, stability, and reversibility for archetype MOFs post-synthetically modified with Eu^{3+}

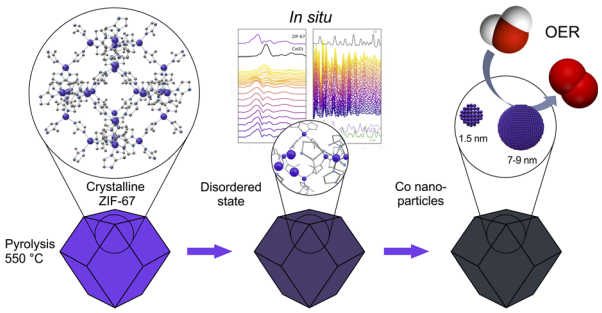
Thomas Kasper,* Matilde Pavan and Klaus Müller-Buschbaum



781

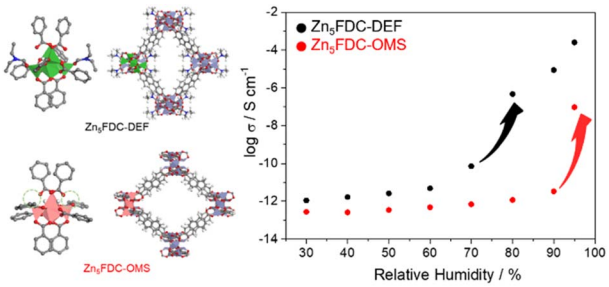
Correlating the structural transformation and properties of ZIF-67 during pyrolysis, towards electrocatalytic oxygen evolution

Sara Frank, Mads Folkjær, Mads L. N. Nielsen, Melissa J. Marks, Henrik S. Jeppesen, Marcel Ceccato, Simon J. L. Billinge, Jacopo Catalano* and Nina Lock*



Open Access Article. Published on 03 January 2024. Downloaded on 12/9/2025 1:58:47 AM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

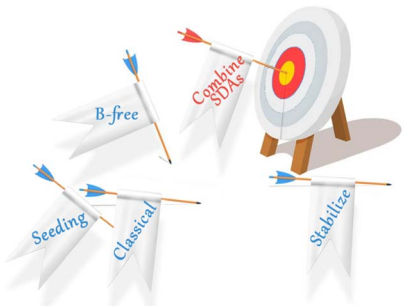
795



Moisture-triggered proton conductivity switching in metal–organic frameworks: role of coordinating solvents

Hong Kyu Lee, Yasaswini Oruganti, Jonghyeon Lee, Seunghee Han, Jihan Kim, Dohyun Moon,* Min Kim,* Dae-Woon Lim* and Hoi Ri Moon*

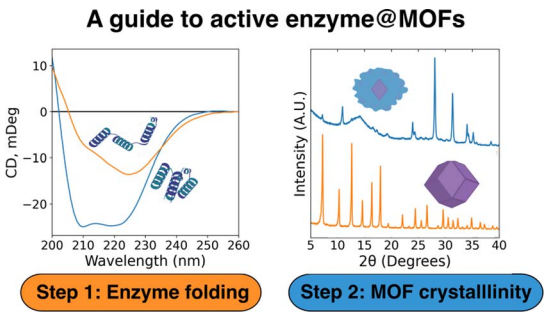
802



ADOR zeolite with 12 × 8 × 8-ring pores derived from IWR germanosilicate

Qiudi Yue, Valeryia Kasneryk, Michal Mazur, Sarra Abdi, Yong Zhou, Paul S. Wheatley, Russell E. Morris, Jiří Čejka, Mariya Shamzhy* and Maksym Opanasenko

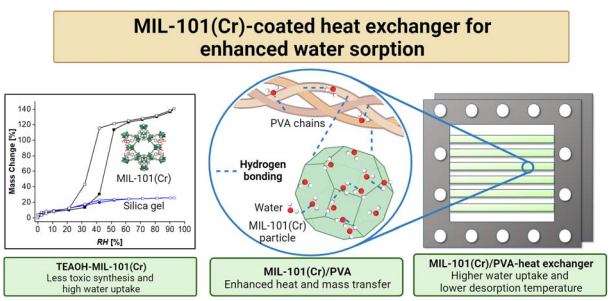
813



The role of protein folding in prenucleation clusters on the activity of enzyme@metal–organic frameworks

Brooke P. Carpenter, Ben Rose, Elisa M. Olivas, Mariana X. Navarro, A. Rain Talosig, Paul J. Hurst, Giuseppe Di Palma, Li Xing, Rweetuparna Guha, Stacy M. Copp and Joseph P. Patterson*

824



Enhanced moisture sorption through regulated MIL-101(Cr) synthesis and its integration onto heat exchangers

Mei Gui Vanessa Wee, Amutha Chinnappan,* Runxin Shang, Poh Seng Lee and Seeram Ramakrishna*

This journal is © The Royal Society of Chemistry 2024

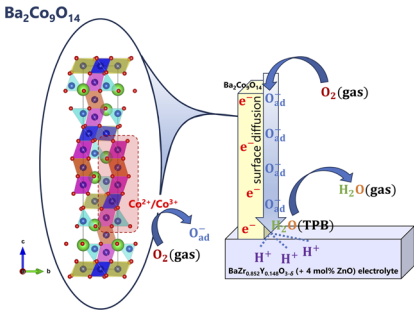
Open Access Article. Published on 03 January 2024. Downloaded on 12/9/2025 1:58:47 AM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

PAPERS

840

A new layered barium cobaltite electrode for protonic ceramic cells

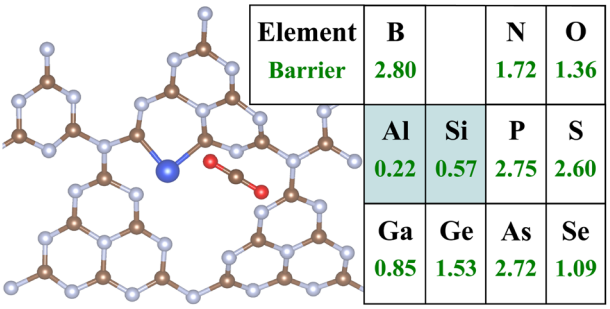
Allan J. M. Araújo,* Vanessa C. D. Graça, Rafael A. Raimundo, Antonio C. L. Filho, Daniel A. Macedo and Francisco J. A. Loureiro*



854

Graphitic carbon nitride with the pyridinic N substituted by Al and Si as efficient photocatalysts for CO_2 reduction

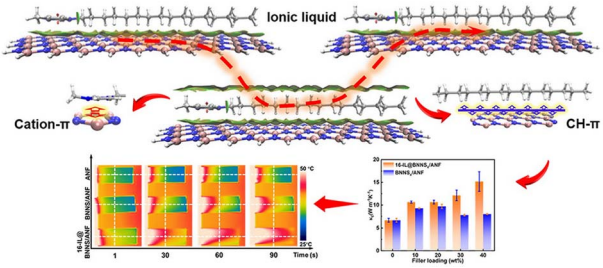
Min Zhang, Xiao Zhang, Yaru Liu, Ya-nan Jiang and Yuchen Ma*



864

Effect of regulating the interfacial structure of multiple non-covalent bonding on improving thermal management capability

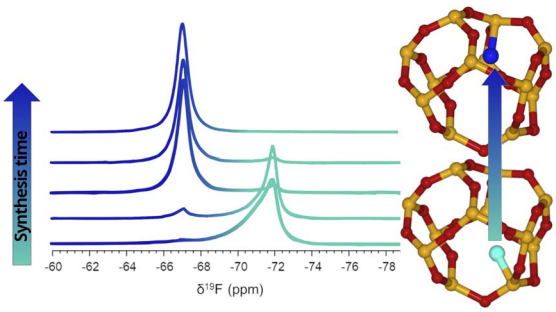
Xu Li, Bin Wu,* Ying Lv, Ru Xia and Jiasheng Qian*



876

Crystalline phase transition in as-synthesized pure silica zeolite RTH containing tetra-alkyl phosphonium as organic structure directing agent

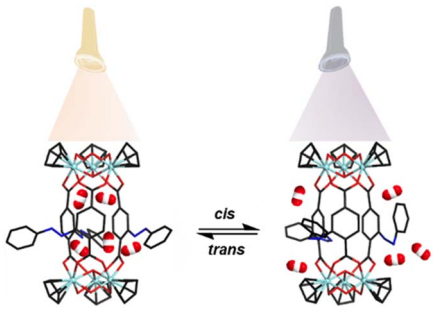
Joaquin Martinez-Ortigosa, Reisel Millán, Jorge Simancas, Manuel Hernández-Rodríguez, J. Alejandro Vidal-Moya, Jose L. Jordá, Charlotte Martineau-Corcos, Vincent Sarou-Kanian, Mercedes Boronat, Teresa Blasco* and Fernando Rey*



Open Access Article. Published on 03 January 2024. Downloaded on 12/9/2025 1:58:47 AM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

PAPERS

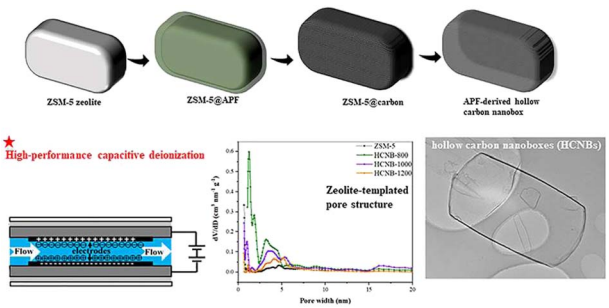
892



A metal–organic cage with light-switchable motifs for controllable CO_2 adsorption

Yao Jiang,* Tao Yang, Xiao-Qin Liu, Peng Cui and Lin-Bing Sun*

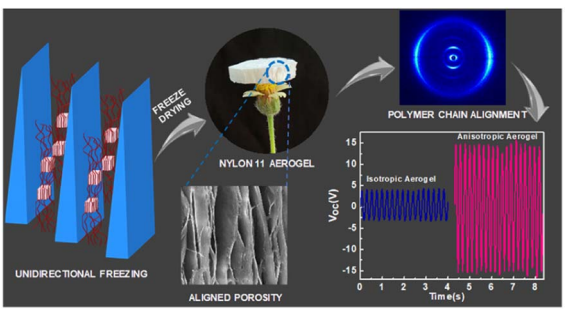
899



Synthesis of nitrogen-doped carbon nanoboxes with pore structure derived from zeolite and their excellent performance in capacitive deionization

Keyang Li, Shaoqing Zhu, Shunan Zhao, Ming Gong, Xiaohuan Zhao, Jie Liang, Jianning Gan, Yilun Huang,* Ming Zhao, Daming Zhuang and Qianming Gong*

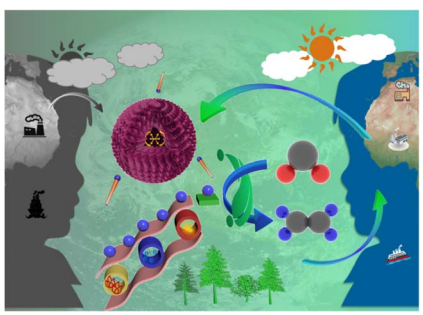
911



Directional freezing-induced self-poled piezoelectric nylon 11 aerogels as high-performance mechanical energy harvesters

Ashitha George, Harris Varghese, Achu Chandran,* Kuzhichalil Peethambharan Surendran* and E. Bhoje Gowd*

923



Highly selective photothermal conversion of CO_2 to ethylene using hierarchical boxwood ball-like Weyl semimetal WTe_2 catalysts

Xiaoyue Zhang, Chaoran Dong, Yong Yang,* Yingjie Hu, Lizhi Wu, Yu Gu, Kan Zhang and Jinyou Shen*

This journal is © The Royal Society of Chemistry 2024

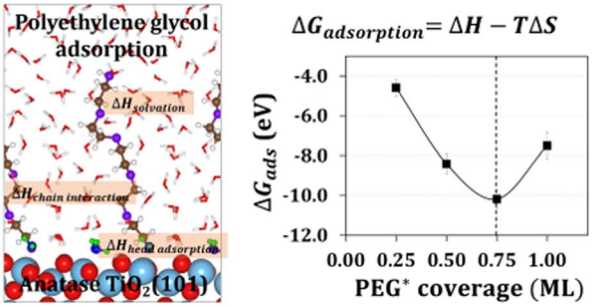
Open Access Article. Published on 03 January 2024. Downloaded on 12/9/2025 1:58:47 AM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

PAPERS

932

Elucidation of polyethylene glycol adsorption at the solid–H_2O(l) interfaces of anatase TiO_2(101) using density functional theory and molecular dynamics simulations

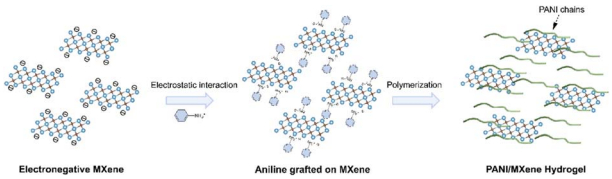
Hee-Joon Chun,* Kang-Sahn Kim and Giwoong Ha*



943

3D nanostructured conductive PANI/MXene hydrogels for durable aqueous Zn-ion batteries

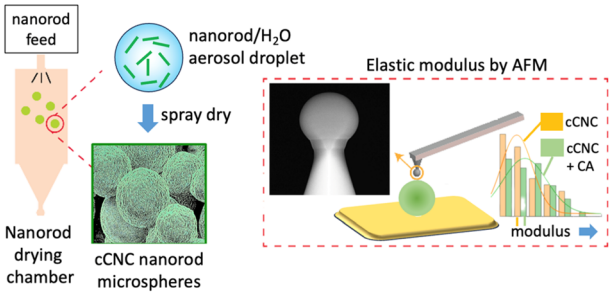
Yalei Wang, Jun Song* and Wai-Yeung Wong*



950

Mechanical, morphological and comparative properties of microbeads assembled from carboxylated cellulose nanocrystals

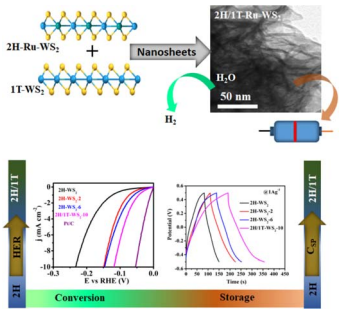
Junqi Wu and Mark P. Andrews*



961

Enhanced hydrogen evolution and symmetric supercapacitor performance of a Ru-doped multiphase WS_2 electrode

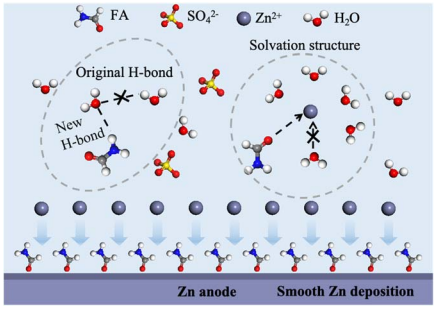
Pamula Siva and Kuraganti Vasu*



Open Access Article. Published on 03 January 2024. Downloaded on 12/9/2025 1:58:47 AM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

PAPERS

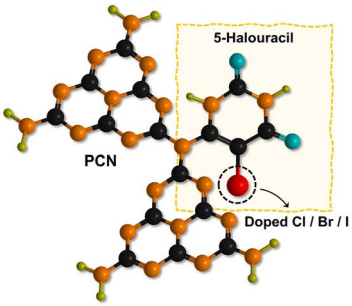
968



Solvation structure regulation of an organic small molecule additive for dendrite-free aqueous zinc-ion batteries

Xiaomin Li, Jinwei Miao, Fulong Hu, Kang Yan, Lin Song, Huiqing Fan, Longtao Ma and Weijia Wang*

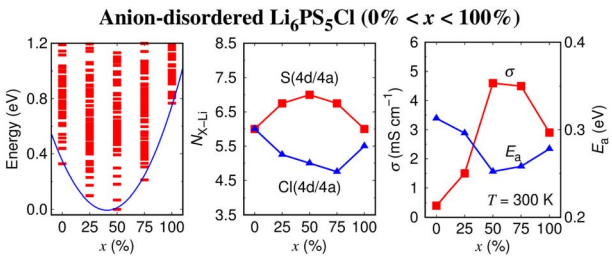
979



Counterion chemistry of 5-halo (X: Cl, Br, I)-uracil derived carbon nitride: unlocking enhanced photocatalytic performance

Toshali Bhoyar, B. Moses Abraham, Akanksha Gupta, Dong Jin Kim, Nilesh R. Manwar, Kedhareswara Sairam Pasupuleti, Devthade Vidyasagar* and Suresh S. Umare*

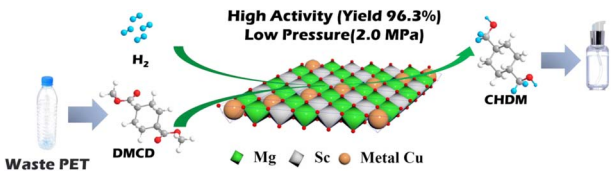
993



Understanding the anion disorder governing lithium distribution and diffusion in an argyrodite Li_6PS_5Cl solid electrolyte

Taegon Jeon, Gyeong Ho Cha and Sung Chul Jung*

1003



Synthesis of $Cu_1Mg_3Sc_2(OH)_{12}CO_3$ layered double hydroxide and its derived catalyst for hydrogenation of DMCD to CHDM

Zhili Chang, Boyong Ye, Zixin Zhong, Songlin Wang, Han Wang, Weichen Du and Zhaoyin Hou*

This journal is © The Royal Society of Chemistry 2024

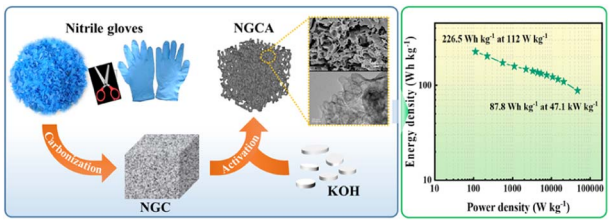
Open Access Article. Published on 03 January 2024. Downloaded on 12/9/2025 1:58:47 AM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

PAPERS

1012

From wasted polymers to N/O co-doped partially graphitic carbon with hierarchical porous architecture as a promising cathode for high performance Zn-ion hybrid supercapacitors

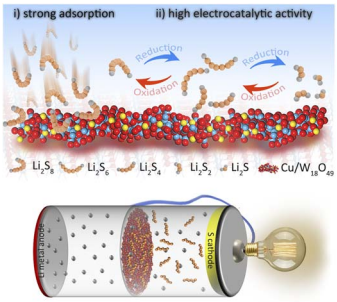
Huan Liu,* Xiuli Huang, Wei Chen, Lei Ding, Yiming Ren, Zongcheng Miao,* Maodong Xu and Jiang Zhu*



1026

Fast redox conversion in lithium–sulfur batteries enabled by Cu-doped $W_{18}O_{49}$ with abundant oxygen defects

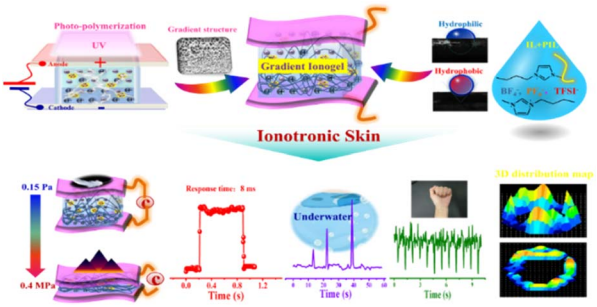
Guilin Meng, Guojun Dong, Yanfei Yang,* Yingpu Bi* and Junping Zhang*



1036

Skin-inspired gradient ionogels induced by electric field for ultrasensitive and ultrafast-responsive multifunctional ionotronics

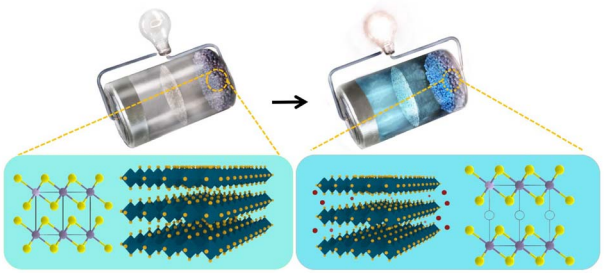
Min Xu, Xuchao Shen, Shuaijie Li, Hongnan Zhu, Yan Cheng, Hongying Lv, Zhuoer Wang, Cunguang Lou* and Hongzan Song*



1047

Improving the performance of a SnS_2 cathode with interspace layer engineering using a Na^+ insertion/extraction method for aqueous zinc ion batteries

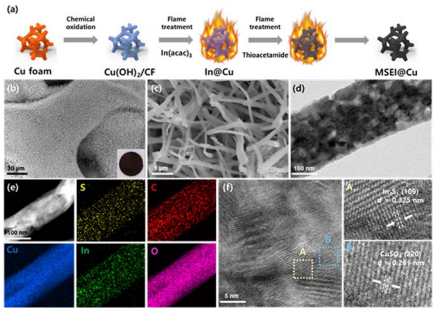
Ali Molaei Aghdam,* Nima Mikaeili Chahartagh, Shahriar Namvar, Mahshid Ershadi, Farshad Boorboor Ajdari* and Ehsan Delfani



Open Access Article. Published on 03 January 2024. Downloaded on 12/9/2025 1:58:47 AM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

PAPERS

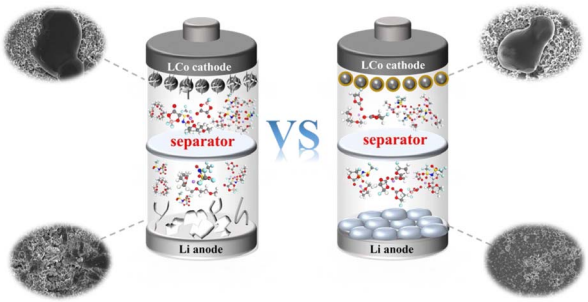
1058



Establishing a multifunctional solid electrolyte interphase on a 3D host by an ultra-fast double coating strategy for stable lithium metal batteries

Ji Young Maeng, Minjun Bae, Yonghwan Kim, Dohyeong Kim, Yujin Chang, Seungman Park, Juhyung Choi, Eunji Lee, Jeongyeon Lee* and Yuanzhe Piao*

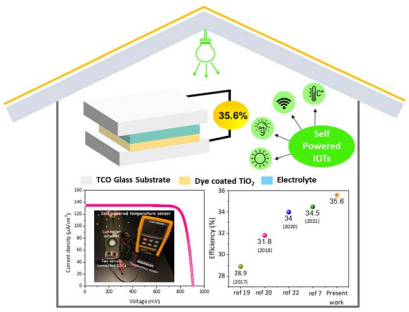
1072



Inorganic/organic composite fluorinated interphase layers for stabilizing ether-based electrolyte in high-voltage lithium metal batteries

Qimeng Ren, Qinglei Wang,* Li Su, Guodong Liu, Yan Song, Xuehui Shangguan* and Faqiang Li*

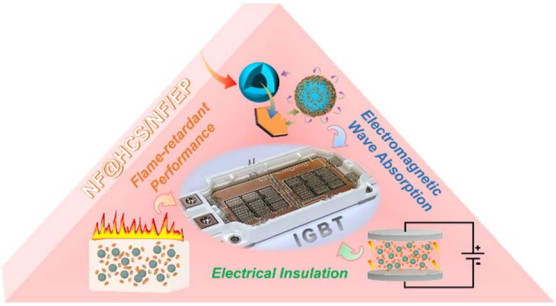
1081



Asymmetric dual species copper(II/I) electrolyte dye-sensitized solar cells with 35.6% efficiency under indoor light

Sruthi Meledath Meethal, Sourava Chandra Pradhan, Jayadev Velore, Sunil Varughese, Renjith S. Pillai, Frédéric Sauvage, Anders Hagfeldt and Suraj Soman*

1094



High electromagnetic wave absorption and flame retardancy performance from NF@HCS/NF-filled epoxy-based electronic packaging material

Tianshun Xiong, Yubo Luo,* Yongxin Qian, You Li, Junwei Li, Luyao Wang, Wenyuan Ma and Junyou Yang*

This journal is © The Royal Society of Chemistry 2024

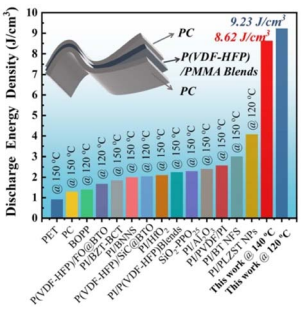
Open Access Article. Published on 03 January 2024. Downloaded on 12/9/2025 1:58:47 AM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

PAPERS

1106

Tri-layer high-temperature all-organic films with superior energy-storage density and thermal stability

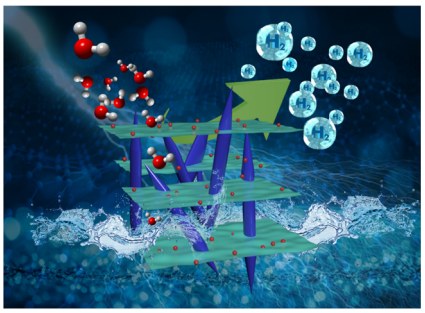
Jie Chen,* Pansong Wang, Zhen Wang, Xiaoyong Zhang, Weixing Chen and Yifei Wang*



1115

MXene–MOF architectural hybrid-supported nickel single-atom catalysts for hydrogen evolution reactions

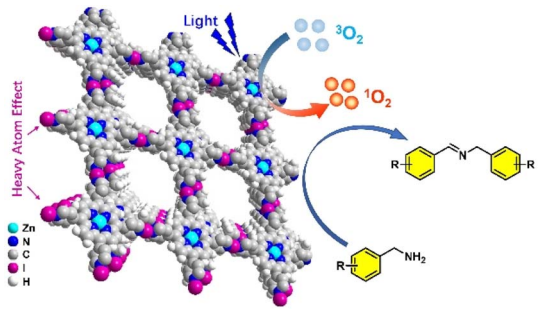
Gayathri Chellasamy, Shiva Kumar Arumugasamy, Satheesh Kuppusamy, Viswanathan Ekambaram, Kandeeban Rajagopalan, Sada Venkateswarlu, Prabhakaran Deivasigamani, Min Jae Choi, Saravanan Govindaraju* and Kyusik Yun*



1128

A zinc porphyrin-based halogen-bonded organic framework with the heavy atom effect as a highly efficient photocatalyst for oxidative coupling of amines

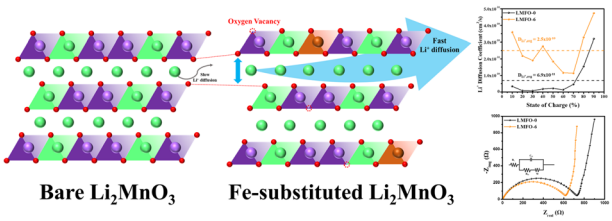
Penghao Sun, Hongqiang Dong, Siheng Lv, Yongfei Yin, Guanfei Gong, Lu Wang, Jike Wang and Shigui Chen*



1135

Ameliorating electrochemical performance of Li-rich Mn-based cathodes for Li-ion batteries by Fe substitution

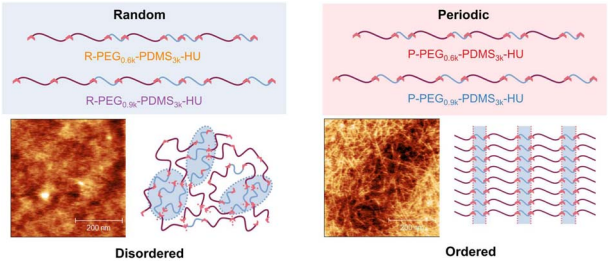
Won-Chan Kim, Juo Kim, Ji-Hwan Kim, Deok-Hye Park, Yu-Yeon Park, Jae-Sung Jang, So-Yeon Ahn, Kyoungmin Min* and Kyung-Won Park*



Open Access Article. Published on 03 January 2024. Downloaded on 12/9/2025 1:58:47 AM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

PAPERS

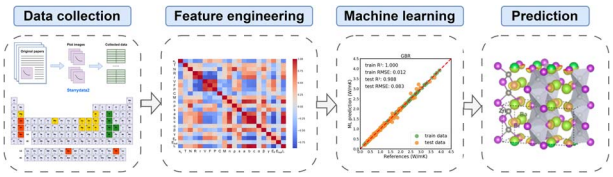
1145



Sequence-dependent self-assembly of supramolecular nanofibers in periodic dynamic block copolymers

Jason K. Phong, Christopher B. Cooper,* Lukas Michalek, Yangju Lin, Yuya Nishio, Yuran Shi, Huaxin Gong, Julian A. Vigil, Jan Ilavsky, Ivan Kuzmenko and Zhenan Bao*

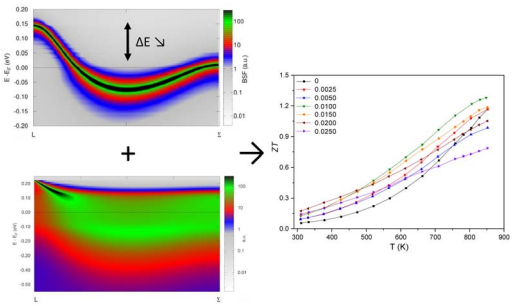
1157



Machine-learning-assisted discovery of 212-Zintl-phase compounds with ultra-low lattice thermal conductivity

Qi Ren, Dali Chen, Lixiang Rao, Yingzhuo Lun, Gang Tang* and Jiawang Hong*

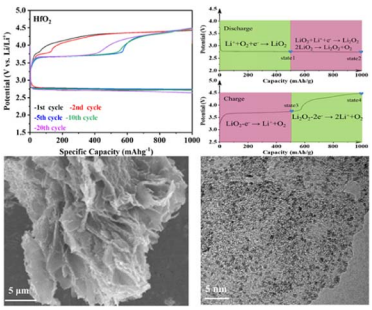
1166



Unravelling the need for balancing band convergence and resonant level in $Sn_{1-x-y}In_xMn_yTe$ for high thermoelectric performance

Shantanu Misra, Bartlomiej Wiendlocha,* Soufiane El Oualid, Anne Dauscher, Bertrand Lenoir and Christophe Candolfi*

1176



Oxygen defect regulation, catalytic mechanism, and modification of HfO_2 as a novel catalyst for lithium–oxygen batteries

Liwei Su,* Lei Zhang, Xingyi Zhan, Yifan Zhang, Lianbang Wang* and Yuanhao Wang*

This journal is © The Royal Society of Chemistry 2024

Open Access Article. Published on 03 January 2024. Downloaded on 12/9/2025 1:58:47 AM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

PAPERS

1185

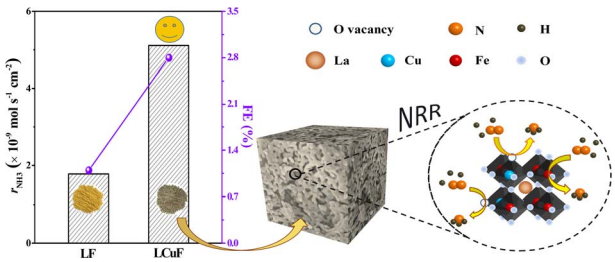
The Mott–Schottky Co_2P/Co heterocatalyst encapsulated by N,P-doped graphene/carbon nanotubes as high-efficiency trifunctional electrocatalysts for cable-type flexible Zn–air batteries and water splitting

Quynh Phuong Ngo, Thanh Tuan Nguyen, Manjinder Singh, Nam Hoon Kim* and Joong Hee Lee*

1200

Ammonia synthesis *via* a protonic ceramic electrolysis cell (PCEC) using $LaCu_{0.1}Fe_{0.9}O_{3-\delta}$ catalyst

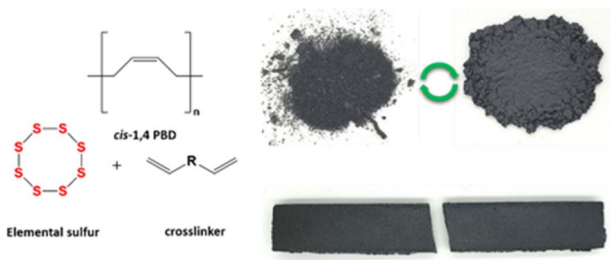
Wenhua Guo, Yawei Li, Si-Dian Li, Zongping Shao and Huili Chen*



1211

Liquid polybutadiene reinforced inverse vulcanised polymers

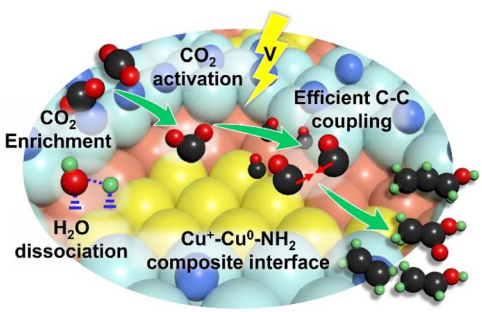
Veronica Hanna,* Michael Graysmark, Helen Willcock and Tom Hasell*



1218

SiO_2 assisted Cu^0–Cu^+–NH_2 composite interfaces for efficient CO_2 electroreduction to C_{2+} products

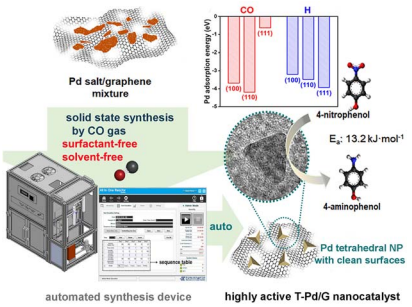
Zi-Yang Zhang, Hao Tian, Han Jiao, Xin Wang, Lei Bian, Yuan Liu, Nithima Khaorapapong, Yusuke Yamauchi and Zhong-Li Wang*



Open Access Article. Published on 03 January 2024. Downloaded on 12/9/2025 1:58:47 AM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

PAPERS

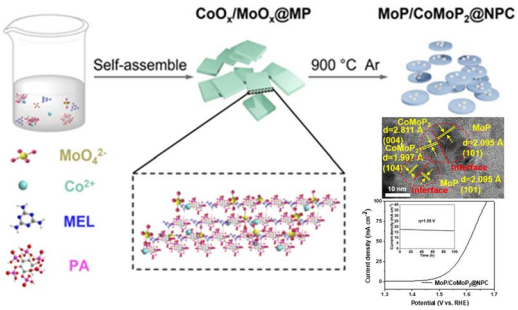
1233



Novel solid-state synthesis of surfactant- and solvent-free Pd tetrahedron nanocatalysts

Kyung Hee Oh, Kwangsoo Kim, Jin Gyu Lee, Nahyun Park, Hack-Keun Lee, Shin Wook Kang, Jung-Il Yang, Byeong-Seon An, Kang Hyun Park, Chang Seop Hong,* Byung-Hyun Kim* and Ji Chan Park*

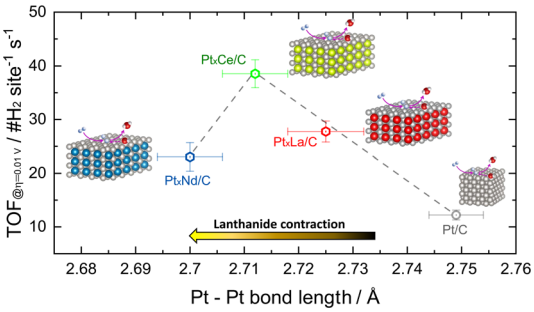
1243



Heterostructured MoP/$CoMoP_2$ embedded in an N, P-doped carbon matrix as a highly efficient cooperative catalyst for pH-universal overall water splitting

Luyao Zheng, Cong Liu, Wenbiao Zhang, Boxu Gao, Tianlan Yan, Yahong Zhang, Xiaoming Cao, Qingsheng Gao* and Yi Tang*

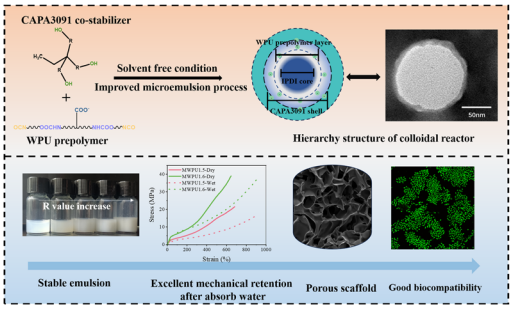
1253



Lanthanide contraction effect on the alkaline hydrogen evolution and oxidation reactions activity in platinum–rare earth nanoalloys

Carlos A. Campos-Roldán,* Raphaël Chattot, Frédéric Pailloux, Andrea Zitolo, Jacques Rozière, Deborah J. Jones and Sara Cavaliere*

1259



Synthesis of completely solvent-free biomedical waterborne polyurethane with excellent mechanical property retention and satisfactory water absorption

Ao Zhen, Guanyu Zhang, Ao Wang, Feng Luo, Jiehua Li,* Hong Tan* and Zhen Li

This journal is © The Royal Society of Chemistry 2024

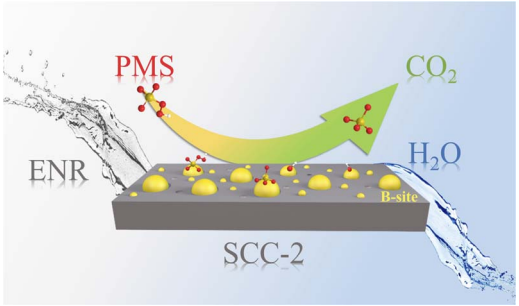
Open Access Article. Published on 03 January 2024. Downloaded on 12/9/2025 1:58:47 AM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

PAPERS

1274

Switching the adsorption sites of PMS on $SrCoO_{2.52}$ to enhance catalytic performance

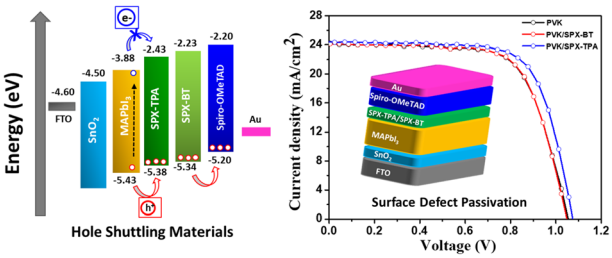
Dan Yu, Jiahong He,* Taiping Xie, Qiang Xu, Houyang Chen and Bin Xiang*



1284

Spiro[fluorene-9,9′-xanthene]-based hole shuttle materials for effective defect passivation in perovskite solar cells

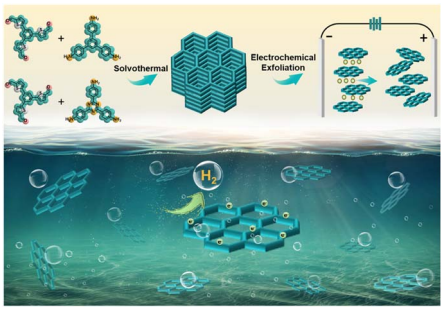
Bommaramoni Yadagiri, Sanjay Sandhu, Ashok Kumar Kaliamurthy, Francis Kwaku Asiam, Jongdeok Park, Appiagyei Ewusi Mensah and Jae-Joon Lee*



1292

Electrochemically exfoliated covalent organic frameworks for improved photocatalytic hydrogen evolution

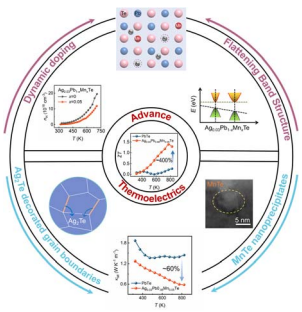
Ting Wang, Ruijuan Zhang, Pengda Zhai,* Mingjie Li,* Xinying Liu and Chaoxu Li*



1300

Synergistic carrier and phonon transport advance Ag dynamically-doped n-type PbTe thermoelectrics *via* Mn alloying

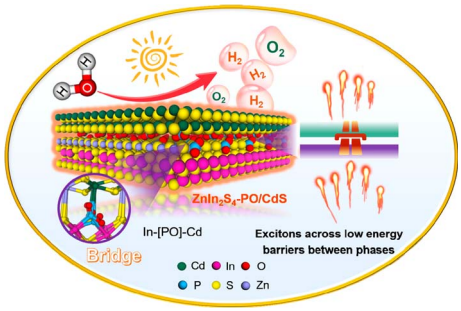
Wei Yuan, Qian Deng, Dong Pan, Xiang An, Canyang Zhao, Wenjun Su, Zhengmin He, Qiang Sun* and Ran Ang*



Open Access Article. Published on 03 January 2024. Downloaded on 12/9/2025 1:58:47 AM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

PAPERS

1309



Interfacial phosphate-like "bridge" mediates bulk charge and surface oxygenated-intermediate migration for efficient photoelectrochemical water splitting

Cheng Wang, Wei Zhang, Shuo Gu, Shengdong Sun, Meng Zhou,* Wei Chen and Shikuo Li*

EXPRESSION OF CONCERN

1317

Expression of concern: Interfacial adsorption study of nitrogen based inhibitors in silane nanocontainers as anticorrosive and self-healing material for steel in strong acid solution

Darris M. S. and S. M. A. Shibli

CORRECTIONS

1318

Correction: Hierarchical Co/MoNi heterostructure grown on monocrystalline $CoNiMoO_x$ nanorods with robust bifunctionality for hydrazine oxidation-assisted energy-saving hydrogen evolution

Zehao Xiao, Jie Wang, Hongxiu Lu, Yinyin Qian, Qiang Zhang, Aidong Tang* and Huaming Yang*

1320

Correction: Synthesis of TiC nanotube arrays and their excellent supercapacitor performance

Tongxiang Ma, Yuzheng Pan, Junyu Chen, Zhiming Yan,* Buxin Chen, Lang Zhao, Liwen Hu, Liangying Wen and Meilong Hu*

This journal is © The Royal Society of Chemistry 2024