

# Journal of Materials Chemistry A

Materials for energy and sustainability

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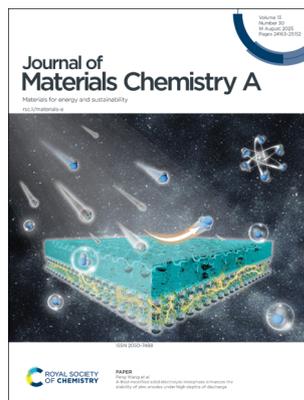
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### Inside cover

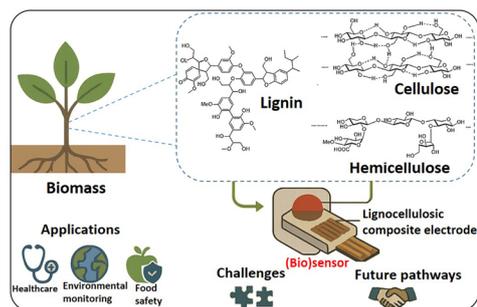
See Peng Wang *et al.*, pp. 24483–24494. Image reproduced by permission of Peng Wang from *J. Mater. Chem. A*, 2025, 13, 24483.

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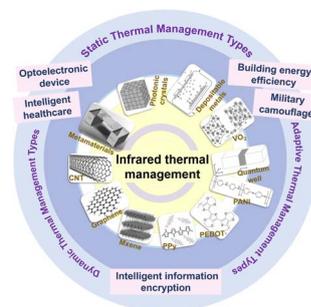
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Xiaoxiao Liu, Wenshuo Zhao, Ying Feng, Xinyu Zhao, Kunming Zhao, Yanli Xiao, Jingyi Guan,\* Guohua Wu, Xuyang Zhang, Nana Liu, Lebin Wang,\* Xiangwei Wang and Bo Wang\*



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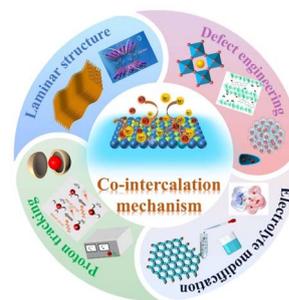
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## REVIEWS

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**Proton co-intercalation enabled high-performance aqueous multivalent metal-ion batteries**

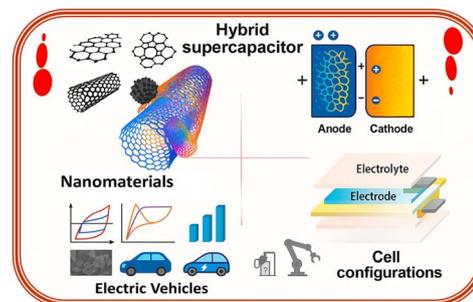
Long Fu, Xiaoqiang Wang,\* Ruihao Zhang, Ruiyang Li, Guoqing Wei and Mingya Li



24320

**Recent advances in hybrid supercapacitors: a review of high performance materials and scalable fabrication techniques**

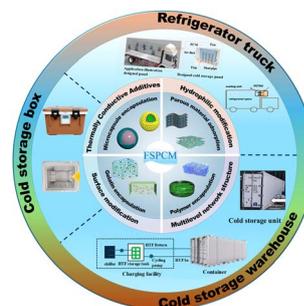
Nargish Parvin, Dhananjaya Merum, Misook Kang, Sang Woo Joo, Jae Hak Jung\* and Tapas Kumar Mandal\*



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**A comprehensive review of form-stable phase change materials in cold chain logistics: encapsulation strategies, thermal conductivity enhancement, and applications**

Cai Liang, Xin Wang, Yajie Hao, Yuang Zhang, Lanlan Jiang,\* Bingtao Tang and Yongchen Song\*

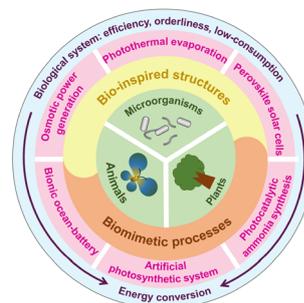


## PERSPECTIVE

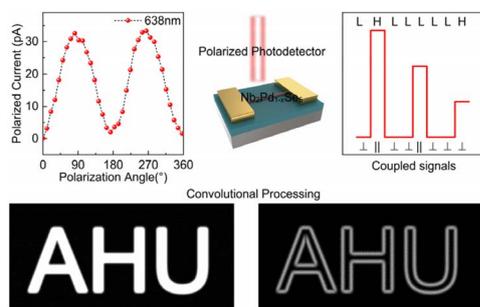
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**Ordered energy conversion systems inspired from the biological world**

Chengzhen Sun,\* Xinyi Ma, Qingyun Chen, Dong Li, Wen Cao, Wei Yin, Wenting Wang, Zixuan Gao and Liejin Guo\*



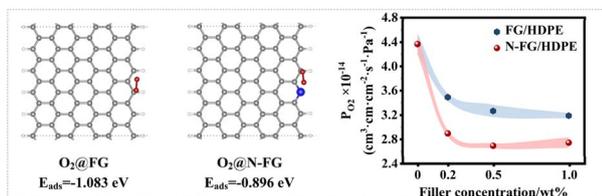
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### Symmetry-reduction enhanced one-dimensional polarization-sensitive photodetectors for multi-functional applications

Wei Gan, Chentao Zhang, Guanghui Peng, Liqiang Xu, Zihao Tong, Zhuxin Zhang, Chuanqiang Wu,\* Yang Zhou\* and Zhen Wang\*

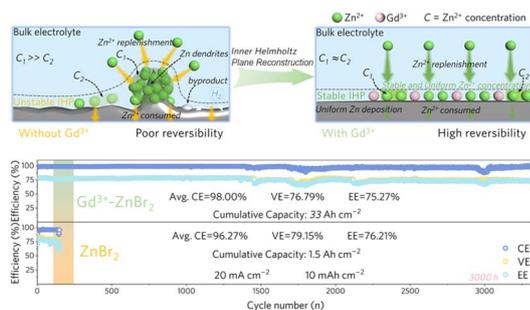
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### Enhanced multifunctional performance of flash graphene-polymer composites via nitrogen doping

Xiangbo Liu, Channa Wang, Yaping Zhang, Chao Ma, Junkai Deng,\* Xiangdong Ding\* and Changsheng Xiang\*

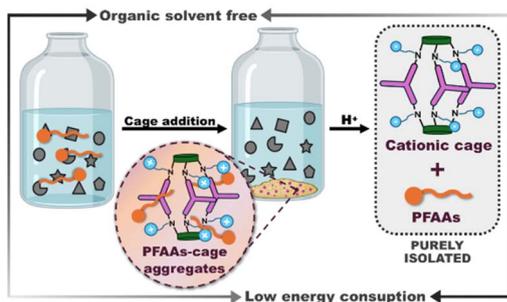
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### Reconstructing a $Gd^{3+}$ -enriched inner Helmholtz plane with a dynamic electrostatic shielding effect for highly reversible Zn-bromine flow batteries

Guangyu Zhu, Yichan Hu, Zhenglin Li, Wei Xiong,\* Haibo Hu\* and Guojin Liang\*

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### Sustainable recovery of perfluoroalkyl acids using a reusable molecular cage

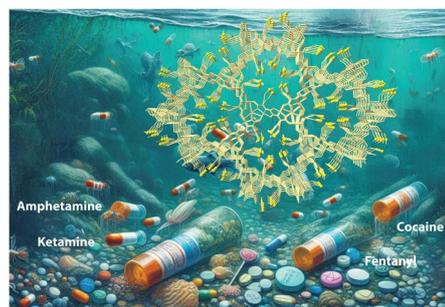
María Pérez-Ferreiro, Quinn M. Gallagher, Michael A. Webb, Alejandro Criado\* and Jesús Mosquera\*



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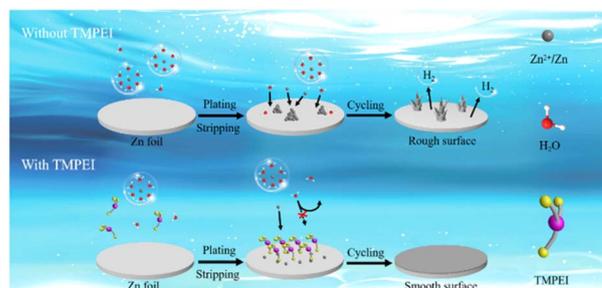
Thais Grancha, Patricia Garcia-Atienza, Sergio Armenta, José Manuel Herrero-Martínez,\* Rita Maria Percoco, Donatella Armentano,\* Jesús Ferrando-Soria and Emilio Pardo\*



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### A thiol-modified solid electrolyte interphase enhances the stability of zinc anodes under high depths of discharge

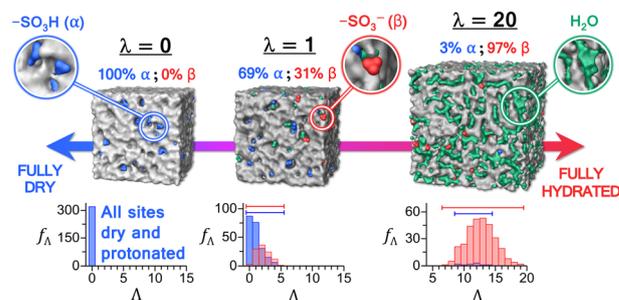
Jie Liu, Peng Wang,\* Xiaoyu Yang, Zinan Wang, Hanguo Miao, Zhe Li, Wei Duan, Ying Yue, Yunpeng Liu and Yang Ju



24495

### Atomistic characterization of hydration-dependent fuel cell ionomer nanostructure: validation by vibrational spectroscopy

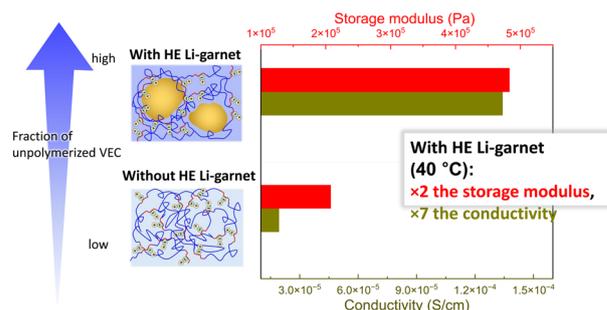
Dan J. Donnelly, III Moon Young Yang, Nicholas Dimakis,\* Seung Soon Jang, William A. Goddard, III\* and Eugene S. Smotkin\*



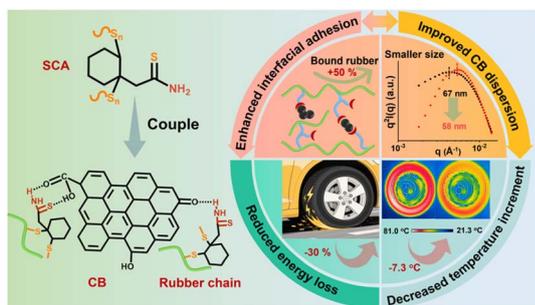
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### A single-ion-conducting polymer and high-entropy Li-garnet composite electrolyte with simultaneous enhancement in ion transport and mechanical properties

Ji-young Ock,\* Michelle Lehmann, Chang Li, Yangyang Wang, Harry M. Meyer III, Alexei P. Sokolov, Zhezhen Fu\* and Xi Chelsea Chen\*



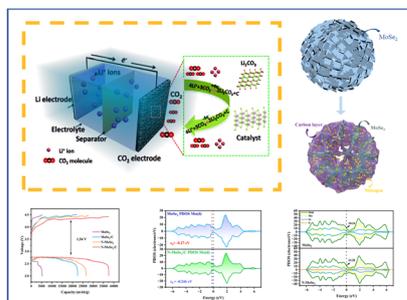
24522



### Mediating the carbon black–natural rubber interface with thioamide-functionalized polysulfide for energy-saving composites

Ruoyan Huang, Dong Wang, Zhenghai Tang,<sup>\*</sup>  
Baochun Guo<sup>\*</sup> and Liqun Zhang<sup>\*</sup>

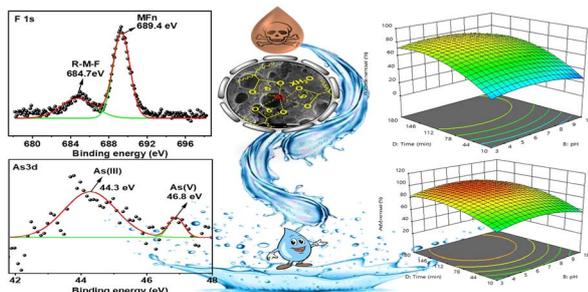
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### Synergistic nitrogen-doping and carbon-coating in N-MoSe<sub>2</sub>/C nanoflowers enable ultra-high discharge capacity for Li-CO<sub>2</sub> batteries

Dandan Zhu, Qingyang Dai, Xinyu Zhang, Jiacheng Yi  
and Yong Yang<sup>\*</sup>

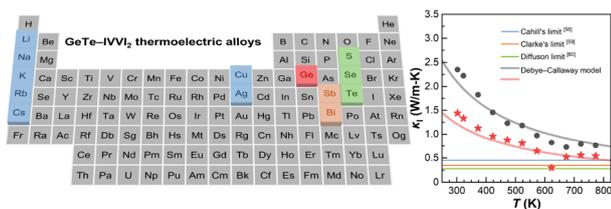
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### A revolutionizing polymeric framework with integrated aluminium fragment for superior water decontamination empowered by a statistical modeling approach

Shraddha Shukla, Anil R. Gupta, Surjit Bhai Ratnkar,  
Biswajit Ganguly, Pankaj D. Indurkar<sup>\*</sup> and Saroj Sharma<sup>\*</sup>

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### Compromise and synergy in thermoelectric GeTe–CuSbS<sub>2</sub> alloys

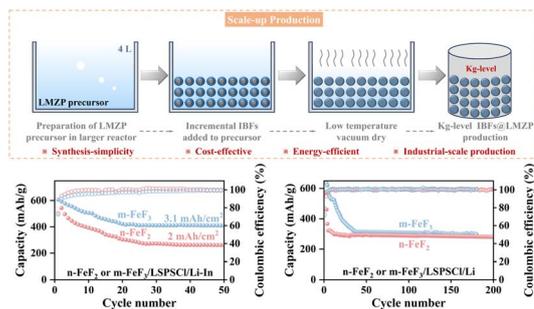
Zi-Wei Feng, Meng Li, Yongqi Chen, Siqi Liu,  
De-Zhuang Wang, Liang-Cao Yin, Hao Wu, Wei-Di Liu,  
Xiao-Lei Shi, Yifeng Wang, Zhi-Gang Chen<sup>\*</sup>  
and Qingfeng Liu<sup>\*</sup>



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## High performance sulfide all-solid-state batteries enabled by $\text{Li}_{1.26}\text{Mg}_{0.12}\text{Zr}_{1.86}(\text{PO}_4)_3$ coating of iron fluoride cathodes

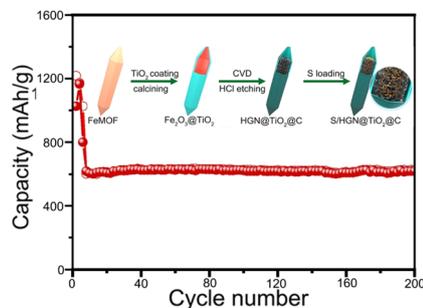
Junyu Chen, Xuedong Zhang, Feixiang Wu, Long Xie, Feng Li, Nina Wu, Zixuan Cao, Jinwen Zhao, Yuxuan Zhang, Xin He, Hongxia Gu, Jianyu Huang\* and Qiao Huang\*



24590

## Honeycomb graphite network confined in biphasic $\text{TiO}_2$ homojunction nanotubes as the sulfur host for advanced lithium sulfur batteries

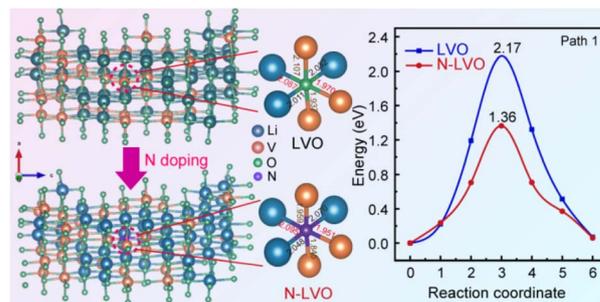
Shidi Huang,\* Xuan Zhao, Zheqian Yu, Weiye Tong and Yijie Zhang



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## Nitrogen-doped rock-salt $\text{Li}_3\text{V}_2\text{O}_5$ nanosheet arrays with improved rate capability as an anode for thin film lithium-ion microbatteries

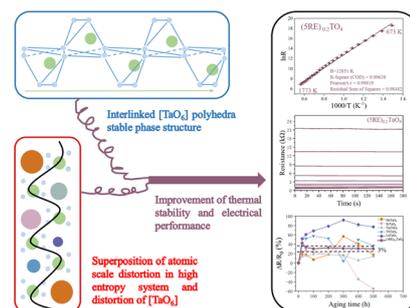
Wei Liu, Chenyang Xu, Fan Kong, Qiuying Xia,\* Feng Zan, Jing Xu and Hui Xia\*



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## Entropy-mediated stable structural evolution of $(\text{HoErTmYbLu})_{0.2}\text{TaO}_4$ for high-temperature thermosensitive applications

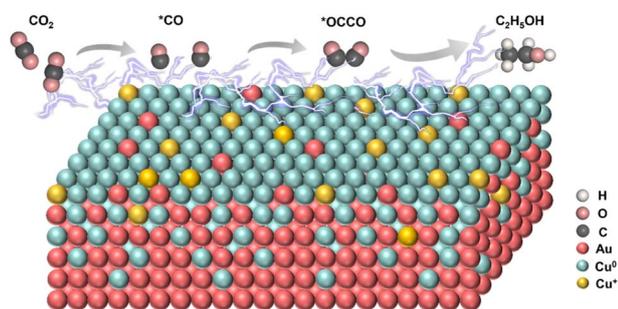
Jia Chen, Yafei Liu, Chaoyan Ma, Hao Sun, Yaxin Wei, Ruifeng Wu, Aimin Chang and Bo Zhang\*







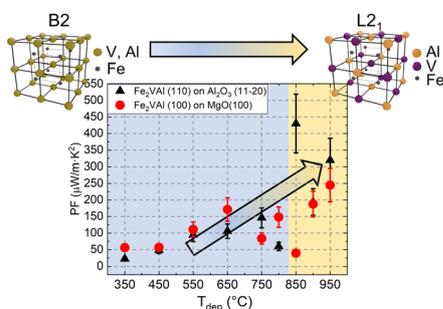
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### Compositional gradient Au–Cu bimetallic heterostructures for efficient electroreduction of CO<sub>2</sub> to ethanol at low potential

You Xu, Xueqi Hu, Jiannan Zhu, Zhengyun Wang, Xiaoling Liu, Jiawei Dai, Jiang Gong, Hongfang Liu and Guangfang Li\*

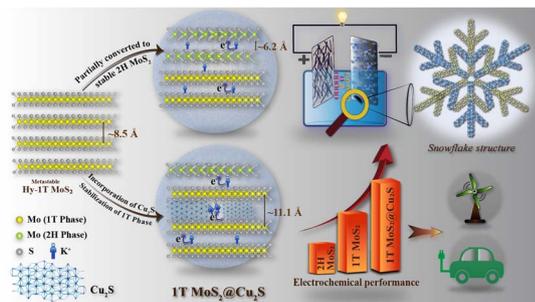
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### Thermoelectric performance boost by chemical order in epitaxial L<sub>21</sub> (100) and (110) oriented undoped Fe<sub>2</sub>VAI thin films: an experimental and theoretical study

José María Domínguez-Vázquez, Olga Caballero-Calero, Ketan Lohani, José J. Plata, Antonio M. Marquez, Cristina V. Manzano, Miguel Ángel Tenaguillo, Hiromichi Ohta, Alfonso Cebollada, Andres Conca\* and Marisol Martín-González

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### A comparative electrochemical study of 2H/1T phases of MoS<sub>2</sub> and designing 1T-MoS<sub>2</sub>@Cu<sub>2</sub>S for high-performance supercapacitors

Arkapriya Das, Alakananda Paul, Ankita Mondal, Kaushik Pal and Bhanu Bhusan Khatua\*

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### Boosting biological hydrogen production by integrating functionally symbiotic bacteria/algae with engineered nitrogen-doped carbon dots

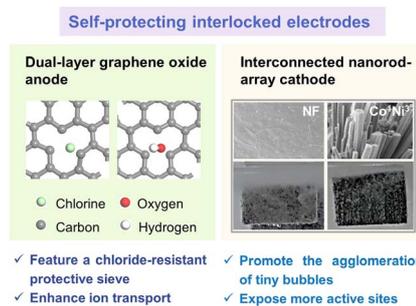
Tianchong Li, Jiaqi Wu, Xiaoxia Chen, Baosheng Du, Jian Li, Shouxin Liu, Zhijun Chen,\* Shujun Li\* and Chenhui Yang\*



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### Self-protecting interlocked electrodes for highly efficient and stable alkaline seawater electrolyzers

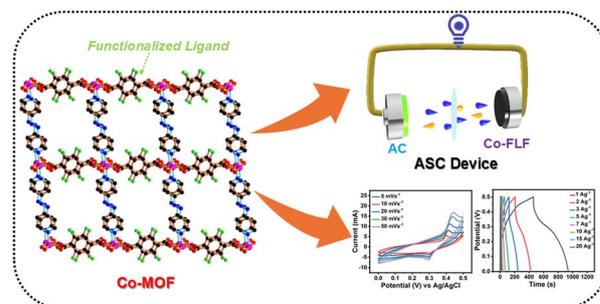
Mingming Yin, Xiongjie Jia, Yukun Sun, Zhipeng Zhan, Tianshou Zhao\* and Haoran Jiang\*



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### A mixed-ligand approach to a cobalt-based electroactive framework for superior supercapacitor performance

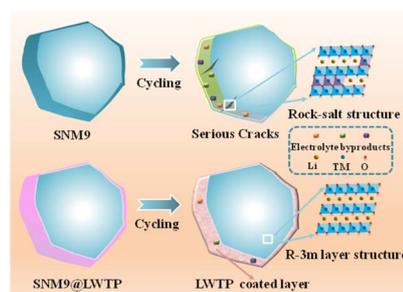
Safwana Shirin KM, Zahir Abbas and Shaikh M. Mobin\*



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### Synergistic bulk–interface stabilization of single-crystal cobalt-free high-nickel cathodes via a fast-ionic-conductor coating

Hailan Feng, Yuxing Xu, Ying Hou, Fuchang Zhuge\* and Qiangqiang Tan\*



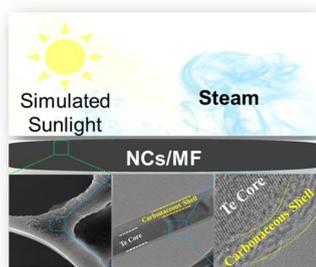
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### Adverse to beneficial: upcycling residual lithium compounds on $\text{LiNi}_{0.8}\text{Mn}_{0.1}\text{Co}_{0.1}\text{O}_2$ into a stabilizing $\text{Li}_{1+x}\text{Mn}_{2-x}\text{O}_4$ interface

Jyotirekha Dutta, Shuvajit Ghosh, Vilas G. Pol and Surendra K. Martha\*



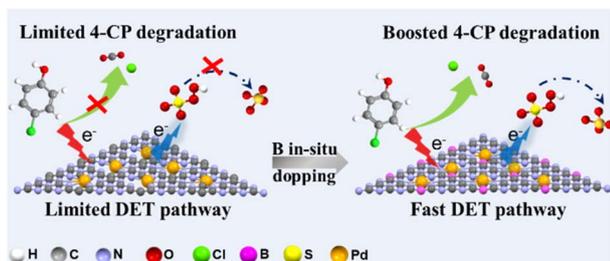
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### A facile one-pot synthesis of advanced Te@hydrothermal carbon nanocables with broad-spectrum solar absorption and high light-to-heat conversion performance

Hossein Fattahimoghaddam, In Ho Kim, Keerthnasre Dhandapani, Yong-Wook Jeong, Se-Jun Jeon, Peerasak Paoprasert, Yong Jin Jeong\* and Tae Kyu An\*

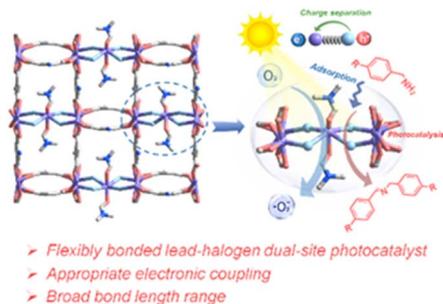
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### Coordination engineering of Pd single-atom catalysts for non-radical organohalide degradation

Zhenjie Li, Chaohuang Chen, Kaijian Sang, Xunheng Jiang, Xinyue Wu, Jiang Xu, Kun Yang and Daohui Lin\*

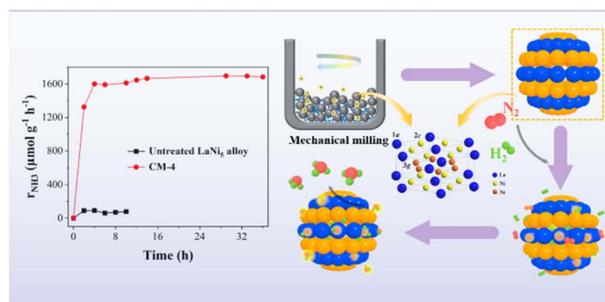
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### Flexibly bonded lead-halogen dual sites of coordination polymers for photocatalytic C–N coupling

Hou-Rong He, Yin-Jing Shi, Qia-Chun Lin, Xiao-Xiang Zhou, Wei-Ming Liao\* and Jun He\*

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### AB<sub>5</sub>-type intermetallic compounds as catalysts for ammonia synthesis

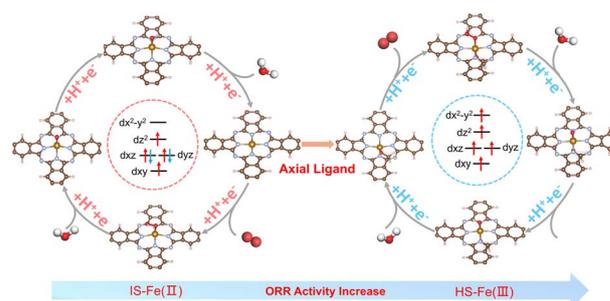
Xi Chen, Yichen Duan, Jing Wang, Xinhai Yuan,\* Lili Liu, Yuhui Chen, Lijun Fu and Yuping Wu\*



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### Synergistic spin-ligand effects on the oxygen reduction activity of the FePPc electrocatalyst

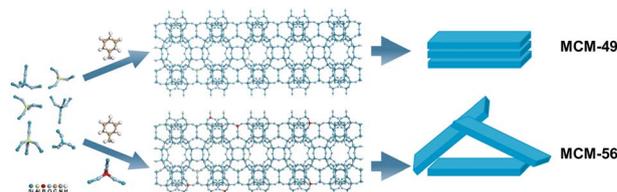
Ya Jin, Mingyuan Yu, Erjun Kan and Cheng Zhan\*



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### Direct synthesis of novel layered MCM-56 zeolite using a boron-assisted cyclohexylamine system

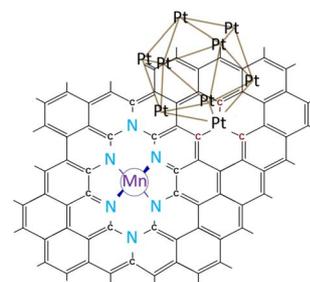
Yu Zhang, Min Yang, Yanan Wang, Weifeng Chu, Wen Liu, Junjie Li, Guangjin Hou, Kuizhi Chen,\* Xiangxue Zhu\* and Xiujie Li\*



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### Pt<sub>n</sub>-Mn<sup>(III)</sup>N<sub>x</sub> and Pt<sub>n</sub>-Mn<sup>(II)</sup>N<sub>x</sub> are both winning combinations for the durability of these hybrid catalysts in PEM fuel cells: a deep insight into synergism between Pt clusters and MnN<sub>x</sub>/C sites

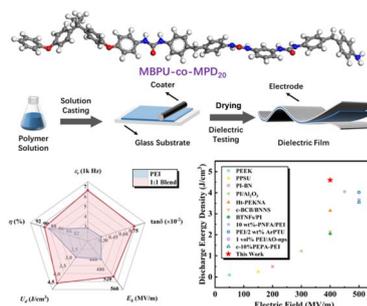
Vassili P. Glibin,\* Jean-Pol Dodelet\* and Gaixia Zhang\*



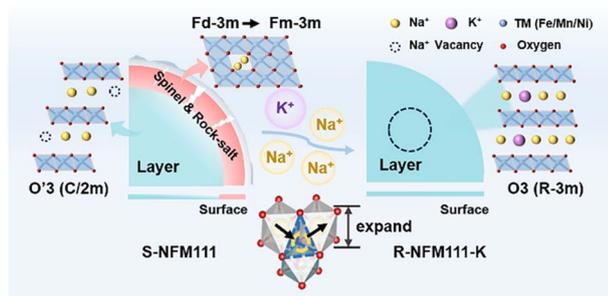
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### Tailoring dielectric performance via dipole density and hydrogen bonding interaction towards high-temperature capacitive energy storage polymers

Feng Zhou, Chong Tian, Lei Huang, Yunfeng Jiang, Fuqi Zhao, Na Yang, Dandan Yuan and Xu-fu Cai\*



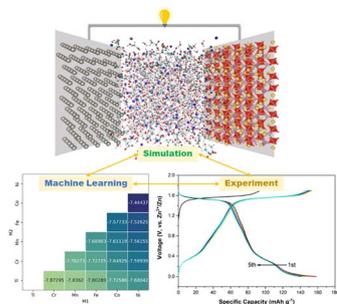
24880



### Direct upcycling of spent layered oxide cathodes via a dual-functional eutectic salt for sodium-ion batteries

Shili Gan, Xin Zeng, Dongyu Liu, Tiandu Sheng, Lihua Wang\* and Jian Li\*

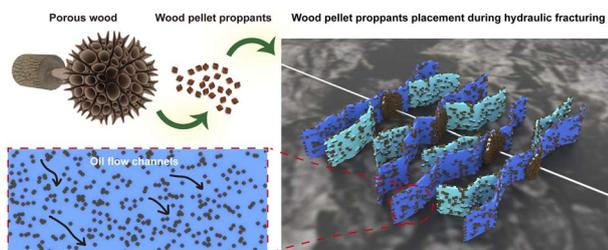
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### An $\text{Na}_3\text{VMn}_{0.5}\text{Ti}_{0.5}(\text{PO}_4)_3$ NASICON cathode with multielectron reactions for sustainable energy storage

Adi Tiara Zikri, Muhammad Hilmy Alfaruqi, Zulkifli, Uyeong Jo, Yuri Choi, Seunggyeong Lee, Sangbin Lee, Sungjin Kim and Jaekook Kim\*

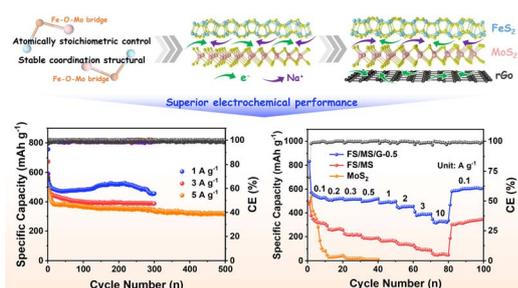
24903



### Strength–density synergy of proppants via composition and structural tailoring of wood

Chao Ma, Zulin Wu, Mengyu Sun, Xiangdong Ding,\* Jun Sun\* and Changsheng Xiang\*

24916



### Anderson-typed POM-derived $\text{FeS}_2/\text{MoS}_2$ heterostructure hybridized with graphene for sodium-ion batteries anodes

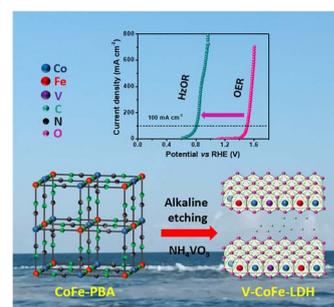
Lingling Liu, Xu Yao, Ziwei Yin, Jinlong Zhuo, Xiansen Tao, Jingwen Sun,\* Jiwen Cui\* and Jingquan Sha



24925

## Hydrazine oxidation-assisted electrocatalytic water splitting with Prussian blue analog-derived V-doped CoFe-layered double hydroxide nanosheets

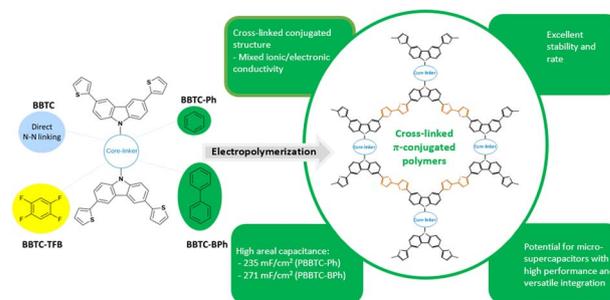
Baghendra Singh, Toufik Ansari and Arindam Indra\*



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## Cross-linked electrodeposited conjugated polymers based on bis-thiophene-carbazole bis-adducts with an aromatic core for high performance supercapacitor electrodes

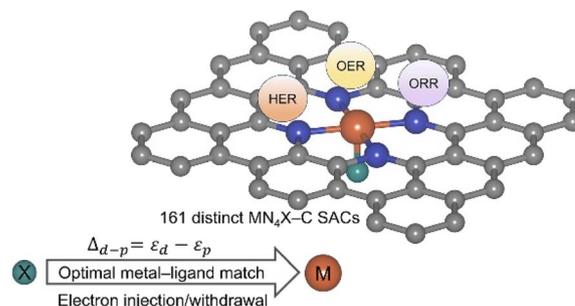
N. M. T. Tran, Vincent Lazeran, Jesus Santos-Pena and Nicolas Berton\*



24948

## Boosting the catalytic activity of water splitting and oxygen reduction reactions through axial coordination to $MN_4-C$ model catalysts

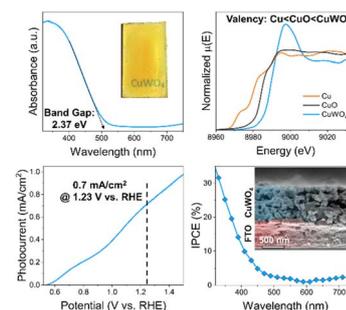
Yalei Sun, Baibiao Huang, Ying Dai\* and Wei Wei\*



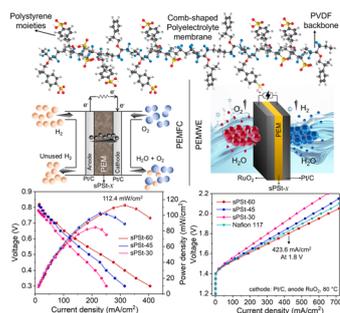
24959

## Copper tungstate photoanodes with enhanced solar water splitting performance

Kanishk Arunraj, Michael Wilms, Owen Kendall, Mitchell Perrin, Triet T. H. Nguyen, Xiaoning Li, Peter C. Sherrell, Joel van Embden, Daniel E. Gómez, Rowena Yew, Noel Duffy and Enrico Della Gaspera\*



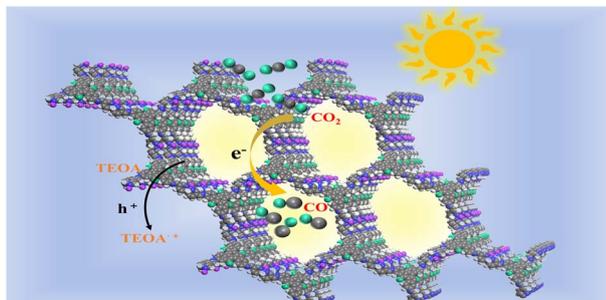
24971



### Comb-shaped proton exchange membranes with dangling polystyrene grafted onto PVDF for PEM fuel cells and water electrolysis

Pratyush Patnaik, Vanshita Goyal, Sk Miraz Hossain and Uma Chatterjee\*

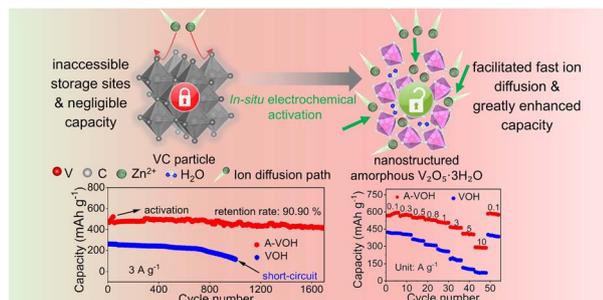
24988



### Truxenone-based donor–acceptor covalent organic frameworks incorporated with metal sites for enhanced photocatalytic CO<sub>2</sub> reduction

Yanyan Ren, Haiping Liu, Fang Duan,\* Shuanglong Lu, Xin Chen and Mingliang Du\*

24997

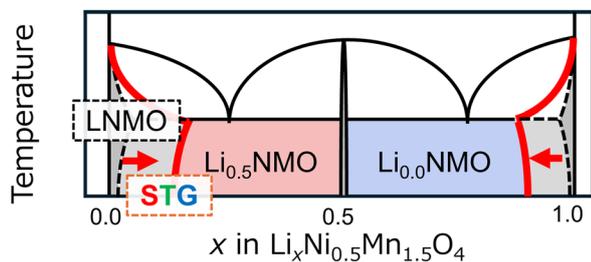


### *In situ* electrochemical activation enabling high-performance cathodes for aqueous zinc-ion batteries

Qingpu Zeng, Shitong Zhou, Neng Yu,\* Jiachen Huo, Changfang Sun and Kai Guo\*

25008

### Tailoring room-temperature miscibility gap



### Tailoring the room-temperature miscibility gap in ordered spinel LiNi<sub>0.5</sub>Mn<sub>1.5</sub>O<sub>4</sub> cathodes by multi-element doping

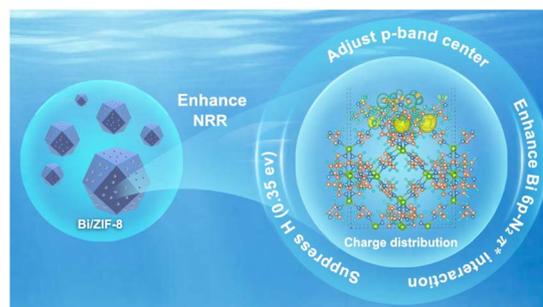
Shunsuke Narumi, H. Eugenio Otal, Tien Quang Nguyen, Michihisa Koyama and Nobuyuki Zettsu\*



25022

### Bi/ZIF-8 catalysts: the important role of ZIF-8 for enhanced electrochemical $N_2$ -to- $NH_3$ conversion using a neutral electrolyte

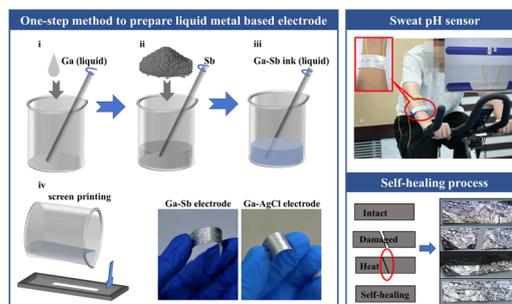
Pengju Guo, Fengxiang Yin\* and Jiahui Liang



25032

### Ga-Sb and Ga-AgCl liquid metal-based electrodes with self-healing for sweat pH sensors

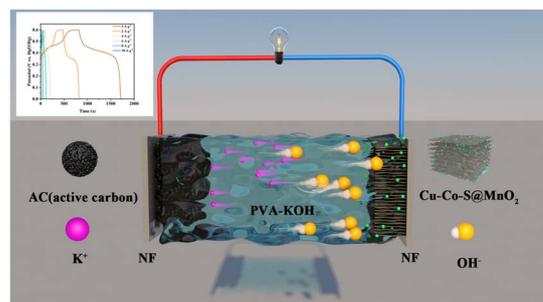
Guangxing Hu, Shuang Cui, Zhuang Li, Yan Shi\* and Hongda Wang\*



25042

### Integrating bimetallic MOF-derived sulfides with $MnO_2$ : synergistic Cu-Co-S@ $MnO_2$ heterojunctions for flexible hybrid supercapacitors

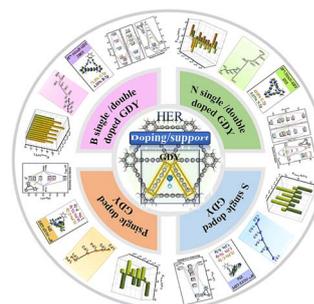
Jiale Hou, Ziheng Huang, Haofeng Lu, Cheng Chen,\* Xinfeng Wu, Yonghou Xiao, Wanghui Wei, Minjie Xue, Yanyun Ma, Xinzhou Ma, Shigang Sun and Donghai Lin\*



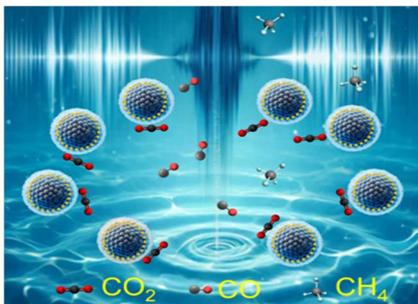
25054

### Nickel single-atom catalysts anchored on heteroatom (X = B, N, P, and S)-doped graphdiyne for a highly efficient hydrogen evolution reaction

Wangdi Zhang, Xiaojun Li,\* Jun Lu, Shuna Li, Yunguang Zhang, Zhongkui Zhang, Mengqi Zhang and Wenyu Xi



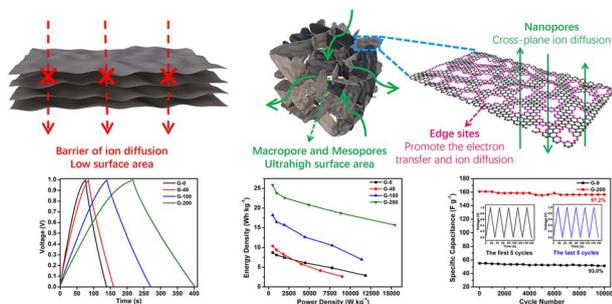
25067



### Solid–liquid interface reassembly enhances surface piezoelectric properties: transition from the parallel interface O-MoS<sub>2</sub> to the spherical interface ZnS@O-MoS<sub>2</sub>

Ting Li, Wenjin Hu, Changxin Tang, Longlong Shu\* and Fei Li\*

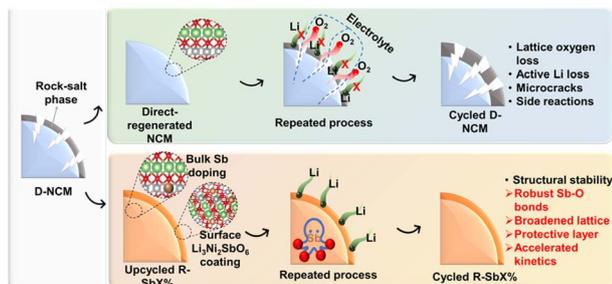
25082



### Alkaline earth metal carboxylate hydrate-mediated controllable self-assembly of three-dimensional hierarchical nanoporous graphene for high-performance supercapacitors

Xiao Wu, Canyu Zhong, Lian Ying Zhang, Jianguo Lu, Qinggang He, Qinghua Zhang, Weiyong Yuan\* and Chang Ming Li

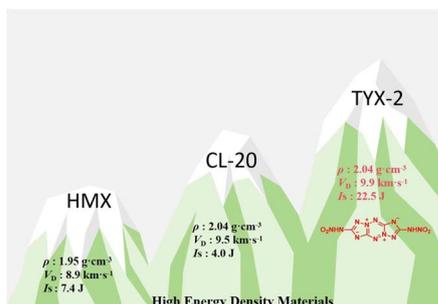
25093



### Upcycling of degraded NCM cathode materials for prolonged high-rate stability: simultaneous dual modification from surface to bulk

Chao Zhu, Bin Wang, Jiexiang Li, Zihao Zeng, Hai Lei, Xiangjin Lu, Chi Zhang,\* Wei Sun, Yue Yang and Peng Ge\*

25103



### A bistriazolotetrazine zwitterionic architecture: mitigating the pervasive energy-stability antagonism in bistable energetic matrices

Bojun Tan,\* Jian Su, Jing Zhang, Changwei Tang, Jinkang Dou, Xiong Yang, Minghui Xu, Shu Zeng, Wenjie Li, Jieyu Luan, Gen Zhang,\* Siwei Song, Qinghua Zhang,\* Xianming Lu, Bozhou Wang and Ning Liu\*

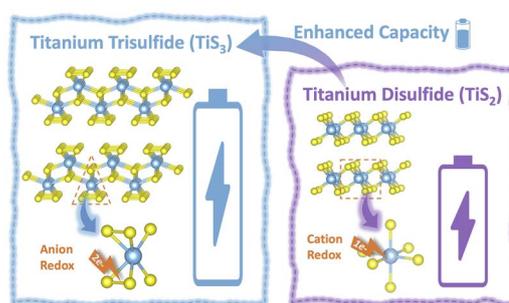


## PAPERS

25110

### Exploiting $S_2^{2-}/S^{2-}$ redox chemistry in pseudo-layered chain-structured titanium trisulfide cathodes for high-energy magnesium–lithium hybrid ion batteries

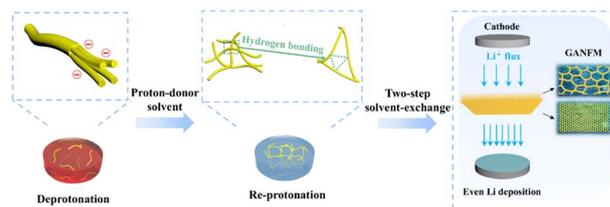
Pengcheng Jing, Atsushi Inoishi, Eiichi Kobayashi, Chengcheng Zhao, Yisong Han, Peng Ren, Isaac Abrahams and Duncan H. Gregory\*



25120

### Gradient architecture design of porous aramid nanofiber separators for robust and safe lithium-ion batteries

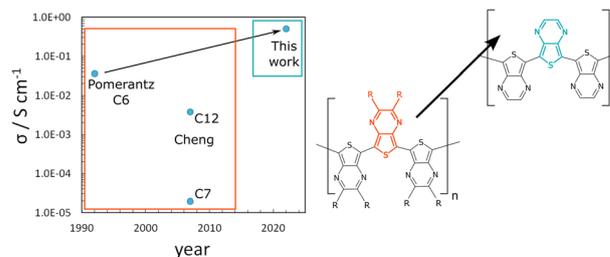
Hui Xu, Fang Wang, Shenglin Yang, Guang Li and Jingjing Zhang\*



25131

### Polythieno[3,4-*b*]pyrazine: pathways to metallic charge transport

Dominik Farka,\* Elisabeth Leeb, Olvido Irrazabal Moreda, Theresia Greunz, Christoph Ulbricht, Jiří Duchoslav, Jaroslav Vacek, Kristian Kříž, Jindřich Fanfrlík, Cigdem Yumusak, Jakub Drnec, Jozef Kajčovič, David Stifter and Niyazi Serdar Sariciftci



## CORRECTIONS

25146

### Correction: Enhancing the performance of indoor organic photovoltaics through precise modulation of chlorine density in wide bandgap random copolymers

Soyoung Kim, Seon Joong Kim, Gayoung Ham, Ji-Eun Jeong, Donghwa Lee, Eunho Lee, Hyungju Ahn, Hyojung Cha,\* Jae Won Shim\* and Wonho Lee\*



## CORRECTIONS

25149

**Correction: Improvement of photocatalytic antibacterial action of Mn, S<sub>v</sub>-co-doped ZnIn<sub>2</sub>S<sub>4</sub> prepared by a novel O<sub>v</sub>-rich  $\alpha$ -MnO<sub>2</sub> decomposition approach**

Hui Zhang, Jie Zhang,\* Zeyu Zuo, Ruiyong Zhang,\* Mengmeng Sun,\* Jizhou Duan, Wolfgang Sand, Bo Xiao and Baorong Hou

