

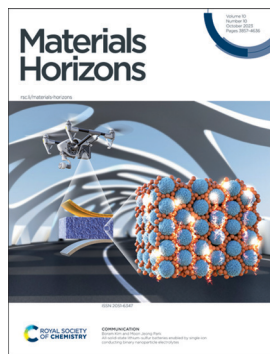
# Materials Horizons

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## IN THIS ISSUE

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### Cover

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See Chunjing Guo, Daquan Chen, Xingcai Zhang *et al.*, pp. 3879–3894. Image reproduced by permission of Xingcai Zhang and Daquan Chen from *Mater. Horiz.*, 2023, 10, 3879.

## EDITORIALS

3875

### Editor's Choice: Chiral Functional Materials

Yong Cui



3877

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Building and designing systems from the molecular level

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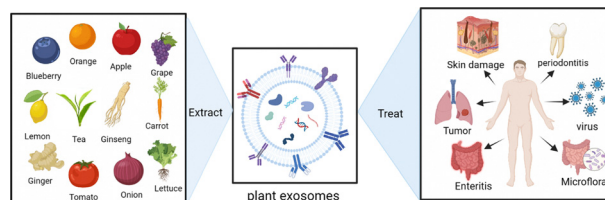
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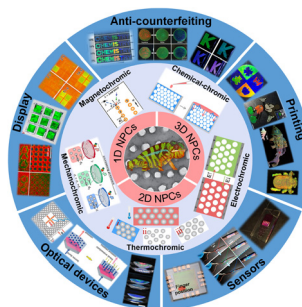


Min Cao, Ningning Diao, Xiaolu Cai, Xing Chen, Yi Xiao,  
Chunjing Guo,\* Daquan Chen\* and Xingcai Zhang\*



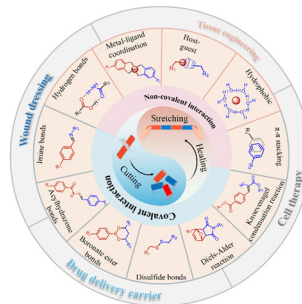
## Stimulus-responsive nonclose-packed photonic crystals: fabrications and applications

Yang Hu, Siyi Yu, Boru Wei, Dongpeng Yang,\*  
Dekun Ma and Shaoming Huang\*



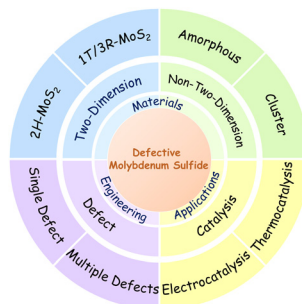
## Designing self-healing hydrogels for biomedical applications

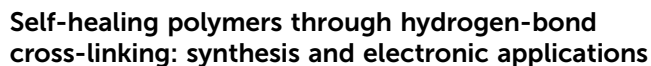
Xiaoya Ding, Lu Fan, Li Wang, Min Zhou,\*  
Yongxiang Wang\* and Yuanjin Zhao\*



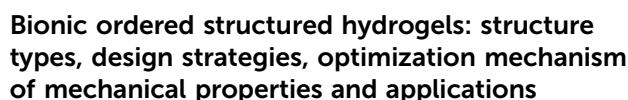
## Recent advances in defect-engineered molybdenum sulfides for catalytic applications

Yunxing Zhao, Xiaolin Zheng,\* Pingqi Gao\* and Hong Li\*

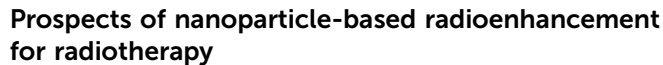




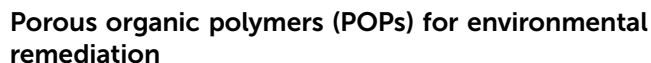
4033



4059



4083



3862 | Mater. Horiz., 2023, 10, 3859–3874

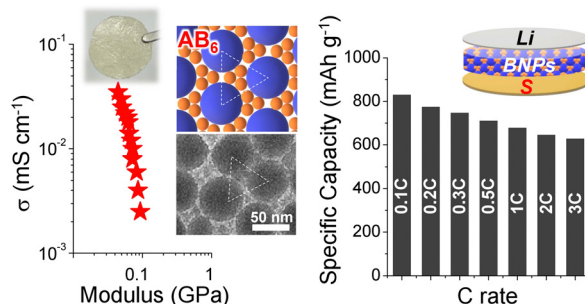


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4139

### All-solid-state lithium–sulfur batteries enabled by single-ion conducting binary nanoparticle electrolytes

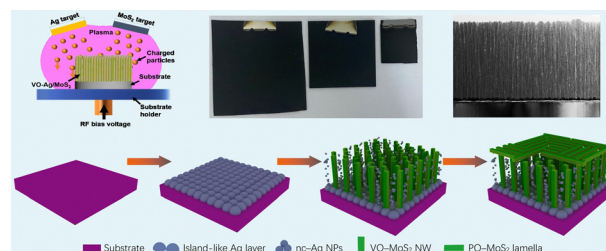
Boram Kim and Moon Jeong Park\*



4148

### Template-free scalable growth of vertically-aligned MoS<sub>2</sub> nanowire array meta-structural films towards robust superlubricity

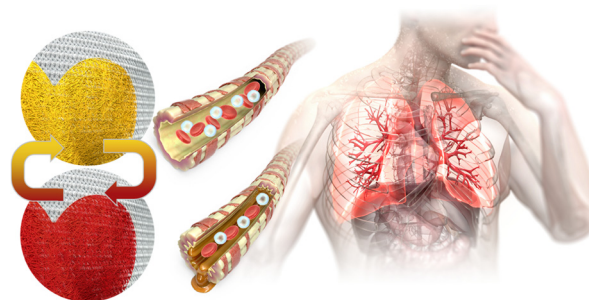
Jing Shi, Runqiang Zhao, Zaixiu Yang, Jinzhu Yang, Wenhe Zhang, Chengbing Wang\* and Junyan Zhang\*



4163

### A wearable colorimetric sweat pH sensor-based smart textile for health state diagnosis

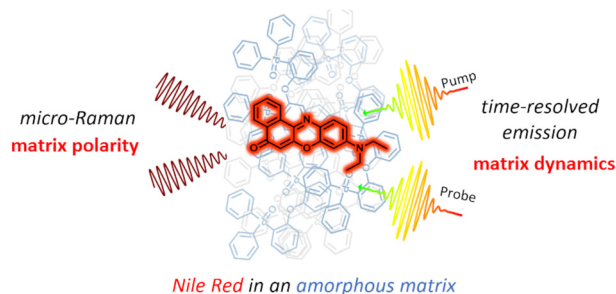
Ji-Hwan Ha, Yongrok Jeong, Junseong Ahn, Soonhyong Hwang, Sohee Jeon, Dahong Kim, Jiwoo Ko, Byeongmin Kang, Young Jung, Jungrak Choi, Hyeonseok Han, Jimin Gu, Seokjoo Cho, Hyunjin Kim, Moonjeong Bok, Su A. Park, Jun-Ho Jeong\* and Inkyu Park\*



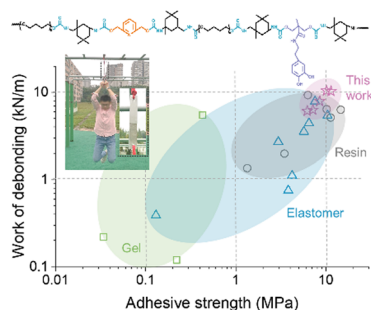
4172

### Solid state solvation: a fresh view

Brunella Bardi, Davide Giavazzi, Elena Ferrari, Alessandro Iagatti, Mariangela Di Donato, D. K. Andrea Phan Huu, Francesco Di Maiolo, Cristina Sissa, Matteo Masino, Andrea Lapini\* and Anna Painelli\*



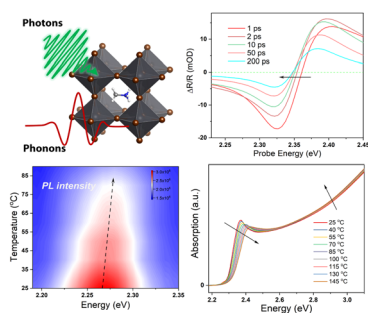
4183



### A strain-reinforcing elastomer adhesive with superior adhesive strength and toughness

Chuanlong Li, Wenbo Dong, Longyu Li, Zhengli Dou, Yuhao Li, Liuhe Wei, Qin Zhang,\* Qiang Fu and Kai Wu\*

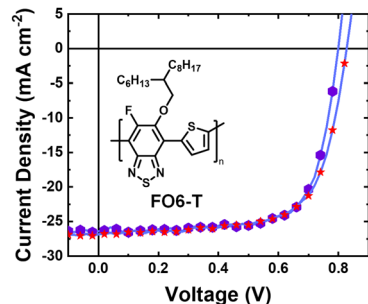
4192



### Phonon-driven transient bandgap renormalization in perovskite single crystals

Lijie Wang, Hong Wang, Razan Nughays, Wojciech Ogieglo, Jun Yin, Luis Gutiérrez-Arzaluz, Xinyuan Zhang, Jian-Xin Wang, Ingo Pinnau, Osman M. Bakr and Omar F. Mohammed\*

4202

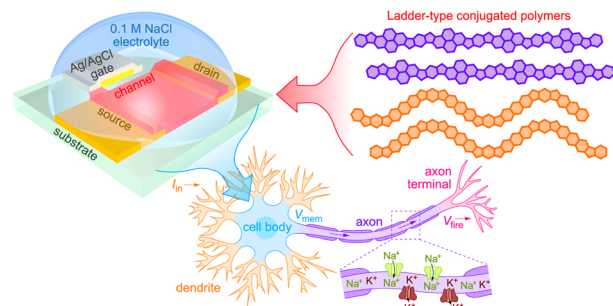


- Short synthesis
- Low Synthetic complexity
- High PCE of 15.4%

### A polymer library enables the rapid identification of a highly scalable and efficient donor material for organic solar cells

Martina Rimmele, Zhuoran Qiao, Julianna Panidi, Francesco Furlan, Chulyeon Lee, Wen Liang Tan, Christopher R. McNeill, Youngkyoo Kim, Nicola Gasparini\* and Martin Heeney\*

4213



### Stable organic electrochemical neurons based on p-type and n-type ladder polymers

Han-Yan Wu, Jun-Da Huang, Sang Young Jeong, Tiefeng Liu, Ziang Wu, Tom van der Pol, Qingqing Wang, Marc-Antoine Stoeckel, Qifan Li, Mats Fahlman, Deyu Tu, Han Young Woo, Chi-Yuan Yang and Simone Fabiano\*

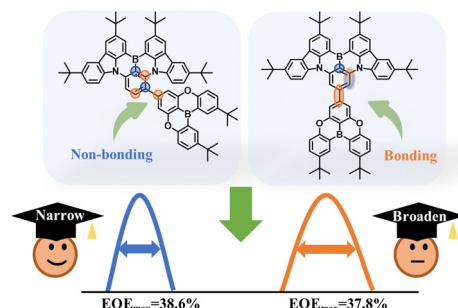


## COMMUNICATIONS

4224

### Integrating the atomically separated frontier molecular orbital distribution of two multiple resonance frameworks through a single bond for high-efficiency narrowband emission

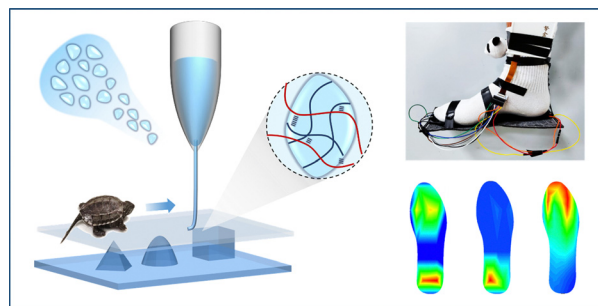
Meng-Yuan Chen, Feng Huang, Hao Wu, Ying-Chun Cheng, Hui Wang, Ya-Nan Hu, Xiao-Chun Fan, Jia Yu, Kai Wang\* and Xiao-Hong Zhang\*



4232

### 3D printed microstructured ultra-sensitive pressure sensors based on microgel-reinforced double network hydrogels for biomechanical applications

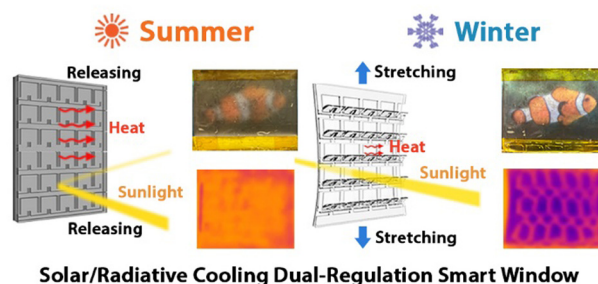
Jingxia Zheng, Guoqi Chen, Hailong Yang, Canjie Zhu, Shengnan Li, Wenquan Wang, Jiayuan Ren, Yang Cong, Xun Xu, Xinwei Wang and Jun Fu\*



4243

### A solar/radiative cooling dual-regulation smart window based on shape-morphing kirigami structures

Shancheng Wang, Yuting Dong, Yanbin Li, Keunhyuk Ryu, Zhili Dong, Jian Chen, Zhendong Dai, Yujie Ke,\* Jie Yin\* and Yi Long\*



4251

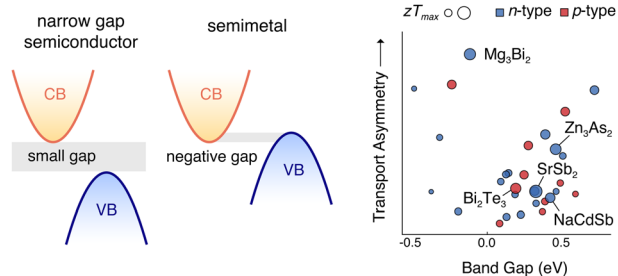
### Inclination of polarized illumination increases symmetry of structures grown via inorganic phototropism

Madeline C. Meier, Nathan S. Lewis\* and Azhar I. Carim\*



## COMMUNICATIONS

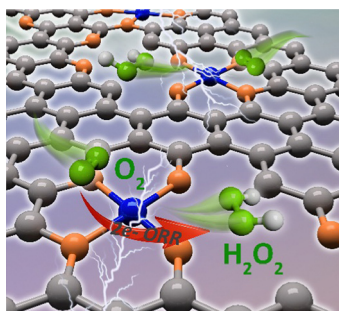
4256



### Material descriptors for thermoelectric performance of narrow-gap semiconductors and semimetals

Michael Y. Toriyama,\* Adam N. Carranco, G. Jeffrey Snyder and Prashun Gorai\*

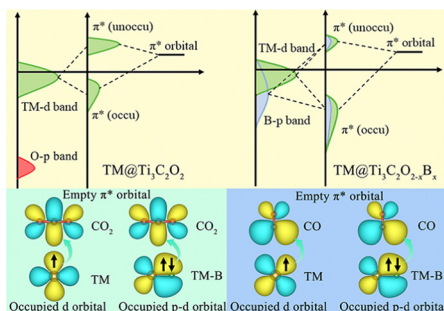
4270



### Defect-stabilized and oxygen-coordinated iron single-atom sites facilitate hydrogen peroxide electrosynthesis

Taotao Gao, Lu Qiu, Minghao Xie, Zhaoyu Jin, Panpan Li\* and Guihua Yu\*

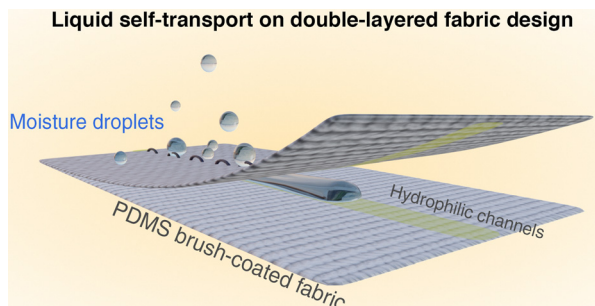
4278



### Charge-orbital synergistic engineering of TM@Ti<sub>3</sub>C<sub>2</sub>O<sub>1-x</sub>B<sub>x</sub> for highly selective CO<sub>2</sub> electrochemical reduction

Jiahe Peng, Zuhao Shi, Jizhou Jiang, Peng Zhang, Jyh-Ping Hsu and Neng Li\*

4293



### Surface-engineered double-layered fabrics for continuous, passive fluid transport

Mohammad Soltani, Sudip Kumar Lahiri, Sadaf Shabanian and Kevin Golovin\*



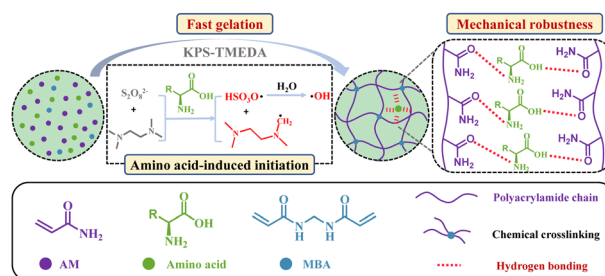


## COMMUNICATIONS

4303

### Amino acid-induced rapid gelation and mechanical reinforcement of hydrogels with low-hysteresis and self-recoverable and fatigue-resistant properties

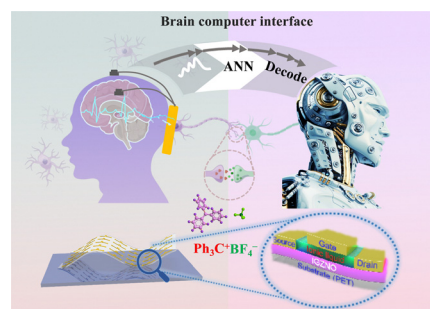
Xingqi Luo, Zhaoyang Yuan, Xiangyan Xie, Yuanjie Xie, Hongyi Lv, Jin Zhao, Hao Wang, Yuanji Gao, Lijuan Zhao, Yi Wang\* and Jinrong Wu\*



4317

### Flexible In–Ga–Zn–N–O synaptic transistors for ultralow-power neuromorphic computing and EEG-based brain–computer interfaces

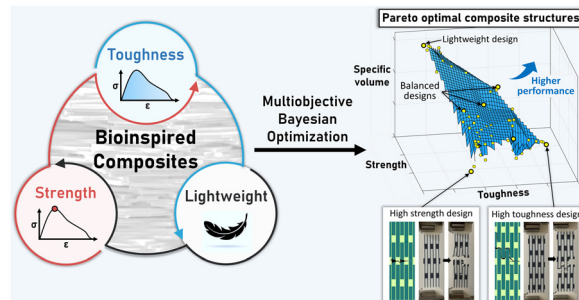
Shuangqing Fan, Enxiu Wu, Minghui Cao, Ting Xu, Tong Liu, Lijun Yang,\* Jie Su\* and Jing Liu\*



4329

### Multi-objective Bayesian optimization for the design of nacre-inspired composites: optimizing and understanding biomimetics through AI

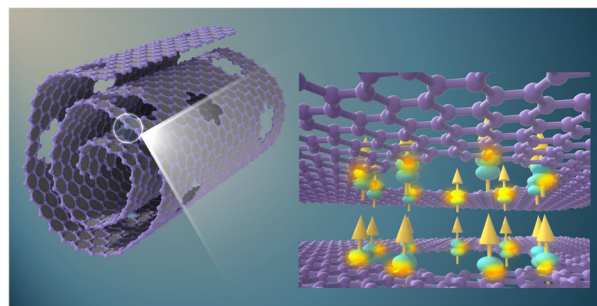
Kundo Park, Chihyeon Song, Jinkyoo Park and Seunghwa Ryu\*



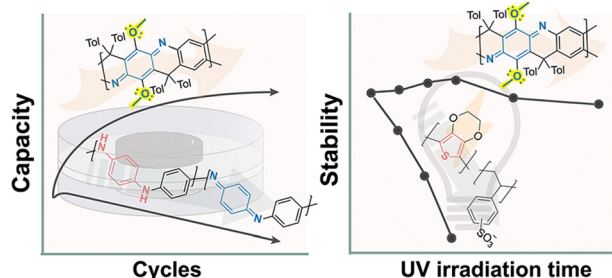
4344

### Scrolling reduced graphene oxides to induce room temperature magnetism via spatial coupling of defects

Ting Shi, Yuan Yao,\* Yang Hong, Yang Li, Songtao Lu, Wei Qin and Xiaohong Wu\*



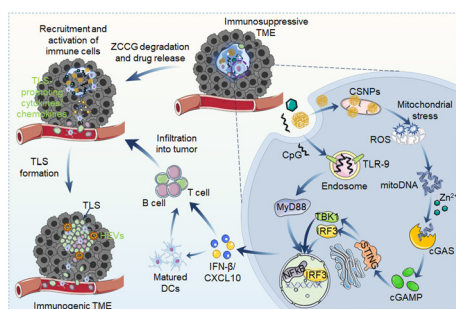
4354



### Synthesis and exceptional operational durability of polyaniline-inspired conductive ladder polymers

Mingwan Leng, Nandu Koripally, Junjie Huang, Aikaterini Vriza, Kyeong Yeon Lee, Xiaozhou Ji, Chenxuan Li, Megan Hays, Qing Tu, Kim Dunbar, Jie Xu,\* Tse Nga Ng\* and Lei Fang\*

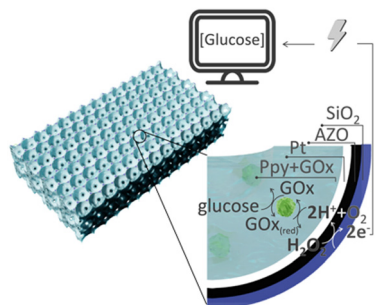
4365



### Engineering metal-based hydrogel-mediated tertiary lymphoid structure formation *via* activation of the STING pathway for enhanced immunotherapy

Xiao-Kang Jin, Jun-Long Liang, Shi-Man Zhang, Ping Ji, Qian-Xiao Huang, You-Teng Qin, Xin-Chen Deng, Chuan-Jun Liu\* and Xian-Zheng Zhang\*

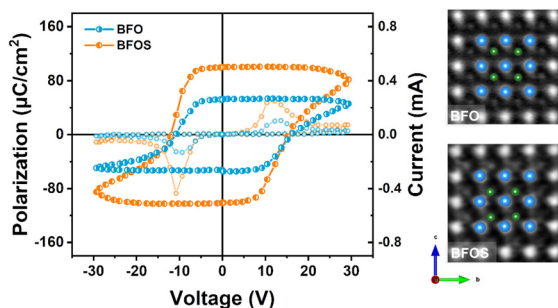
4380



### Nature-inspired functional porous materials for low-concentration biomarker detection

Irene Papiano, Simona De Zio, André Hofer, Marco Malferrari, Ignacio Minguez Bacho, Julien Bachmann, Stefania Rapino, Nicolas Vogel and Giulia Magnabosco\*

4389



### Anion-induced robust ferroelectricity in sulfurized pseudo-rhombohedral epitaxial BiFeO<sub>3</sub> thin films *via* polarization rotation

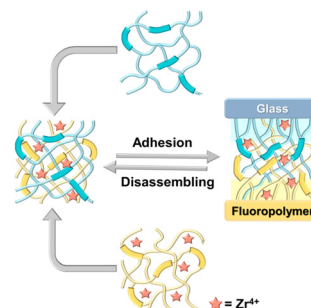
Guoqiang Xi, Zhao Pan,\* Yue-Wen Fang,\* Jie Tu, Hangren Li, Qianqian Yang, Chen Liu, Huajie Luo, Jiaqi Ding, Shuai Xu, Shiqing Deng, Qingxiao Wang, Dongxing Zheng, Youwen Long, Kuijuan Jin, Xixiang Zhang, Jianjun Tian and Linxing Zhang\*



4398

### Ultrastrong bonding, on-demand debonding, and easy re-bonding of non-sticking materials enabled by reversibly interlocked macromolecular networks-based Janus-like adhesive

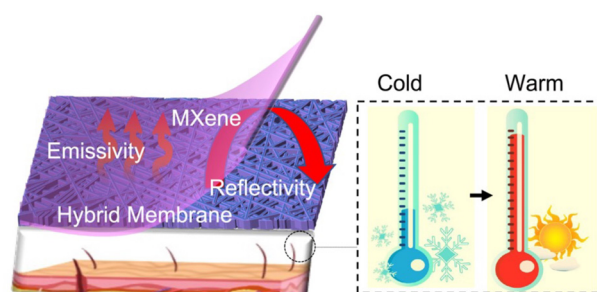
Zheng Yue Wang, Yang You, Ming Li, Min Zhi Rong\* and Ming Qiu Zhang\*



4407

### Toward low-emissivity passive heating: a supramolecular-enhanced membrane with warmth retention

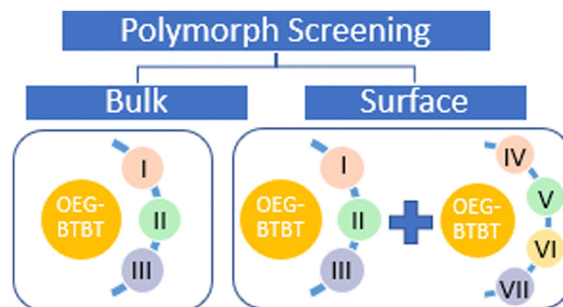
Leqi Lei, Dong Wang, Shuo Shi, Jieqiong Yang, Jing Su, Cong Wang, Yifan Si and Jinlian Hu\*



4415

### Polymorph screening at surfaces of a benzothienobenzothiophene derivative: discovering new solvate forms

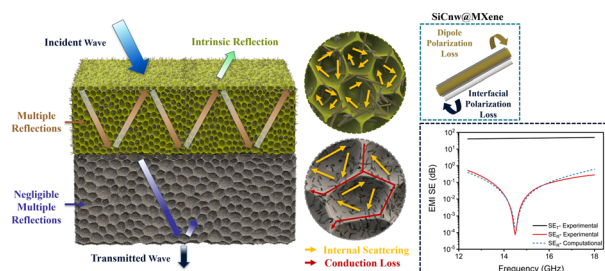
Ann Maria James, Nemo McIntosh, Félix Devaux, Patrick Brocorens, Jérôme Cornil, Alessandro Greco, Lucia Maini, Priya Pandey, Lorenzo Pandolfi, Birgit Kunert, Elisabetta Venuti, Yves Henri Geerts and Roland Resel\*



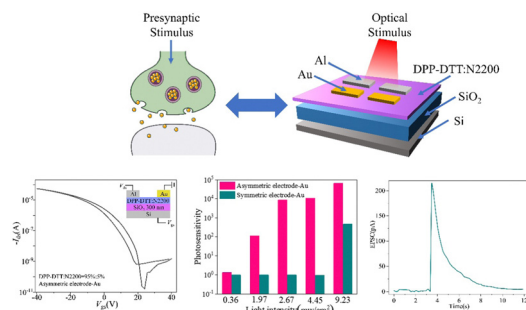
4423

### Layered polymer composite foams for broadband ultra-low reflectance EMI shielding: a computationally guided fabrication approach

Li Ma, Linfeng Wei, Mahdi Hamidinejad\* and Chul B. Park\*



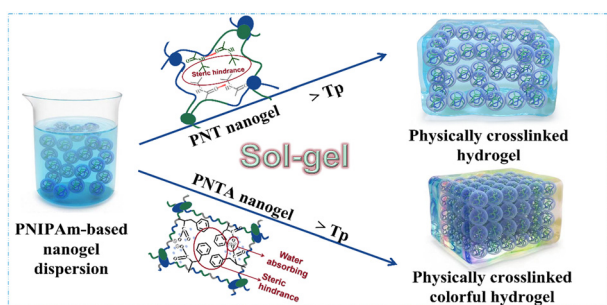
4438



### High-performance asymmetric electrode structured light-stimulated synaptic transistor for artificial neural networks

Yixin Ran, Wanlong Lu, Xin Wang, Zongze Qin, Xinsu Qin, Guanyu Lu, Zhen Hu, Yuanwei Zhu, Laju Bu and Guanghao Lu\*

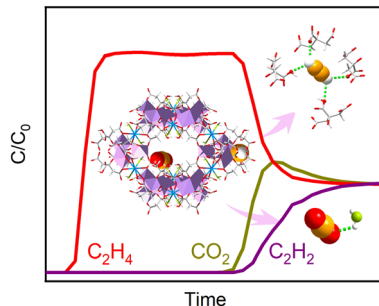
4452



### Remarkable sol-gel transition of PNIPAm-based nanogels via large steric hindrance of side-chains

Xiaoxiao Li, Xueting Li, Tingting Xia, Wei Chen, Kenneth J. Shea and Xihua Lu\*

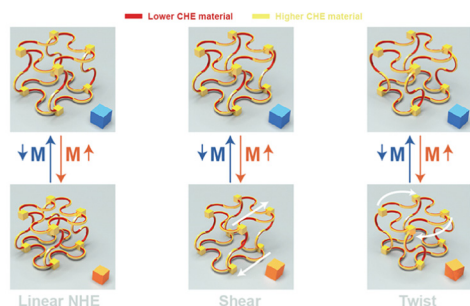
4463



### One-step ethylene purification from ternary mixtures by an ultramicroporous material with synergistic binding centers

Xingye Li, Qi Ding, Jia Liu, Lihui Dong, Xingzhen Qin, Liqin Zhou, Zhenxia Zhao, Hongbing Ji, Sui Zhang\* and Kungang Chai\*

4470



### Modular reprogrammable 3D mechanical metamaterials with unusual hygroscopic deformation modes

Yisong Bai, Chuanbao Liu,\* Yang Li, Jinxi Li, Lijie Qiao, Ji Zhou and Yang Bai\*

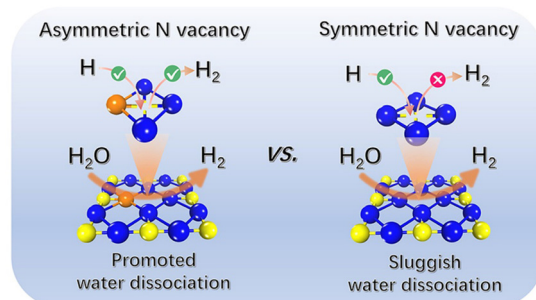




4480

### Symmetry or asymmetry: which one is the platform of nitrogen vacancies for alkaline hydrogen evolution

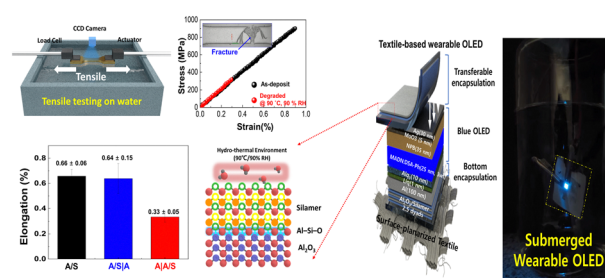
Yu Zhang, Yingxin Ma, Wenfang Yuan, Lejuan Cai,\*  
Yang Chai and Bocheng Qiu\*



4488

### Study of mechanical degradation of freestanding ALD $\text{Al}_2\text{O}_3$ by a hygrothermal environment and a facile protective method for environmentally stable $\text{Al}_2\text{O}_3$ : toward highly reliable wearable OLEDs

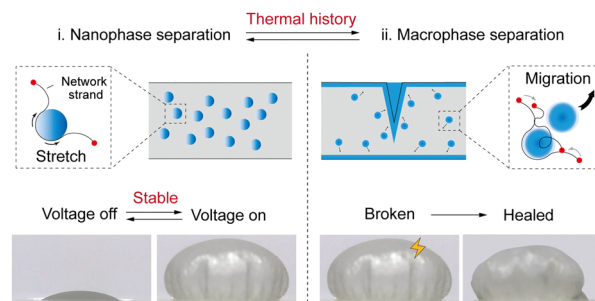
Sangmin Lee, Yongmin Jeon, Seung Jin Oh,  
Sun-Woo Lee, Kyung Cheol Choi,\* Taek-Soo Kim\* and  
Jeong Hyun Kwon\*



4501

### Composite elastomers with on-demand convertible phase separations achieve large and healable electro-actuation

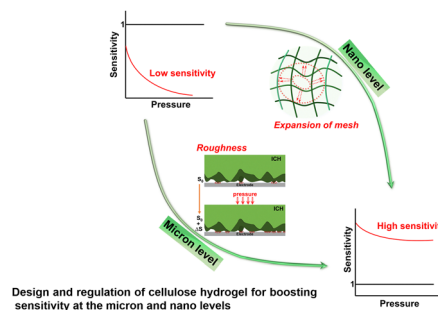
Jiali Tang, Zheqi Chen, Yiting Cai, Yang Gao, Jin He,  
Youhua Xiao, Jie Mao, Junjie Zhao, Xiang Gao,  
Tiefeng Li and Yingwu Luo\*



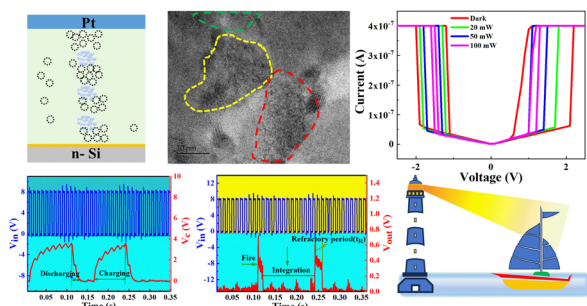
4510

### Rationally designed cellulose hydrogel for an ultrasensitive pressure sensor

Minzhang Chen, Huixiong Wan, Yang Hu, Fengyan Zhao,  
Xiaoni An and Ang Lu\*



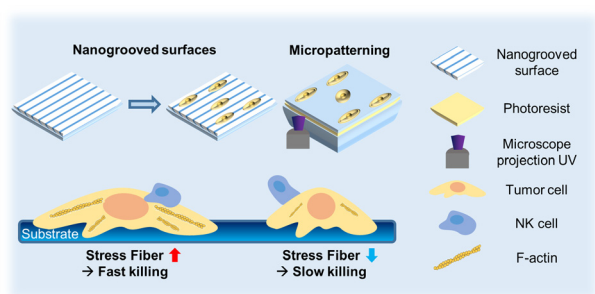
4521



### Memristors based on NdNiO<sub>3</sub> nanocrystals film as sensory neurons for neuromorphic computing

Jianhui Zhao, Yunfeng Ran, Yifei Pei, Yiheng Wei, Jiameng Sun, Zixuan Zhang, Jiacheng Wang, Zhenyu Zhou, Zhongrong Wang, Yong Sun and Xiaobing Yan\*

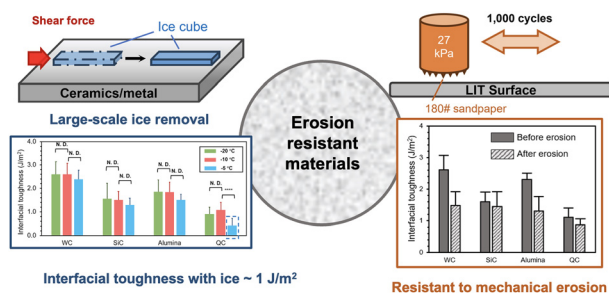
4532



### Surface nanotopography and cell shape modulate tumor cell susceptibility to NK cell cytotoxicity

Yongbum Cho, JangHyuk Kim, Jeehun Park\* and Junsang Doh\*

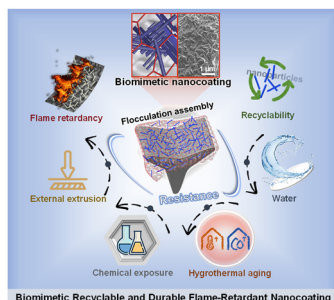
4541



### Erosion-resistant materials demonstrate low interfacial toughness with ice and superior durability

Qimeng Yang, Ali Dolatabadi and Kevin Golovin\*

4551



### A biomimetic closed-loop recyclable, long-term durable, extreme-condition resistant, flame-retardant nanocoating synthesized by reversible flocculation assembly

Jiayan Zhang, Furong Zeng, Bowen Liu, Zihao Wang, Xincen Lin, Haibo Zhao\* and Yuzhong Wang\*

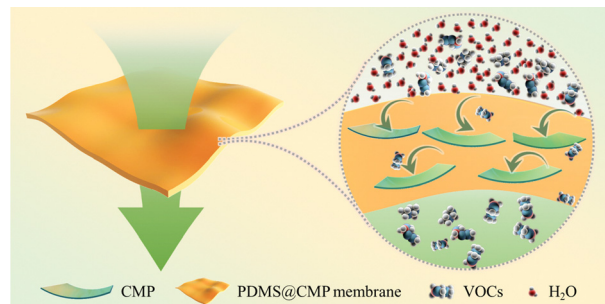


## COMMUNICATIONS

4562

**Superoleophilic conjugated microporous polymer nano-surfactants for realizing unprecedented fast recovery of volatile organic compounds**

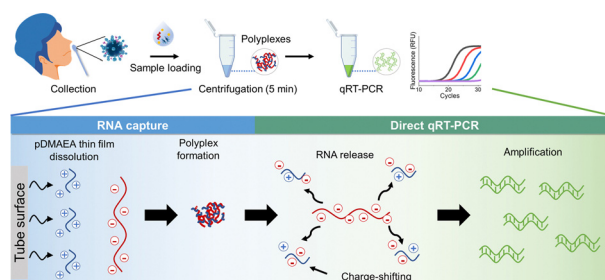
Liang Shen, Wei Liu, Yanqiu Lu, Chenyi Fang and Sui Zhang\*



4571

**Charge-shifting polyplex as a viral RNA extraction carrier for streamlined detection of infectious viruses**

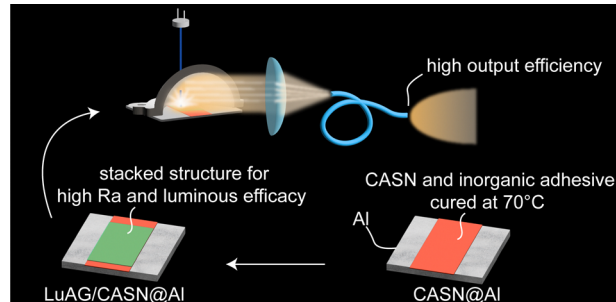
Younseong Song, Jayeon Song, Seongeun Kim, Hyowon Jang, Hogi Kim, Booseok Jeong, Nahyun Park, Sunjoo Kim, Dongeun Yong, Eun-Kyung Lim, Kyoung G. Lee,\* Taejoon Kang\* and Sung Gap Im\*



4581

**A super-high brightness and excellent colour quality laser-driven white light source enables miniaturized endoscopy**

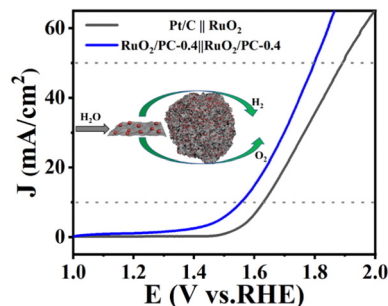
Shuxing Li, Linhui Huang, Yunqin Guo, Le Wang\* and Rong-Jun Xie\*



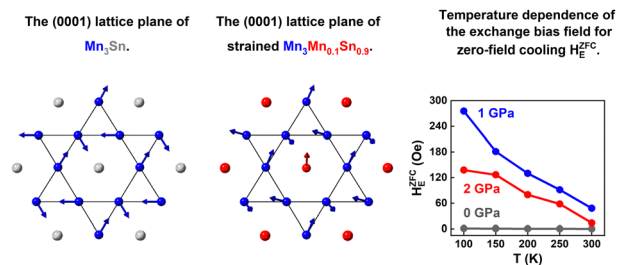
4589

**Densely populated tiny RuO<sub>2</sub> crystallites supported by hierarchically porous carbon for full acidic water splitting**

Bo Yu, Jin-Hang Liu, Shuaibiao Guo, Guanlin Huang, Shengjia Zhang, Shuangqiang Chen, Xiaopeng Li,\* Yong Wang\* and Li-Ping Lv\*



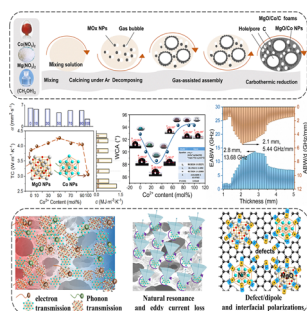
4597



### Zero-field-cooling exchange bias up to room temperature in the strained kagome antiferromagnet $\text{Mn}_{3.1}\text{Sn}_{0.9}$

Mingyue Zhao, Wei Guo, Xian Wu, Li Ma,\* Ping Song,\* Guoke Li, Congmian Zhen, Dewei Zhao and Denglu Hou

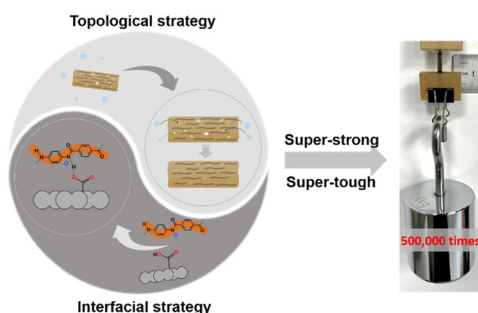
4609



### *In situ* generated gas bubble-directed self-assembly of multifunctional MgO-based hybrid foams for highly efficient thermal conduction, microwave absorption, and self-cleaning

Feifei You, Xinyu Liu, Meiwan Ying, Yijun Yang, Yutong Ke, Yi Shen, Guoxiu Tong\* and Wenhua Wu

4626



### A synergistic interfacial and topological strategy for reinforcing aramid nanofiber films

Jiongke Jin, Xun-En Wu, Huarun Liang, Haomin Wang, Shuo Li, Haojie Lu, Peng Bi, Jiali Niu, Yang Wu and Yingying Zhang\*

