

# Materials Horizons

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## IN THIS ISSUE

ISSN 2051-6347 CODEN MHAOAL 10(12) 5317-5986 (2023)



### Cover

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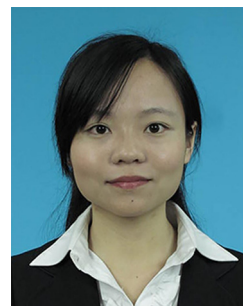
### Inside cover

See Sandip Thakur and Ashutosh Giri, pp. 5484–5491. Image reproduced by permission of Ashutosh Giri from *Mater. Horiz.*, 2023, 10, 5484.

## EDITORIAL

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**Materials Horizons Emerging Investigator Series:**  
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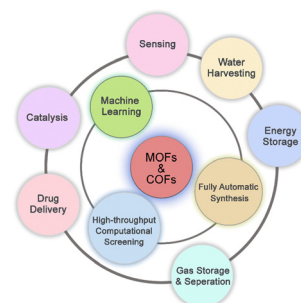


## OPINIONS

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**The future of metal–organic frameworks and covalent organic frameworks: rational synthesis and customized applications**

Xing Han, Wenqiang Zhang, Zhijie Chen,\* Yan Liu\* and Yong Cui\*



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Building and designing systems from the molecular level

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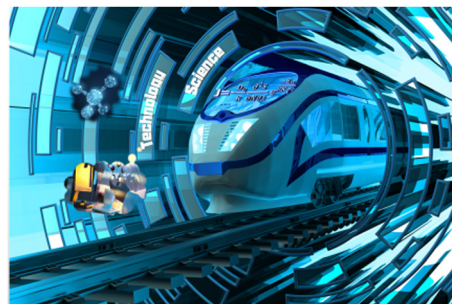


## OPINIONS

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### Prediction of future breakthroughs in materials synthesis and manufacturing techniques: a new perspective of synthesis dynamics theory

Zeshuo Meng, Zijin Xu, Zhengyan Du, Ting Deng, Dong Wang, Yi Zeng, Shansheng Yu, Xiaoying Hu\* and Hongwei Tian\*



## FOCUS

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### Dynamic light scattering and transmission electron microscopy in drug delivery: a roadmap for correct characterization of nanoparticles and interpretation of results

Sergey K. Filippov,\* Ramil Khusnutdinov, Anastasiia Murmiliuk, Wali Inam, Lucia Ya. Zakharova, Hongbo Zhang and Vitaliy V. Khutoryanskiy

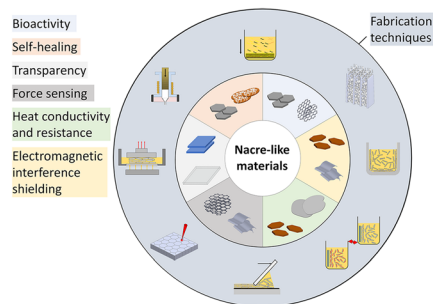


## REVIEWS

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### Multifunctional nacre-like materials

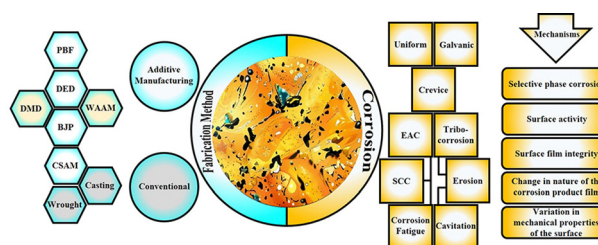
Zizhen Ding, Travis Klein, Christopher Barner-Kowollik and Mohammad Mirkhalaf\*



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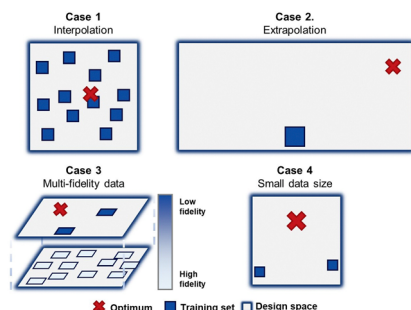
### A review of the corrosion behavior of conventional and additively manufactured nickel–aluminum bronze (NAB) alloys: current status and future challenges

Khashayar Morshed-Behbahani,\* Donald Paul Bishop and Ali Nasiri\*



## REVIEWS

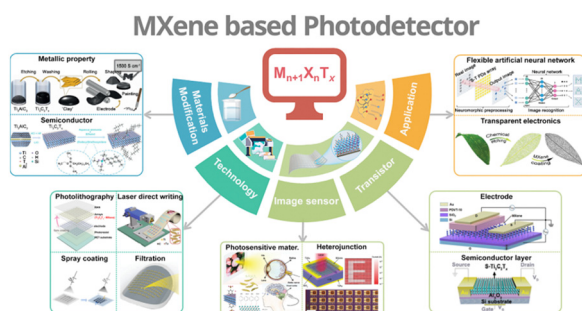
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### Machine learning-based inverse design methods considering data characteristics and design space size in materials design and manufacturing: a review

Junhyeong Lee, Donggeun Park, Mingyu Lee, Hugon Lee, Kundo Park, Ikjin Lee and Seunghwa Ryu\*

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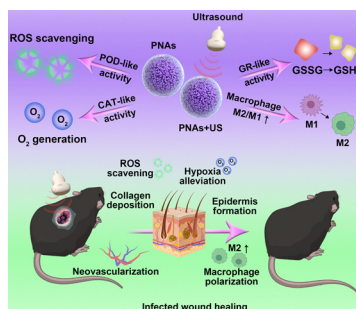


### MXene based flexible photodetectors: progress, challenges, and opportunities

La Li and Guozhen Shen\*

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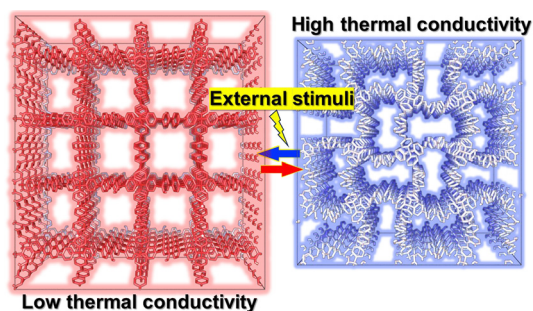
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### Infected wound repair with an ultrasound-enhanced nanozyme hydrogel scaffold

Fan Zhang, Yong Kang, Liwen Feng, Guan Xi, Wei Chen, Na Kong, Wei Tao,\* Tiangang Luan,\* Seyoung Koo\* and Xiaoyuan Ji\*

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### Reversible and high-contrast thermal conductivity switching in a flexible covalent organic framework possessing negative Poisson's ratio

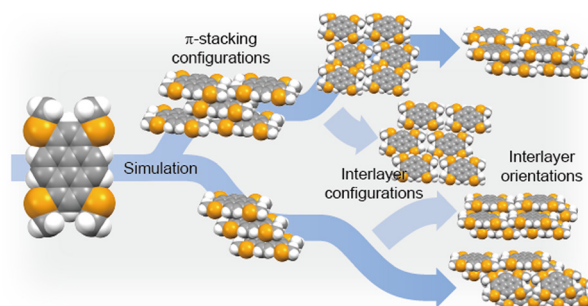
Sandip Thakur and Ashutosh Giri\*



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### Crystal-structure simulation of molecular semiconductors: brickwork-related crystal structures of methylthiolated *peri*-condensed polycyclic aromatic hydrocarbons

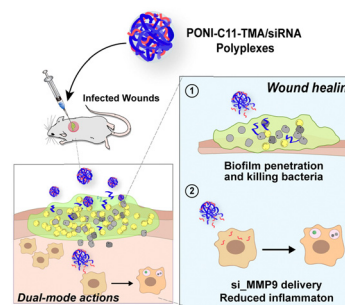
Kirill Bulgarevich and Kazuo Takimiya\*



5500

### Antimicrobial polymer-siRNA polyplexes as a dual-mode platform for the treatment of wound biofilm infections

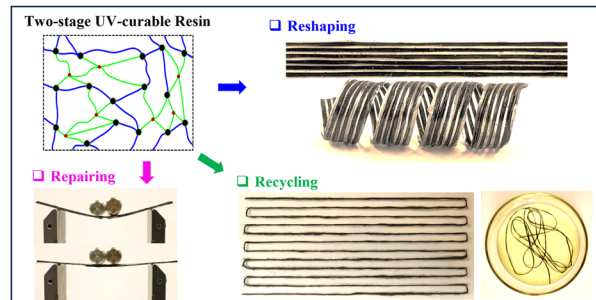
Taewon Jeon, Jessa Marie V. Makabenta, Jungmi Park, Ahmed Nabawy, Yagiz Anil Cicek, Sarah S. Mirza, Janelle Welton, Muhammad Aamir Hassan, Rui Huang, Jesse Mager and Vincent M. Rotello\*



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### 3D Printing of continuous fiber composites using two-stage UV curable resin

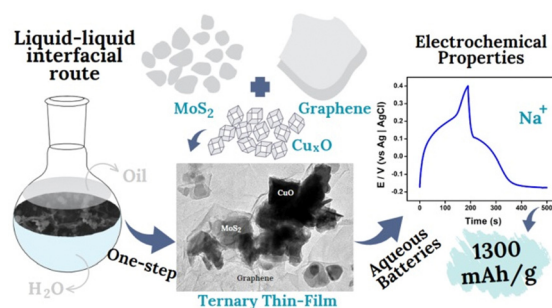
Huan Jiang, Arif M. Abdullah, Yuchen Ding, Christopher Chung, Martin L. Dunn\* and Kai Yu\*



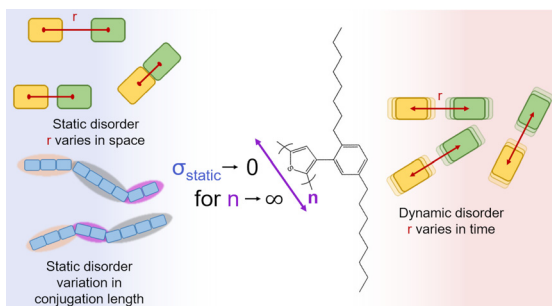
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### Nanoarchitected graphene/copper oxide nanoparticles/MoS<sub>2</sub> ternary thin films as highly efficient electrodes for aqueous sodium-ion batteries

Maria K. Ramos, Gustavo Martins, Luiz H. Marcolino-Junior, Márcio F. Bergamini, Marcela M. Oliveira and Aldo J. G. Zarbin\*



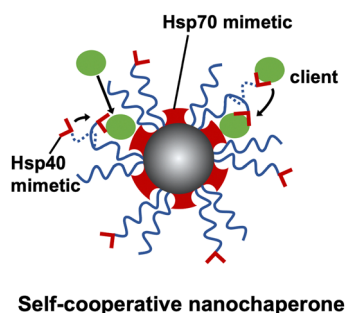
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### A spectroscopic assessment of static and dynamic disorder in a film of a polythiophene with a planarized backbone

Konstantin Schötz, Fabian Panzer, Michael Sommer, Heinz Bässler and Anna Köhler\*

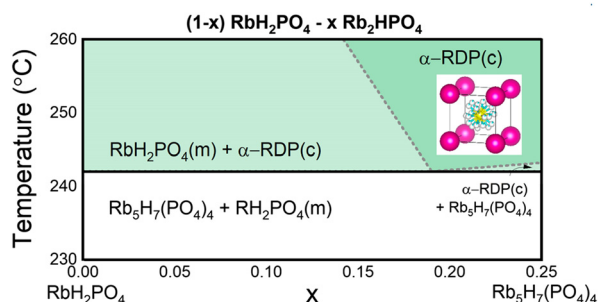
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### Development of self-cooperative nanochaperones with enhanced activity to facilitate protein refolding

Menglin Yang, Yanli Zhang, Fei Deng, Xiaohui Wu, Yujie Chen, Feihe Ma\* and Linqi Shi\*

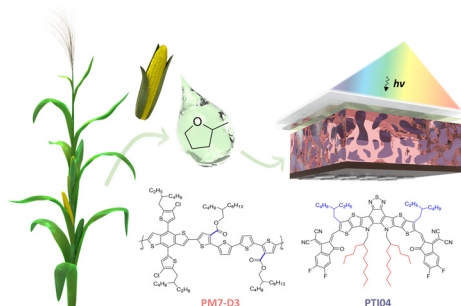
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### Superprotonic conductivity in $\text{RbH}_{2-3y}(\text{PO}_4)_{1-y}$ : a phosphate deficient analog to cubic $\text{CsH}_2\text{PO}_4$ in the $(1-x)\text{RbH}_2\text{PO}_4 - x\text{Rb}_2\text{HPO}_4$ system

Grace Xiong, Louis S. Wang and Sossina M. Haile\*

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### Additive-free molecular acceptor organic solar cells processed from a biorenewable solvent approaching 15% efficiency

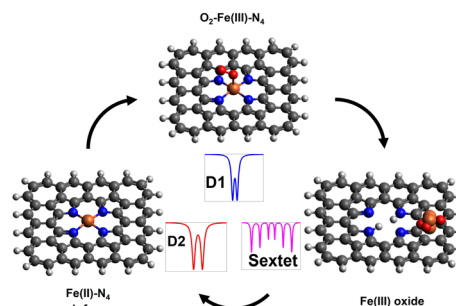
Zhifang Du, Hoang Mai Luong, Sina Sabury, Pattarawadee Therdkatanyuphong, Sangmin Chae, Claire Welton, Austin L. Jones, Junxiang Zhang, Zhengxing Peng, Ziyue Zhu, Sadisha Nanayakkara, Veaceslav Coropceanu, Dylan G. Choi, Steven Xiao, Ahra Yi, Hyo Jung Kim, Jean-Luc Bredas, Harald Ade, G. N. Manjunatha Reddy,\* Seth R. Marder,\* John R. Reynolds\* and Thuc-Quyen Nguyen\*



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### Life cycle of single atom catalysts: a Mössbauer study on degradation and reactivation of tetrapyrrolic Fe–N–C powders

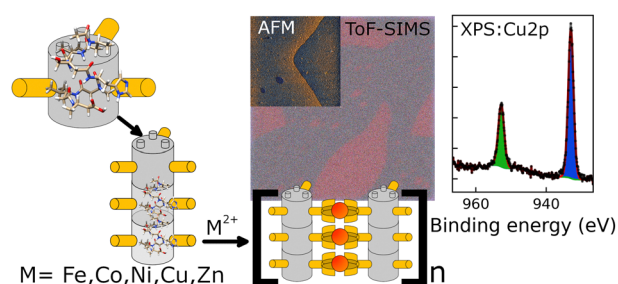
Davide Menga, Friedrich E. Wagner and Tim-Patrick Fellinger\*



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### Controllable hierarchical self-assembly: systematic study forming metallocupramolecular frameworks on the basis of helical beta-oligoamides

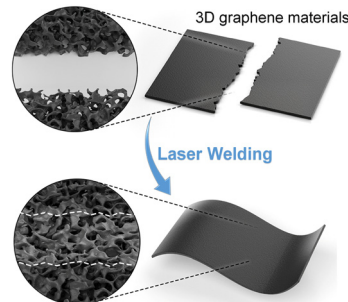
Norton G. West,\* Sarah E. Bamford, Paul J. Pigram, Jisheng Pan,\* Dong-Chen Qi and Adam Mechler\*



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### Pulsed laser welding of macroscopic 3D graphene materials

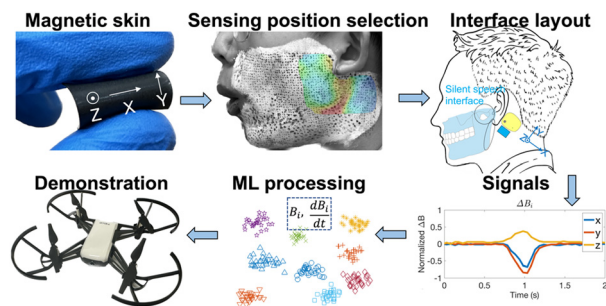
Wenjie Yu, Weiwei Zhao and Xiaoqing Liu\*



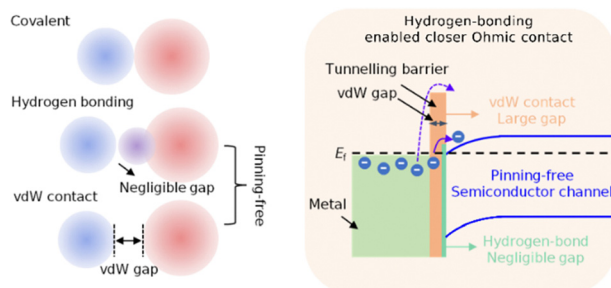
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### Decoding silent speech commands from articulatory movements through soft magnetic skin and machine learning

Penghao Dong, Yizong Li, Si Chen, Justin T. Grafstein, Irfaan Khan and Shanshan Yao\*



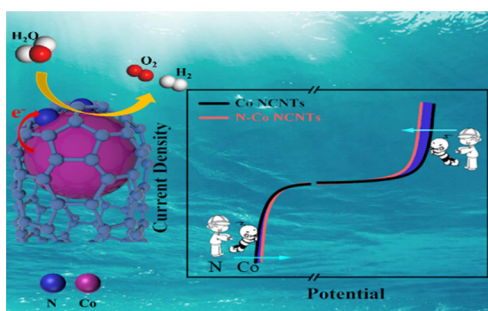
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### Hydrogen-bonding enables two-dimensional metal/semiconductor tunable contacts approaching the quantum limit and the modified Schottky–Mott limit simultaneously

Dexing Liu, Ziyi Liu, Jiahao Zhu and Min Zhang\*

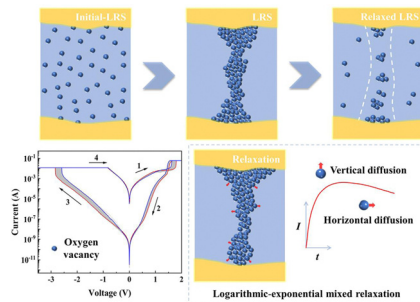
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### Anion-induced electronic localization and polarized cobalt clusters for highly efficient water splitting

Yucheng Wu, Yanli Yu, Wei Shen, Yimin Jiang, Rongxing He\* and Ming Li\*

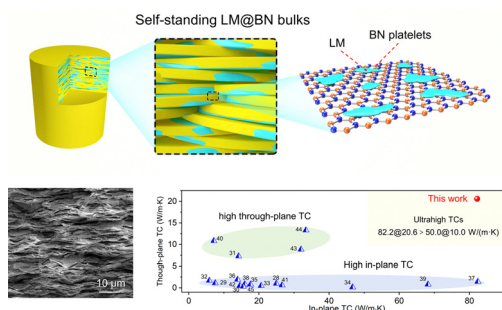
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### Gradual conductance modulation by defect reorganization in amorphous oxide memristors

Siqin Li, Jigang Du, Bojing Lu, Ruqi Yang, Dunan Hu, Pingwei Liu, Haiqing Li, Jingsheng Bai, Zhizhen Ye\* and Jianguo Lu\*

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### Self-standing boron nitride bulks enabled by liquid metals for thermal management

Li-Chuan Jia,\* Zhi-Xing Wang, Lei Wang, Jian-Feng Zeng, Pei-Yao Du, Yun-Fei Yue, Li-Hua Zhao\* and Shen-Li Jia\*

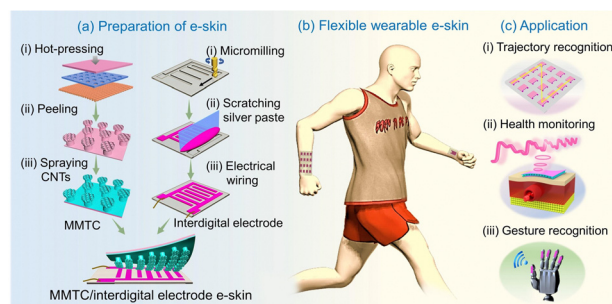




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### Mushroom-mimetic 3D hierarchical architecture-based e-skin with high sensitivity and a wide sensing range for intelligent perception

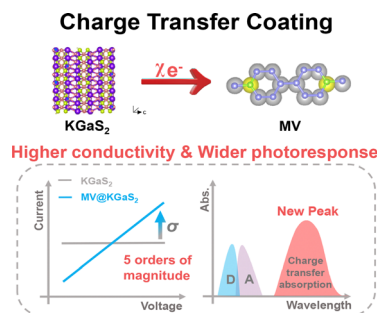
Yajie Zhang, Xinyu Zhang, Chuan Ning, Kun Dai, Guoqiang Zheng,\* Chuntai Liu and Changyu Shen



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### Significant increase of the photoresponse range and conductivity for a chalcogenide semiconductor by viologen coating through charge transfer

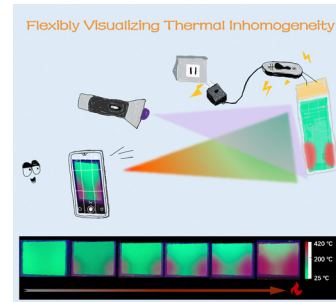
Tian-Tian Song, Wei-Qiang Huang, Kai-Bin Jiang, Wen-Fa Chen, Yu Zhou, Hong-Yi Bian, Ming-Sheng Wang\* and Guo-Cong Guo\*



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### Visualizing temperature inhomogeneity using thermo-responsive smart materials

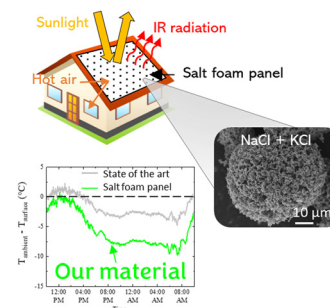
Panqin Wang, Jiaren Du,\* Tengyue Wang, Shaoxing Lyu, Rik Van Deun, Dirk Poelman and Hengwei Lin\*



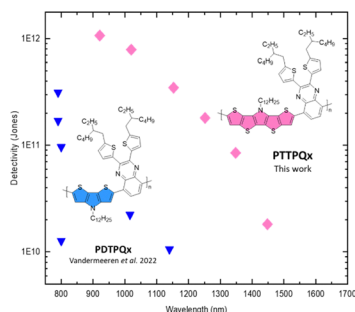
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### All-day passive radiative cooling using common salts

Mariana Desirée Reale Batista, Alyssa L. Troksa, Hannah V. Eshelman, Michael Bagge-Hansen and John D. Roehling\*



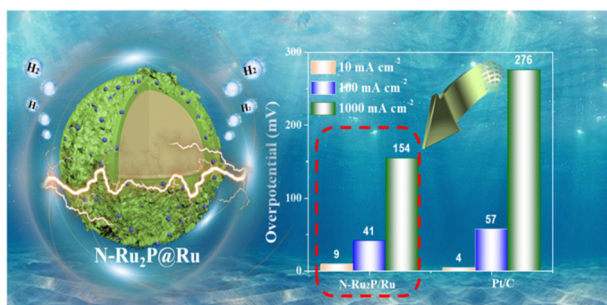
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### A tetrathienopyrrole-based ladder-type donor polymer for high-performance organic near-infrared cavity detectors

Kaat Valkeneers, Jorne Raymakers, Quan Liu,\*  
Jochen Vanderspikken, Yuming Wang, Jurgen Kesters,  
Tyler James Quill, Zhen Liu, Niko Van den Brande,  
Laurence Lutsen, Koen Vandewal\* and Wouter Maes\*

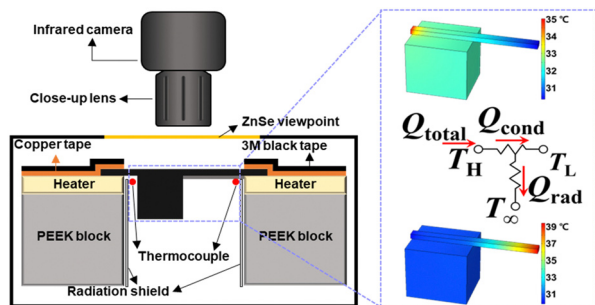
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### Developing energy-efficient N-doping technology to controllably construct N-Ru<sub>2</sub>P@Ru nanospheres for highly efficient hydrogen evolution at an ampere-level current density

Mengmeng Wang, Yunmei Du,\* Shuangshuang Li,  
Xiaoli Sun, Bin Li, Yuanxiang Gu and Lei Wang\*

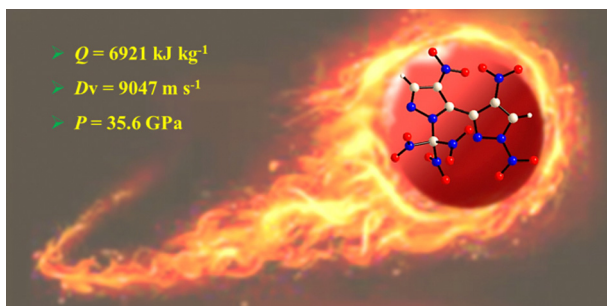
5720



### Giant thermal rectification efficiency by geometrically enhanced asymmetric non-linear radiation

Seongkyun Kim, Taeyeop Kim, Jaehyun Sung,  
Yongjun Kim, Dongwoo Lee\* and Seunghyun Baik\*

5729



### Pushing the limits of the heat of detonation via the construction of polynitro bipyrazole

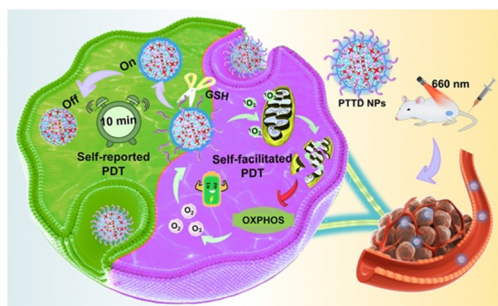
Yaqun Dong, Miao Li, Jing Liu, Yuji Liu, Wei Huang,  
Jean'ne M. Shreeve and Yongxing Tang\*



5734

### Self-reported and self-facilitated theranostic oxygen nano-economizer for precise and hypoxia alleviation-potentiated photodynamic therapy

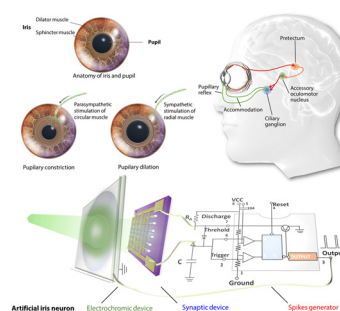
Shumeng Li, Fujun Yang, Yongdan Wang, Linshan Jia and Xiaohong Hou\*



5753

### A retinomorphonic neuron for artificial vision and iris accommodation

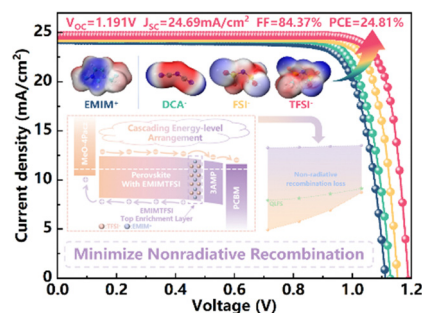
Lin Sun, Shangda Qu and Wentao Xu\*



5763

### In situ dipole formation to achieve high open-circuit voltage in inverted perovskite solar cells via fluorinated pseudohalide engineering

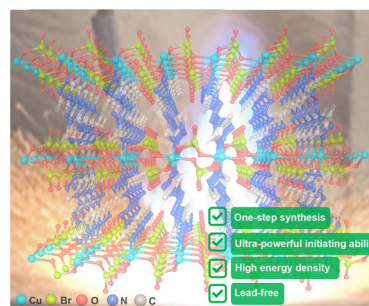
Yuan Liu, Chen Tang, Anxin Sun, Rongshan Zhuang, Yiting Zheng, Congcong Tian, Xueyun Wu, Zihao Li, Beilin Ouyang, Jiajun Du, Ziyi Li, Yong Hua and Chun-Chao Chen\*



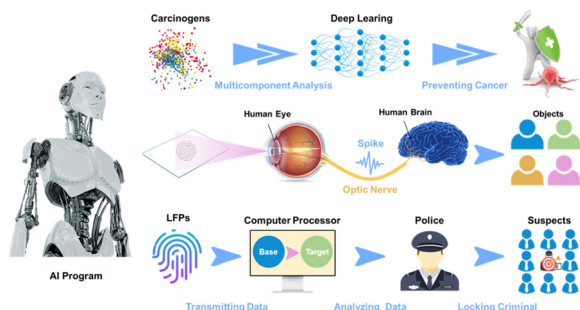
5775

### A three-dimensional energetic coordination compound (BLG-1) with excellent initiating ability for lead-free primary explosives

Guorong Lei, Wenchuan Cheng, Zujia Lu, Tonglai Zhang, Zhimin Li\* and Jianguo Zhang\*



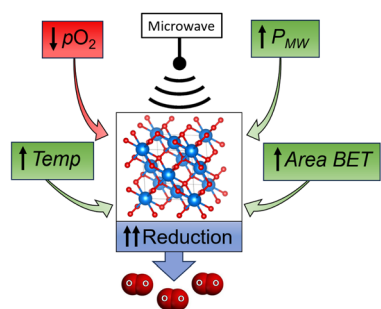
5782



## Multifunctional Eu(III)-modified HOFs: roxarsone and aristolochic acid carcinogen monitoring and latent fingerprint identification based on artificial intelligence

Kai Zhu and Bing Yan\*

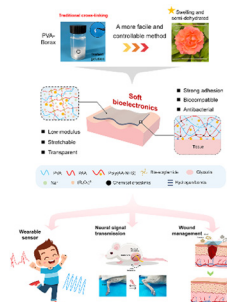
5796



## Modulating redox properties of solid-state ion-conducting materials using microwave irradiation

J. M. Serra,\* M. Balaguer, J. Santos-Blasco, J. F. Borrás-Morell, B. García-Baños, P. Plaza-González, D. Catalán-Martínez, F. Penaranda-Foix, A. Domínguez, L. Navarrete and J. M. Catala-Civera\*

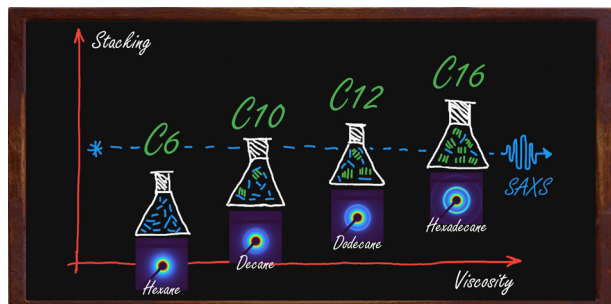
5805



## Conductive and antibacterial dual-network hydrogel for soft bioelectronics

Huiqi Sun, Sai Wang, Fan Yang, Mingyi Tan, Ling Bai, Peipei Wang, Yingying Feng, Wenbo Liu, Rongguo Wang\* and Xiaodong He

5822



## Self-assembly of perovskite nanoplates in colloidal suspensions

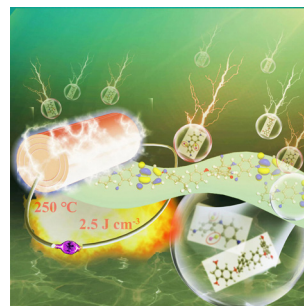
Raphael F. Moral, Antônio A. Malfatti-Gasperini, Luiz G. Bonato, Brenner R. C. Vale, André F. V. Fonseca, Lazaro A. Padilha, Cristiano L. P. Oliveira and Ana F. Nogueira\*



5835

### Intrinsic-designed polyimide dielectric materials with large energy storage density and discharge efficiency at harsh ultra-high temperatures

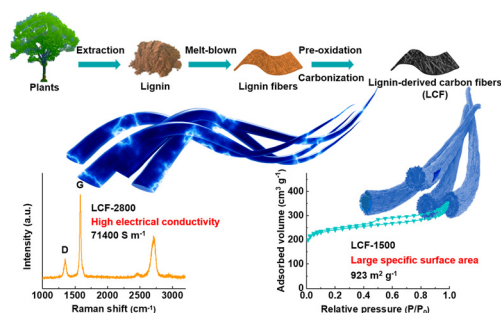
Yaya Tian, Ming-Sheng Zheng,\* Yuchao Li,\* Chuqi Xu, Yiyi Zhang, Wei Liu, Zhi-Min Dang and Jun-Wei Zha\*



5847

### Highly conductive and porous lignin-derived carbon fibers

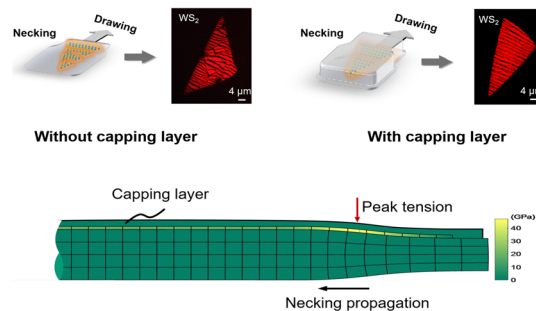
Guosheng Jia, Yan Yu, Xuefen Wang, Chao Jia,\* Zexu Hu, Senlong Yu, Hengxue Xiang\* and Meifang Zhu



5859

### Capping layer enabled controlled fragmentation of two-dimensional materials by cold drawing

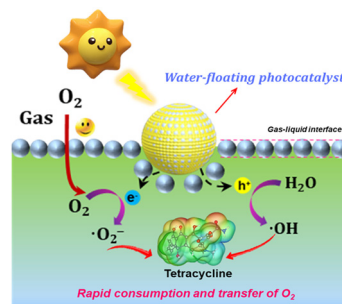
Ming Chen,\* Dong Li, Yuxin Hou, Mengxi Gu, Qingsheng Zeng, De Ning, Weimin Li, Xue Zheng, Yan Shao, Zhixun Wang,\* Juan Xia, Chunlei Yang,\* Lei Wei\* and Huajian Gao\*



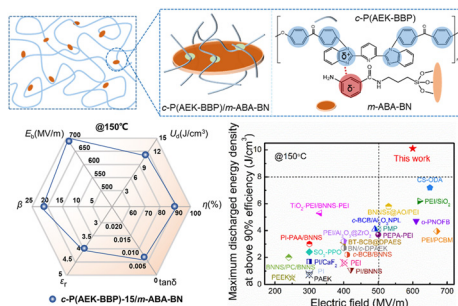
5869

### Fabrication of water-floating litchi-like polystyrene-sphere-supported TiO<sub>2</sub>/Bi<sub>2</sub>O<sub>3</sub> S-scheme heterojunction for efficient photocatalytic degradation of tetracycline

Wensheng Zhang, Qingmei Tan, Tianren Liu, Ying He, Gang Chen, Ke Chen, Dongxue Han,\* Dongdong Qin and Li Niu\*



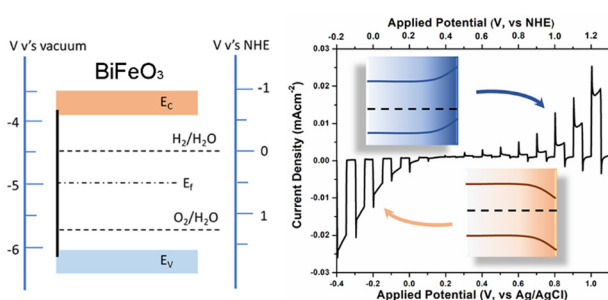
5881



### Superior high-temperature capacitive performance of polyaryl ether ketone copolymer composites enabled by interfacial engineered charge traps

Xinyi Li, Yunchuan Xie, Jie Xiong, Bofeng Zhu, Xiao Zhang,\* Xinhua Duan, Bo Dong\* and Zhicheng Zhang\*

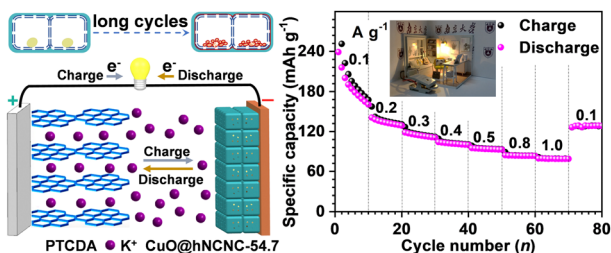
5892



### Origin of the switchable photocurrent direction in BiFeO<sub>3</sub> thin films

Yaqiong Wang, Matyas Daboczi, Man Zhang, Joe Briscoe, Ji-Seon Kim, Haixue Yan\* and Steve Dunn\*

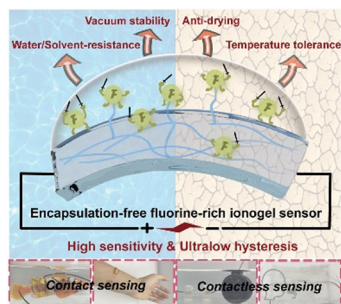
5898



### Loss-free pulverization by confining copper oxide inside hierarchical nitrogen-doped carbon nanocages toward superb potassium-ion batteries

Guanghai Chen, Jia Liu, Shenglan Ma, Changkai Zhou, Jietao Jiang, Zhen Shen, Lijie Yan, Yue Guo, Lijun Yang, Qiang Wu,\* Xizhang Wang\* and Zheng Hu\*

5907



### High-sensitivity and ultralow-hysteresis fluorine-rich ionogel strain sensors for multi-environment contact and contactless sensing

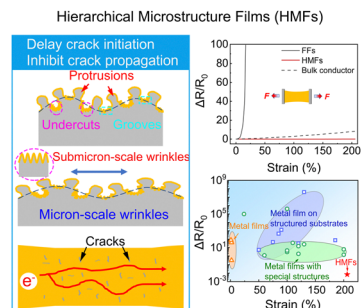
Faqi Hu, Zhenkai Huang, Chuan Luo and Kan Yue\*



5920

## Highly stable and strain-insensitive metal film conductors *via* manipulating strain distribution

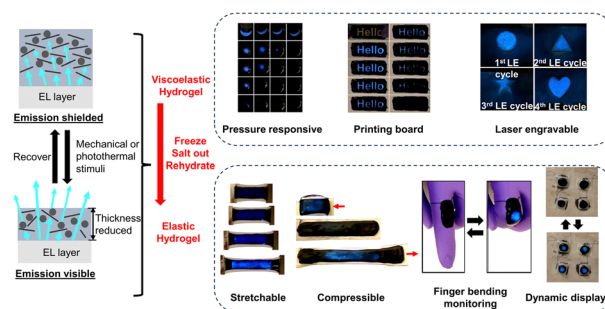
Ting Zhu, Kai Wu,\* Yaqiang Wang, Jinyu Zhang, Gang Liu\* and Jun Sun\*



5931

## Interactive deformable electroluminescent devices enabled by an adaptable hydrogel system with optical/photothermal/mechanical tunability

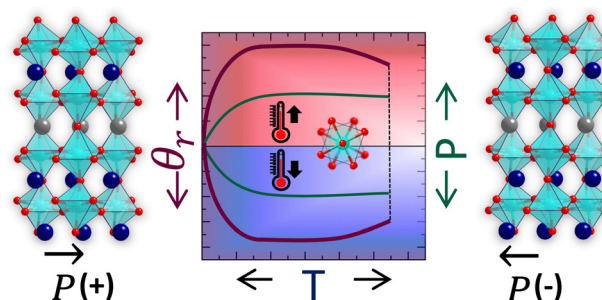
Zaili Hou, Songshan Zeng,\* Kuangyu Shen, Patrick R. Healey, Holly J. Schipper, Luqi Zhang, Miranda Zhang, Michael D. Jones and Luyi Sun\*



5942

## Design of high polarization low switching barrier hybrid improper ferroelectric perovskite oxide superlattices

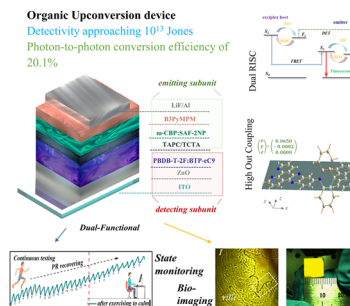
M. J. Swamynadhan, Ayana Ghosh and Saurabh Ghosh\*



5950

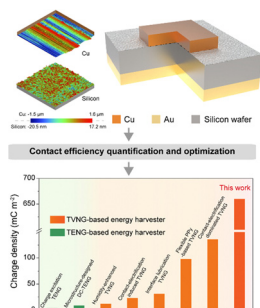
## A high-performance dual-functional organic upconversion device with detectivity approaching $10^{13}$ Jones and photon-to-photon efficiency over 20%

Zeyu He, Heng-yuan Zhang, Xiaoyang Du,\* Xin Yu, Jiayue Han, Luye Cao, Hui Lin, Jun Wang, Caijun Zheng and Silu Tao\*



## COMMUNICATIONS

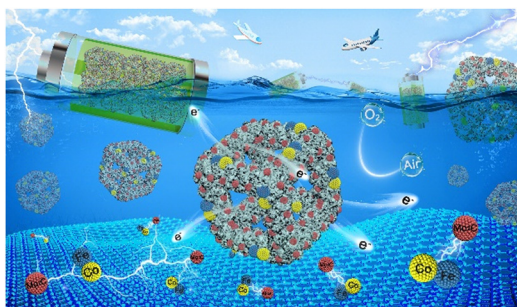
5962



### Contact efficiency optimization for tribovoltaic nanogenerators

Zhihao Zhao, Jiayue Zhang, Wenyan Qiao, Linglin Zhou, Ziting Guo, Xinyuan Li, Zhong Lin Wang\* and Jie Wang\*

5969



### A macroporous carbon nanoframe for hosting Mott–Schottky Fe–Co/Mo<sub>2</sub>C sites as an outstanding bi-functional oxygen electrocatalyst

Jie Hong, Lei Zhang,\* Qiliang Zhu, Ziang Du, Yingtang Zhou,\* Thomas Wågberg and Guangzhi Hu\*

## CORRECTIONS

5983

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

Ji-Hwan Ha, Yongrok Jeong, Junseong Ahn, Soonhyoung 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\*

5984

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

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

