Open Access Article. Published on 10 April 2025. Downloaded on 12/5/2025 4:48:45 PM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

Nanoscale

rsc.li/nanoscale

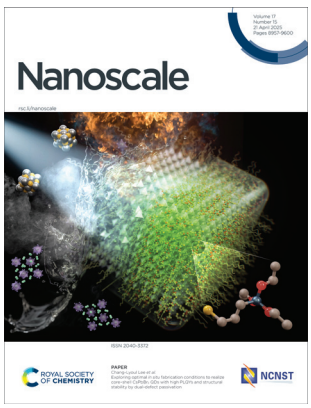
The Royal Society of Chemistry is the world's leading chemistry community. Through our high impact journals and publications we connect the world with the chemical sciences and invest the profits back into the chemistry community.

IN THIS ISSUE

ISSN 2040-3372 CODEN NANOHL 17(15) 8957–9600 (2025)

Cover
See Robert S. Weatherup, Jiabin Cui, Jin He *et al.*, pp. 9144–9153.

Image reproduced by permission of Jiabin Cui from *Nanoscale*, 2025, **17**, 9144.



Inside cover
See Chang-Lyoul Lee *et al.*, pp. 9154–9165.

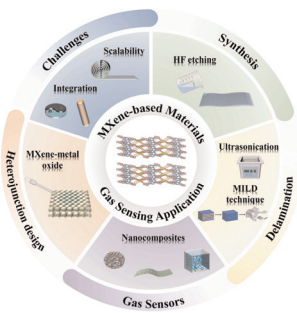
Image reproduced by permission of Chang-Lyoul Lee from *Nanoscale*, 2025, **17**, 9154.

REVIEWS

8975

Recent advances in 2D MXene-based heterostructures for gas sensing: mechanisms and applications in environmental and biomedical fields

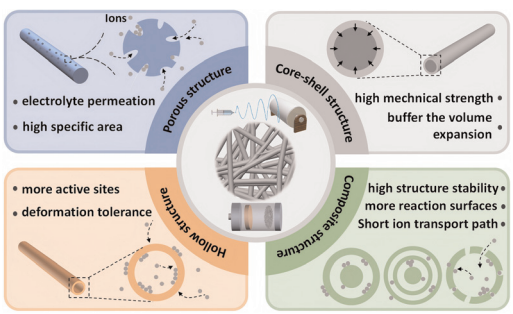
Lanting Qian,* Farnood Rahmati,* Fengchao Li, Tianzhu Zhang, Tao Wang, Haoze Zhang, Shuo Yan and Yun Zheng*



8999

Electrospun freestanding anodes for metal-ion batteries: structural design and application

Xinyu Li, Xunlong Zhang, Fangqin Su, Haoyue Zhao, Zhan Qu, Can Ge and Jian Fang*



View Article Online

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

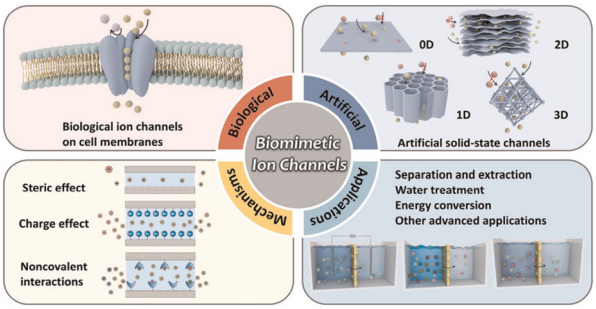
Open Access Article. Published on 10 April 2025. Downloaded on 12/5/2025 4:48:45 PM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

MINIREVIEWS

9021

Biomimetic ion channels with subnanometer sizes for ion sieving: a mini-review

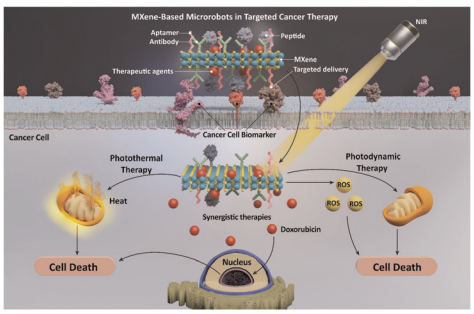
Qianqian Fu, Zhaoyu Ma* and Jun Gao*



9040

Smart MXene-based microrobots for targeted drug delivery and synergistic therapies

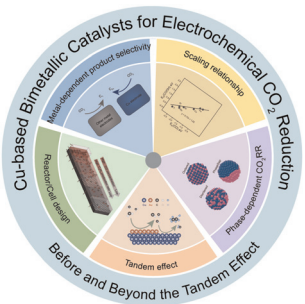
Siavash Iravani,* Atefeh Zarepour, Arezoo Khosravi, Rajender S. Varma* and Ali Zarrabi*



9057

Cu-based bimetallic catalysts for electrochemical CO_2 reduction: before and beyond the tandem effect

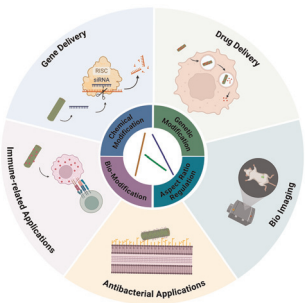
Dimiao Luo, Weidong Dai, Keying Wu, Siyuan Liu, Chiyao Tang, Yanjuan Sun, Fan Dong and Chang Long*



9072

Functionalization of rod-shaped plant viruses for biomedical applications

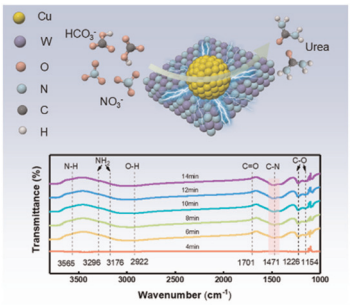
Wei Qian, Zhuang Li, Jingyao Han, Ye Tian* and Zhongwei Niu*



Open Access Article. Published on 10 April 2025. Downloaded on 12/5/2025 4:48:45 PM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

COMMUNICATIONS

9086



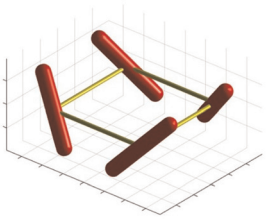
Co-reduction coupling of bicarbonate and nitrate toward efficient urea synthesis

Xue Wang, Lu-Kang Zhao, Siyao Li, Ran Wei, Xuan-Wen Gao,* Zhaomeng Liu and Wen-Bin Luo*

9094

$$\boldsymbol{\varepsilon} = \mathbf{I} + A_{mn}\mathbf{u}_m\mathbf{u}_n^T$$

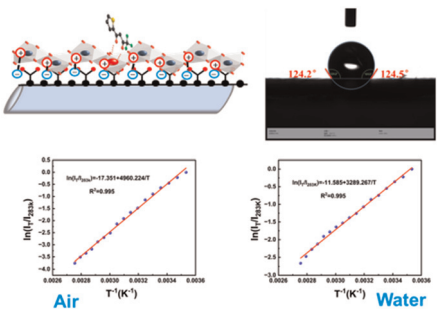
$$\mathbf{g} = c^{-1}\omega A_{mn}\left(\mathbf{u}_n \times \mathbf{u}_m\right)\mathbf{r}_n^T$$



Born–Kuhn coupled oscillator model for optical activity in ordered media

Razvigor Ossikovski* and Oriol Arteaga*

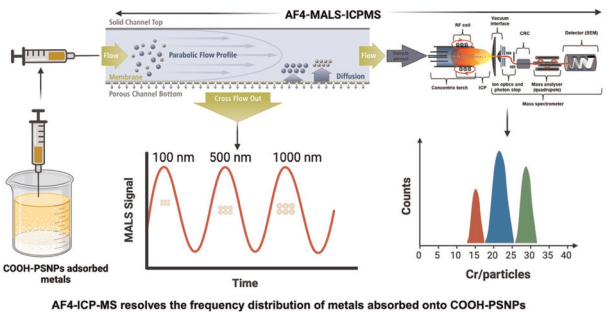
9107



Optical temperature-sensitive hydrophobic membrane based on Eu(III)-doped yttrium oxide nanosheets

Yue Liu, Jinfeng Xia, Danyu Jiang, Yuchen Dong, Ying Chen, Enhui Ma, Qinian Wen and Qiang Li*

9122



An integrated multimethod approach for size-specific assessment of potentially toxic element adsorption onto micro- and nanoplastics: implications for environmental risk

Swaroop Chakraborty,* Roland Drexel, Prathmesh Bhadane, Nathan Langford, Pankti Dhumal, Florian Meier and Iseult Lynch

This journal is © The Royal Society of Chemistry 2025

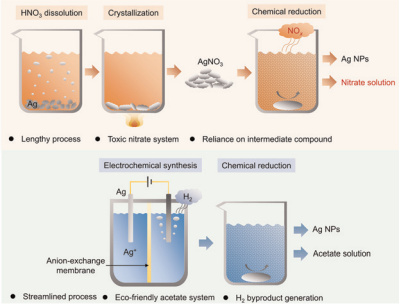
Open Access Article. Published on 10 April 2025. Downloaded on 12/5/2025 4:48:45 PM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

COMMUNICATIONS

9137

Entirely nitrate-free synthesis of silver nanoparticles *via* electrochemical synthesis–chemical reduction

Chenyi Zheng, Xueyi Guo, Songsong Wang, Qinmeng Wang* and Qiang Wang*

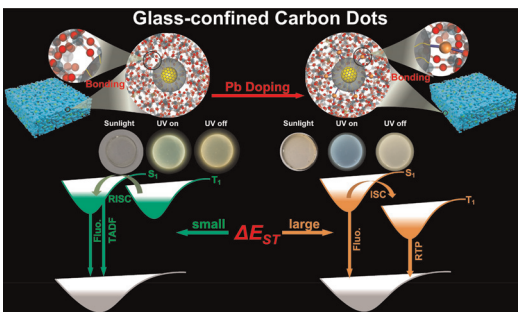


PAPERS

9144

Glass-confined carbon dots: transparent afterglow materials with switchable TADF and RTP

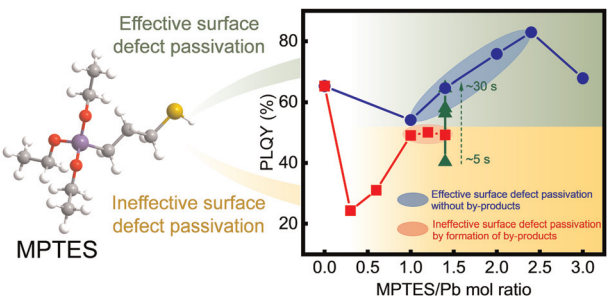
Pengwei Wang, Peixi Cong, Jiachen Chen, Huaiyuan Cao, Qi Yue, Zixiao Xue, Junji Zhang, Long Zhang, Robert S. Weatherup,* Jiabin Cui* and Jin He*



9154

Exploring optimal *in situ* fabrication conditions to realize core–shell $CsPbBr_3$ QDs with high PLQYs and structural stability by dual-defect passivation

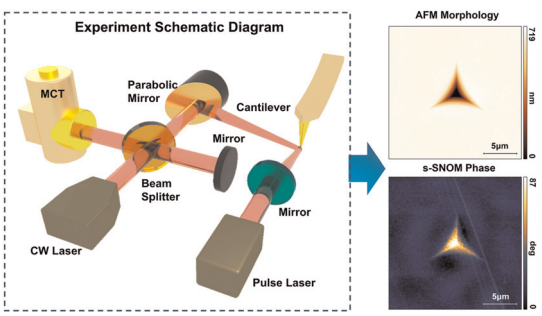
Dokyum Kim, Soogeun Kim, Sang-Youp Yim and Chang-Lyoul Lee*



9166

Quantitative nanometer-scale characterization of densification in fused silica *via* s-SNOM

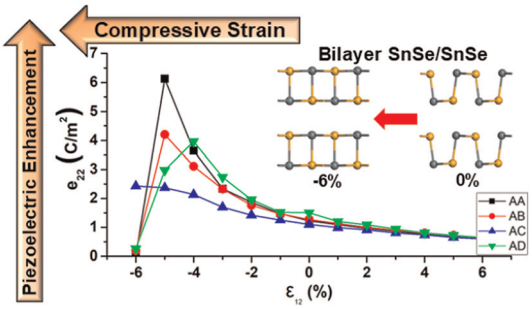
Ying Yan,* Bo Jiang, Qing Mu and Ping Zhou



Open Access Article. Published on 10 April 2025. Downloaded on 12/5/2025 4:48:45 PM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

PAPERS

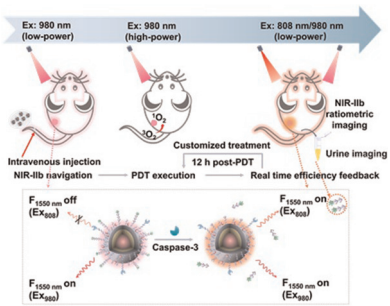
9174



Stacking dependent piezoelectric response of bilayer and heterobilayer group-IV monochalcogenides under applied external strain

Kevin Tran and Michelle J. S. Spencer*

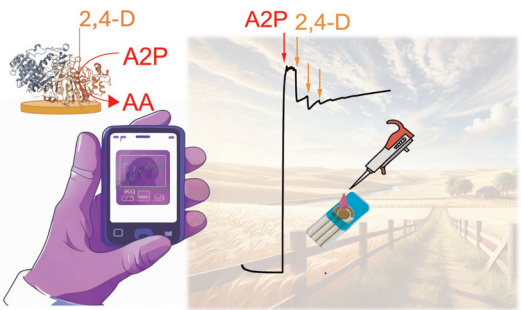
9184



Programming a multiplex lanthanide nanoparticle for customized cancer treatment with real-time efficiency feedback

Hongxia Zhao, Wei Chen, Yu Zhu, Zhicong Chao, Jiahui Sun, Qing Zhang, Hongqian Guo, Huangxian Ju and Ying Liu*

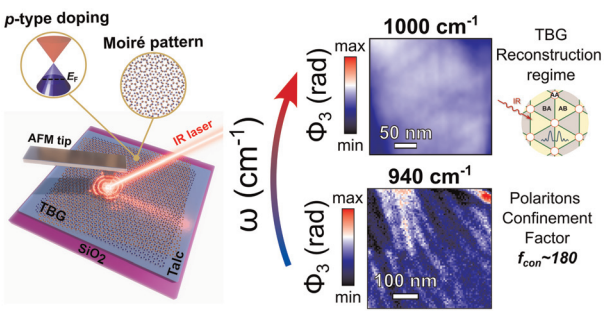
9197



Ultrasensitive detection of 2,4-dichlorophenoxyacetic acid by inhibiting alkaline phosphatase immobilized onto a highly porous gold nanocoral electrode

Angelo Tricase, Michele Catacchio, Verdiana Marchianò, Eleonora Macchia, Paolo Bollella* and Luisa Torsi

9205



Ultra-confined plasmons reveal moiré patterns in a twisted bilayer graphene–talc heterostructure

Tiago C. Barbosa, André J. Chaves, Raul O. Freitas, Leonardo C. Campos* and Ingrid D. Barcelos*

This journal is © The Royal Society of Chemistry 2025

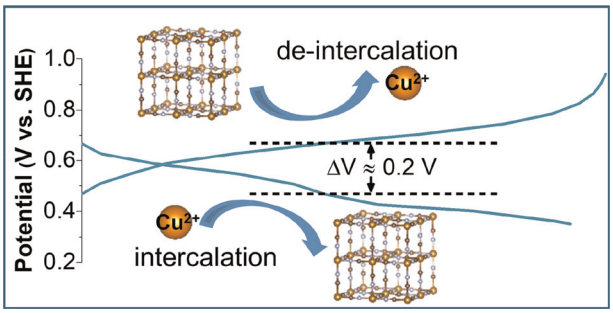
Open Access Article. Published on 10 April 2025. Downloaded on 12/5/2025 4:48:45 PM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

PAPERS

9213

High-performance aqueous copper-ion batteries based on iron hexacyanoferrate cathodes for enhanced energy storage

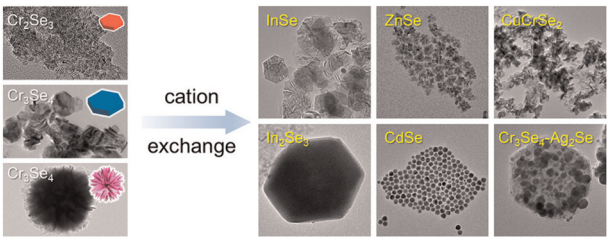
Jinshu Zhang, Lexian Liu, Yuao Wang, Yantuo Li, Yang Yang, Mingyi Ning, Jianxue Wu, Bingjie Ma and Wei Liu*



9222

Structural diversity dependent cation incorporation into magnetic Cr–Se nanocrystals

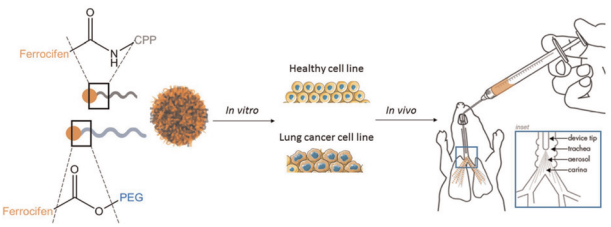
Yifen Wang, Wei Zhao, Bin Wang, Zhendong Song, Huan Yang, Fang Wang, Xiaohong Xu and Yang Liu*



9232

Self-assemblies of cell-penetrating peptides and ferrocifens: design and biological evaluation of an innovative platform for lung cancer treatment

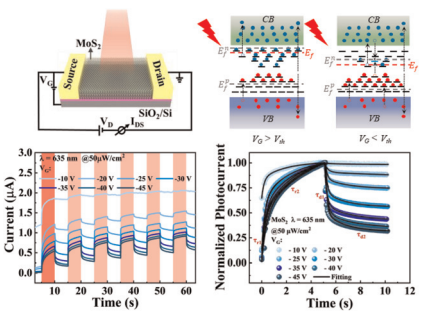
Léna Guyon, Abdallah Ladaycia, Agnese Bosio, Laurent Lemaire, Florence Franconi, Bénédicte Lelièvre, Nolwenn Lautram, Pascal Pigeon, Gérard Jaouen, Catherine Passirani and Elise Lepeltier*



9245

The role of trap states in MoS_2-based photodetectors

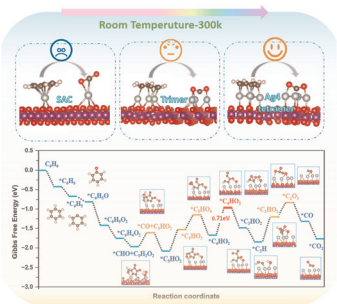
Yuhang Xu, Yuxin Wang, Chunchi Zhang, Haijuan Wu, Chao Tan, Guohua Hu and Zegao Wang*



Open Access Article. Published on 10 April 2025. Downloaded on 12/5/2025 4:48:45 PM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

PAPERS

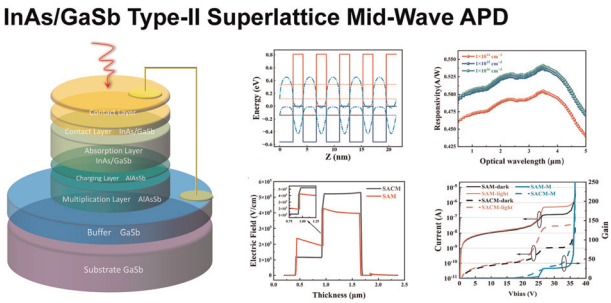
9253



First-principles methods for unraveling the structure–catalytic activity relationship and mechanism of δ-MnO_2-supported metal cluster catalysts in ambient temperature benzene to CO_2 degradation

Jiangmei Yan, Peng Zhang, Dan Chen, Jie Cheng, Tong Mu, Mengshan Song, Shuai Li, Hui Zhao, Guo Chang, Ruqian Lian,* Chuangwei Liu,* Wangtu Huo* and Dongxiao Kan*

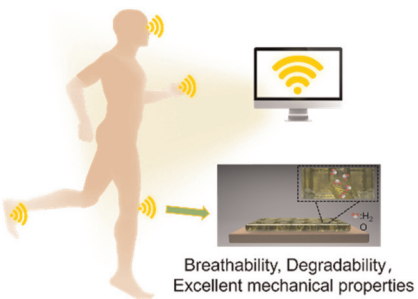
9262



Design and simulation of mid-wavelength InAs/GaSb type-II superlattice avalanche photodiodes

Xinbo Qi, Xiantong Zheng,* Yuan Liu,* Yulin Feng and Dongliang Zhang*

9270



A DMSO-modified porous organogel with breathability and degradability for wearable electronics

Zijun Ye, Hao Lei, Peixuan Zhang, Yingying Liu, Yina Liu, Jun Cao, Zhen Wen, Jiwei Jiang,* Bin Dong* and Xuhui Sun*

9279

Intense, self-induced sustainable microwave plasma using carbon nanotubes made from CO_2

Gad Licht, Kyle Hofstetter and Stuart Licht*

This journal is © The Royal Society of Chemistry 2025

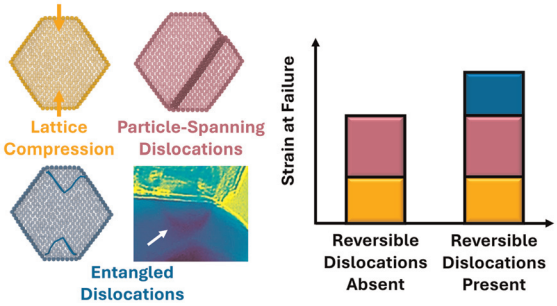
Open Access Article. Published on 10 April 2025. Downloaded on 12/5/2025 4:48:45 PM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

PAPERS

9297

Effect of reversible dislocation-based deformation on nanoparticle strain at failure

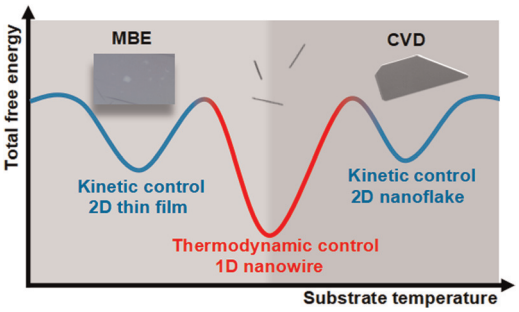
Claire Zhang, Amit Kumar Prasad, Ting Liu, Tevis D. B. Jacobs and Ashlie Martini*



9308

Thermodynamics and kinetics in van der Waals epitaxial growth of Te

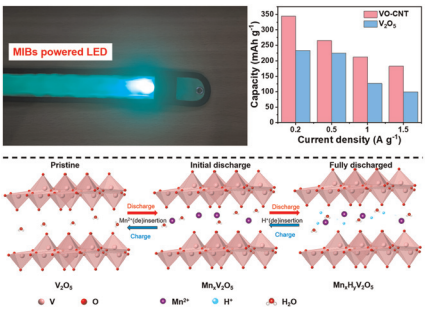
Taotao Li, Wenjin Gao, Yongsong Wang, Tianzhao Li, Guoxiang Zhi, Miao Zhou* and Tianchao Niu*



9315

Binder-free V_2O_5-carbon nanotube composite films for high-performance aqueous manganese-ion batteries

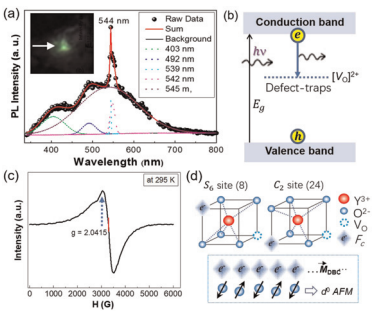
Jianan Zhao, Xinyu Wang,* Xinqi Xie and Hongmei Cao*



9323

Unexpected green-light emission and correlating room-temperature diluted magnetism in pristine non-magnetic closed-shell $4d^0$ yttria nanowires

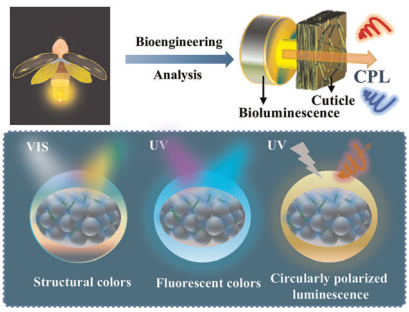
Jian-Min Li* and Yunbing Hu



Open Access Article. Published on 10 April 2025. Downloaded on 12/5/2025 4:48:45 PM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

PAPERS

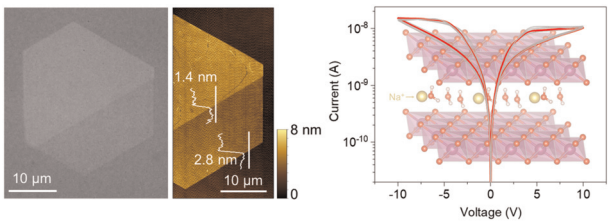
9330



Optically active chiral photonic crystals exhibiting enhanced fluorescence and circularly polarized luminescence

Qilin Guo, Xingye Huang, Huateng Li, Jia Guo and Changchun Wang*

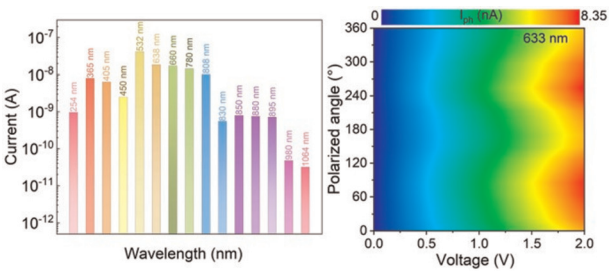
9337



Synthesis of intrinsically sodium intercalated ultra-thin layered MnO_2 and its ionic charge transport

Amir Parsi, Abdulsalam Aji Suleiman, Mohammadali Razeghi, Doruk Pehlivanoğlu, Oğuzhan Oğuz, Uğur Başçı, Hafiz Muhammad Shakir, Emine Yegin and T. Serkan Kasırga*

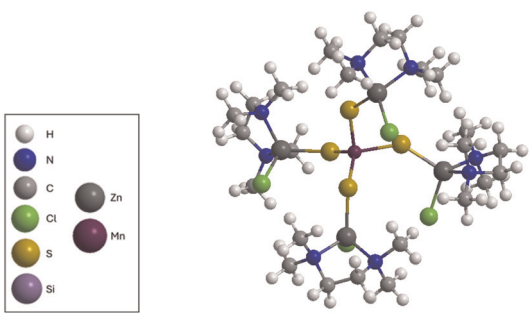
9346



A high-performance broadband polarization-sensitive photodetector based on BiSeS nanowires

Junda Yang, Fen Zhang, Shuo Liu, Xinyun Zhou, Jiacheng Yang, Qinglin Xia and Mianzeng Zhong*

9355



Enhanced spin lifetime in colloidal quantum dots by growth from singly Mn-doped molecular cluster seeds

Julian Schneider, Chris Page, James Harris, Nigel L. Pickett, Nathalie C. Gresty, Christopher Waby, Charles Biddlecombe, Rachel M. Barrett, Adam Brookfield, Patrick Parkinson, Floriana Tuna, Simon M. Fairclough and David J. Binks*

This journal is © The Royal Society of Chemistry 2025

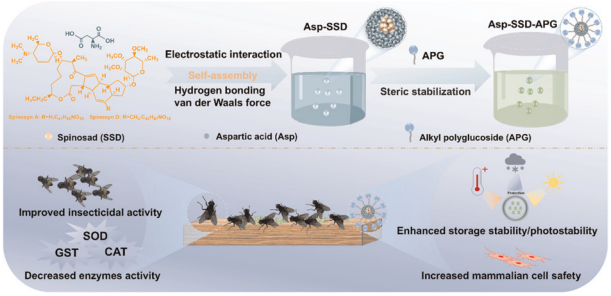
Open Access Article. Published on 10 April 2025. Downloaded on 12/5/2025 4:48:45 PM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

PAPERS

9363

An organic solvent-free self-assembly strategy for scalable preparation of nanobiopesticides with enhanced insecticidal activity against houseflies

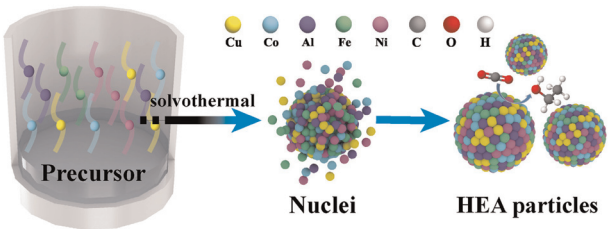
Huiping Chen, Zhifei Yang, Qing Yin, Wenjie Shangguan, Chong Cao, Qiliang Huang and Lidong Cao*



9374

Non-precious metal high-entropy alloys for CO_2 electroreduction

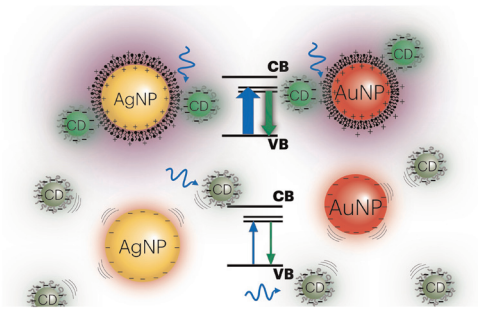
Runyu Xing, Xinyu Wang, Guanbo Wang,* Zeyi Lu, Xiang Yang, Hongqiang Wang, Yun He, Xingyuan San,* Xiaoguang Liang* and Vellaisamy A. L. Roy



9380

Engineering the surface of carbon dots for enhanced photoluminescence and controlled plasmonic interactions

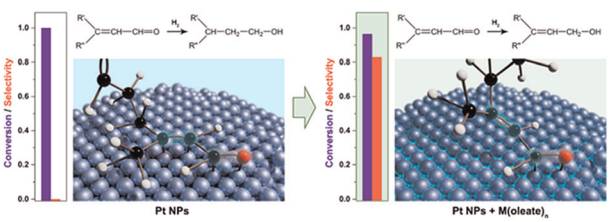
M. Reale, Z. Moussadjy, G. Buscarino, U. De Giovannini, A. Emanuele, M. Cannas, R. Cillari, N. Mauro, A. Sciortino* and F. Messina*



9391

Surface engineering of Pt nanocatalysts with transition metal oleates for selective catalysis: a case study on the hydrogenation of α,β-unsaturated aldehydes

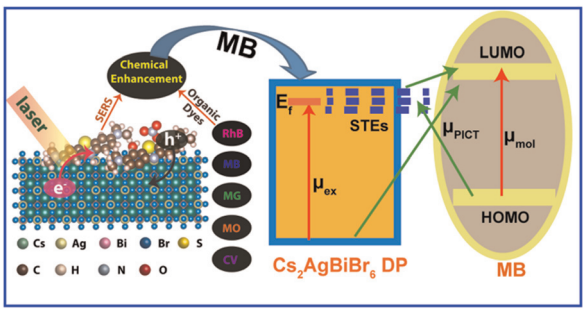
Soon Gu Kwon, Soma Chattopadhyay, Tomohiro Shibata, Galyna Krylova, Sanjubala Sahoo, Alexander Filatov, Shiba Adhikari, Zachary David Hood, Khalil Omotosho, Diana Berman, Emilio Bunel, Julius Jellinek and Elena V. Shevchenko*



Open Access Article. Published on 10 April 2025. Downloaded on 12/5/2025 4:48:45 PM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

PAPERS

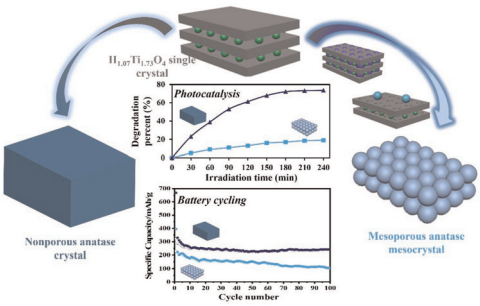
9401



Lead-free halide double perovskite nanoflakes as high-performance SERS substrates for detection of trace organic pollutants: chemical enhancement *versus* electromagnetic enhancement

Ravinder Chahal, Sirsendu Ghosal, Joydip Ghosh and P. K. Giri*

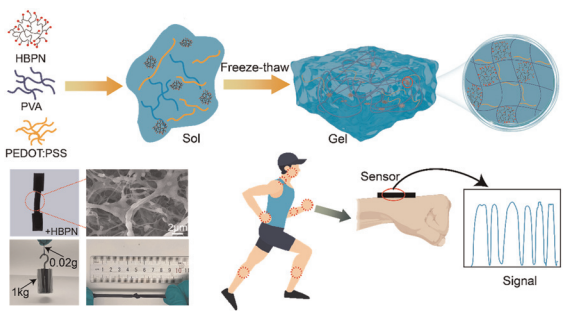
9418



Mesoporous anatase TiO_2 mesocrystal for high-performance photocatalysis and lithium-ion batteries

Wenxiong Zhang,* Fangyi Yao, Mustafa Al Samarai and Qi Feng*

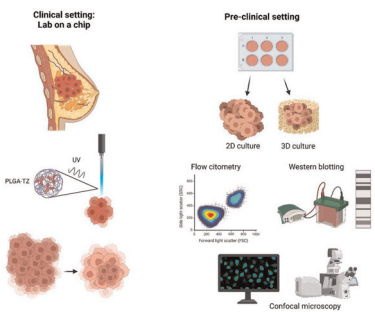
9427



Amino-ended hyperbranched polyamide-cross-linked conducting polymer hydrogels with enhanced performance for wearable electronics

Juan Teng, Xiaokai Jia, Ziyang Qiu, Hanjun Yang* and Hai Li*

9436



Engineered anti-HER2 drug delivery nanosystems for the treatment of breast cancer

Silvia Vanni, Tania Mariastella Caputo, Angela Maria Cusano, Alessandro De Vita,* Andrea Cusano,* Claudia Cocchi, Chiara Mulè, Sofia Principe, Chiara Liverani, Giorgia Celetti, Alberto Micco, Chiara Spadazzi, Giacomo Miserocchi, Toni Ibrahim, Laura Mercatali and Anna Aliberti

This journal is © The Royal Society of Chemistry 2025

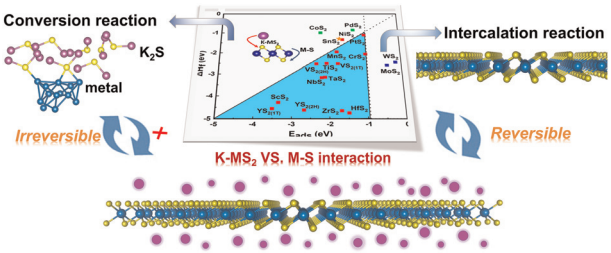
Open Access Article. Published on 10 April 2025. Downloaded on 12/5/2025 4:48:45 PM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

PAPERS

9458

Highly stable rare earth YS_2 and ScS_2 monolayers for potassium-ion batteries: first-principles calculations

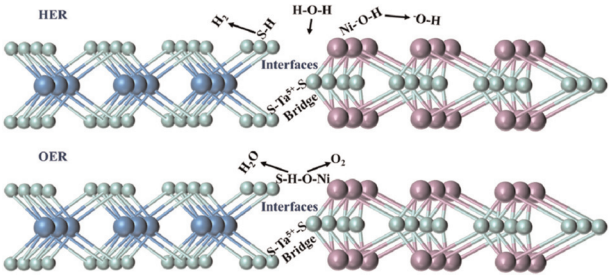
Han-Yu Zhang, Jia-Qi Zhang, Bo Zhao, Yan-Lei Guo, Hao-Peng Liang and Zhong-Ling Lang*



9469

Catalytic synergism in heterostructural Ta-doped Mo–Ni–S nanospheres: an efficient bifunctional catalyst for water splitting

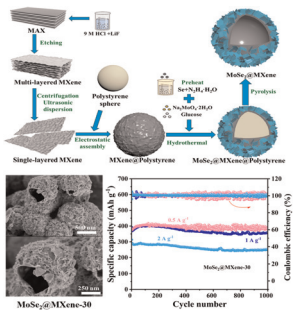
Kaichun Gao, Yuhang Yuan, Hongbang Zheng, Yiyou Wu, Mingxin Ye and Jianfeng Shen*



9480

Synthesis of a hollow $MoSe_2$@MXene anode material for sodium-ion batteries

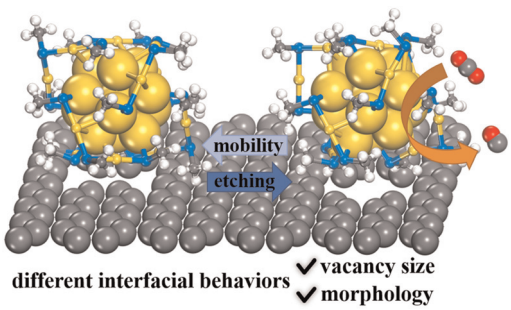
Hanbo Zou,* Shaohao Li, Wei Yang, Quanbing Liu and Shengzhou Chen*



9490

Vacancy-induced modulation of the interfacial properties of $Au_{25}(SCH_3)_{18}$ nanoclusters supported on defective graphene

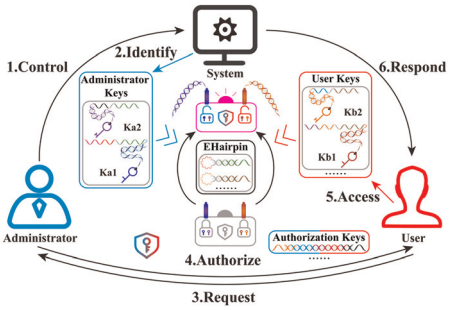
Pan Zhu, Yuping Chen and Qing Tang*



Open Access Article. Published on 10 April 2025. Downloaded on 12/5/2025 4:48:45 PM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

PAPERS

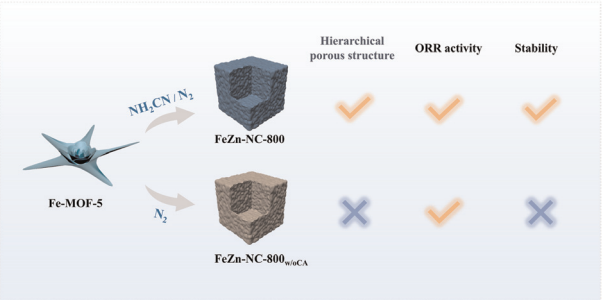
9502



An EHairpin-driven double-stem-loop programmable allosteric strategy for molecular security access control

Yufeng Wang, Xiaokang Zhang, Peijun Shi, Wei Zhao, Bin Wang and Qiang Zhang*

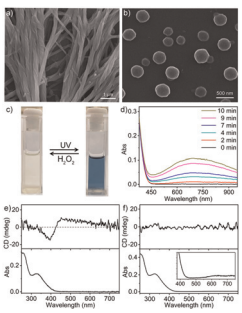
9515



Atomically dispersed iron–zinc dual-metal sites to boost catalytic oxygen reduction activities for efficient zinc–air batteries

Zi-Han Zhao, Dakai Ma, Zewen Zhuang, Kaili Wang, Chenhui Xu, Kaian Sun, Shu-Qi Deng,* Wei Yan* and Jiujun Zhang*

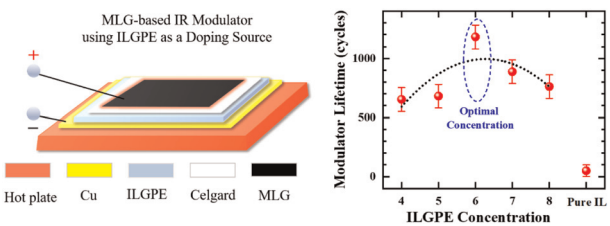
9525



Chiral co-assembly of a polyoxometalate complex with an achiral pyrene derivative enables redox-modulated circularly polarized luminescence

Chengyan Niu, Jiaqi Liu, Qiulan Wu, Shuzhen Liu, Jingjing Tan and Jing Zhang*

9534



Tuning infrared emissivity of multilayer graphene using ionic liquid gel electrolytes

Ying Cao, Kaiyu Yang, Haibo Ke, Lishi Fu, Xitong Yan, Jinghuan Xian, Mingyuan Lin, Weiwei Cai, Xue-ao Zhang, Rui Mu* and Yufeng Zhang*

This journal is © The Royal Society of Chemistry 2025

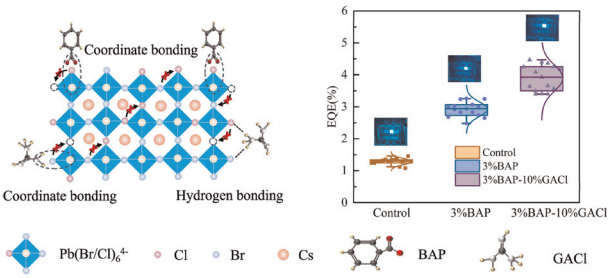
Open Access Article. Published on 10 April 2025. Downloaded on 12/5/2025 4:48:45 PM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

PAPERS

9541

Efficient and stable blue perovskite light-emitting diodes enabled by the synergistic incorporation of dual additives

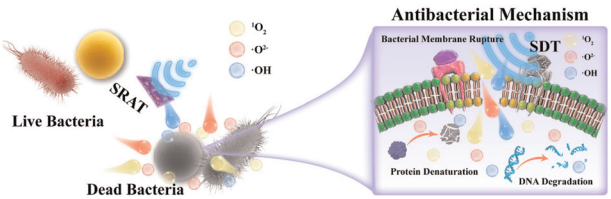
Dandan Li, Yan Bao, Run Wang, Jinjiang Wang, Yu Liu, Lei Cao, Yanhong Deng* and Hengyang Xiang*



9552

A nanocatalytic membrane with sono-responsive antibacterial therapy (SRAT) for rapid sterilization and enhanced chronic wound healing

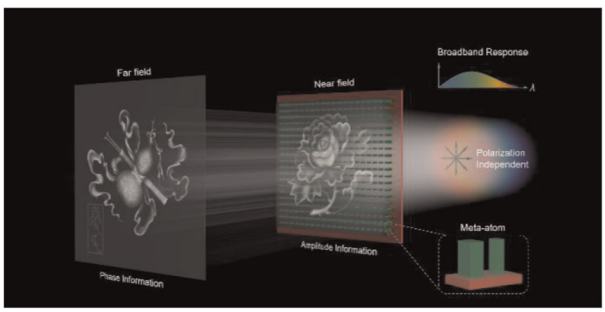
Shuai He, Lu Xie, Daiquan Zhang, Shihao Han, Hongxing Shi, Sheng Yu, Yi Deng,* Song Wang* and Chao Wu*



9562

Broadband and polarization-independent complex amplitude modulation using a single layer dielectric metasurface

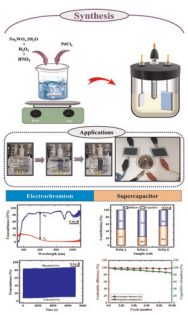
Na Zhang, Fei Wang, Qixuan Min, Xin Liu, Haiming Yuan, Jinying Guo* and Guohai Situ*



9569

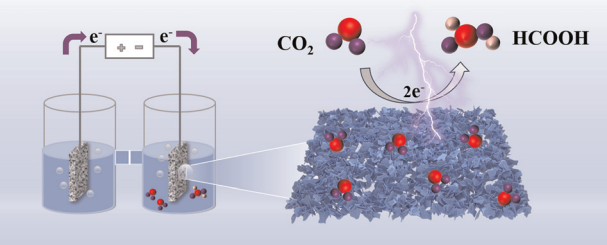
Catalytic synergy in palladium-enriched tungsten oxide nanogranules: redefining electrochromic dynamics and energy storage capabilities

Pritam J. Morankar, Rutuja U. Amate, Aviraj M. Teli, Iftikhar Hussain, Sonali A. Beknalkar and Chan-Wook Jeon*



PAPERS

9588



Bismuth oxycarbonates loaded on nitrogen-doped carbon: an efficient nanocomposite catalyst for electrochemical reduction of CO_2 to formate

Qingqing Xu, Kaixuan Su, Jiayong Chen, Yuanhong Zhong,* Yingxia Zhao, Ming Sun and Lin Yu

Open Access Article. Published on 10 April 2025. Downloaded on 12/5/2025 4:48:45 PM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

This journal is © The Royal Society of Chemistry 2025