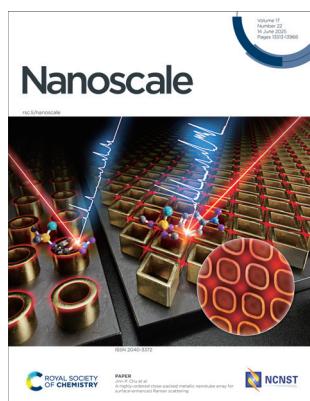


## IN THIS ISSUE

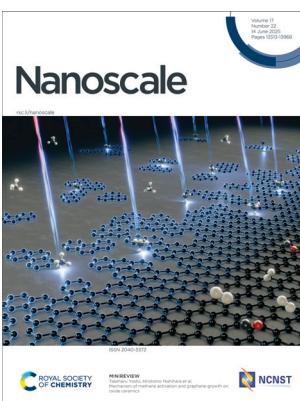
ISSN 2040-3372 CODEN NANOHL 17(22) 13513–13968 (2025)



### Cover

See Jinn P. Chu *et al.*,  
pp. 13685–13697.

Image reproduced  
by permission of  
Jinn P. Chu  
from *Nanoscale*,  
2025, **17**, 13685.



### Inside cover

See Takeharu Yoshii,  
Hirotomo Nishihara *et al.*,  
pp. 13646–13652.

Image reproduced  
by permission of  
Takeharu Yoshii  
from *Nanoscale*,  
2025, **17**, 13646.

## EDITORIAL

13526

### Chiral nanomaterials: theory, synthesis, applications and challenges

Nicholas A. Kotov,\* Jeanne Crassous,\*  
David B. Amabilino\* and Pengfei Duan\*

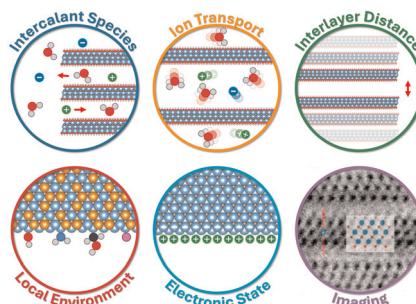


## REVIEWS

13531

### Material characterization methods for investigating charge storage processes in 2D and layered materials-based batteries and supercapacitors

Albert de Kogel, Ruocun (John) Wang,\* Wan-Yu Tsai,\*  
Maciej Tobis, Robert Leiter, Ruipeng Luo,  
Evan Wenbo Zhao,\* Simon Fleischmann\* and  
Xuehang Wang\*



# Environmental Science: Atmospheres



GOLD  
OPEN  
ACCESS

## Connecting communities and inspiring new ideas

[rsc.li/submittoEA](http://rsc.li/submittoEA)

Fundamental questions  
Elemental answers



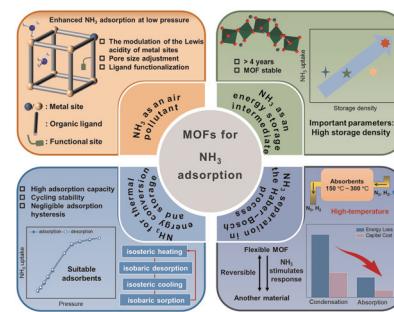
Registered charity number: 207890

## REVIEWS

13561

**Metal–organic frameworks for NH<sub>3</sub> adsorption and separation**

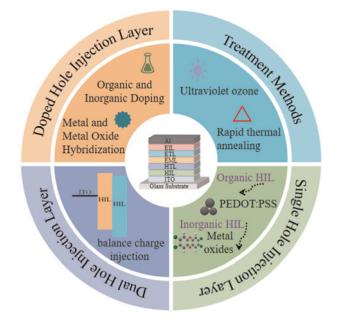
Rui Luo, Dawei Xu, Ruirui Liu, Junwen Zhou\* and Xiaojie Ma\*



13581

**Optimization of the hole-injection layer for quantum dot light-emitting diodes**

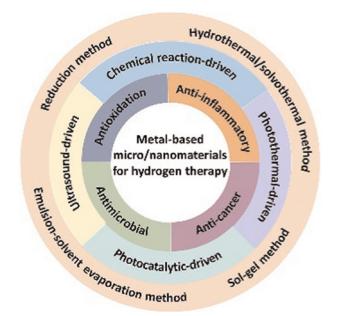
Zirui Wang, Meng Liang, Yongqiang Wang, Haoran Wang, Lei Wang, Ling Zhao, Shuhong Li\* and Yunlong Liu\*



13594

**Metal-based micro/nanomaterials for hydrogen therapy and their biomedical applications**

Yu Wang, Haoyu Wang, Handan Zhang, Tao Liu and Xin Chen\*



13622

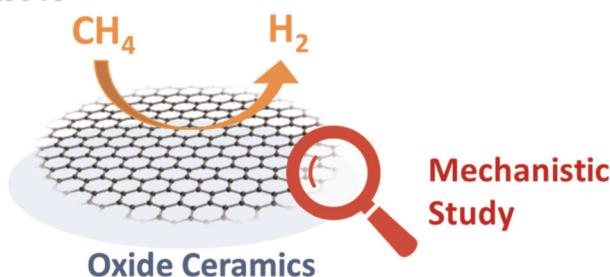
**Challenges and future prospects of the 2D material-based composites for microwave absorption**

Jia Ren, Ping Shi, Xinyan Zu, Lei Ding, Feng Liu,\* Yuzheng Wang, Yuhua Wu, Guimei Shi, Yusheng Wu and Laishi Li\*



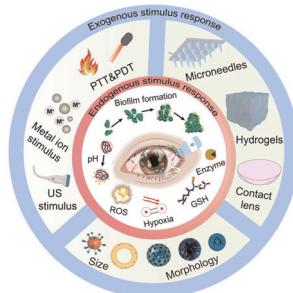
## MINIREVIEWS

13646

**Mechanism of methane activation and graphene growth on oxide ceramics**

Hanzhang Zhou, Mengxuan Zhang, Takeharu Yoshii,\* Devis Di Tommaso and Hirotomo Nishihara\*

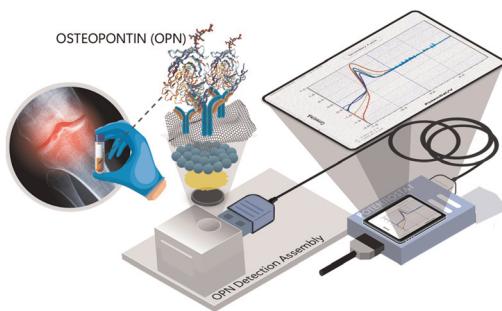
13653

**Stimulus-responsive nanomaterials for ocular antimicrobial therapy**

Tao Zhang and Zichao Luo\*

## COMMUNICATION

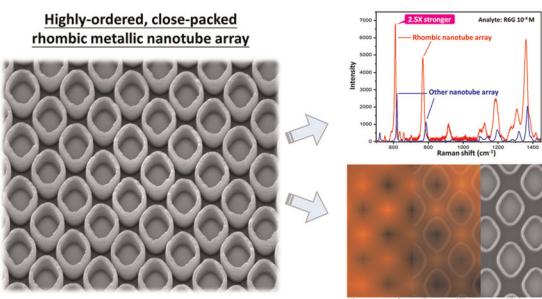
13668

**An electrochemically charged nanoengineered bioelectronic immunosensing device for osteopontin detection in serum samples**

Daphika S. Dkhar, Supratim Mahapatra and Pranjal Chandra\*

## PAPERS

13685

**A highly-ordered close-packed metallic nanotube array for surface-enhanced Raman scattering**

Ting-Hao Chang, Alfreda Krisna Altama, Jun-Ting Wang, Pakman Yiu and Jinn P. Chu\*

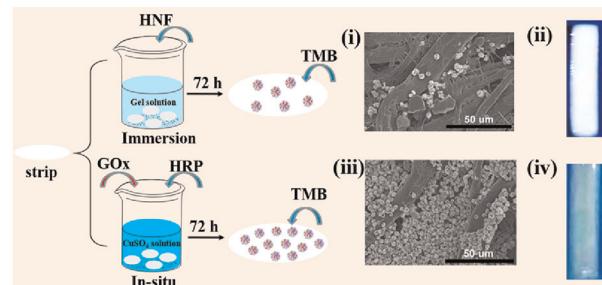


## PAPERS

13698

***In situ* growth of enzyme-inorganic hybrid nanoflowers on paper strips for the visual detection of saliva-level glucose**

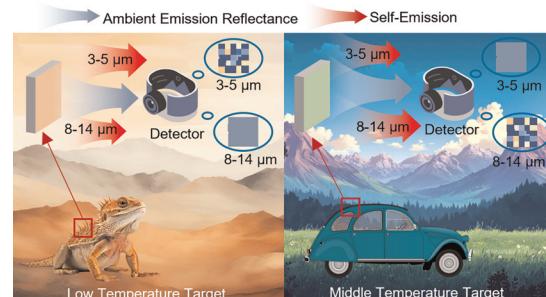
Zifeng Zhang,\* Shiwen Wang, Tingjun Chen, Hui Wang\* and Qian Dou\*



13708

**Tri-spectral decoupled programmable thermal emitter for multimode camouflage with heterogeneous phase-change integration**

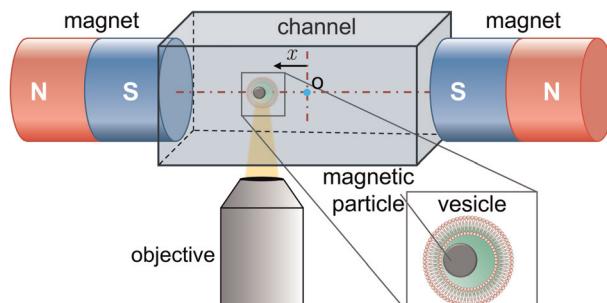
Sihong Zhou, Shikui Dong, Jiameng Song, Yanming Guo, Yong Shuai\* and Guangwei Hu\*



13720

**Magnetically driven lipid vesicles for directed motion and light-triggered cargo release**

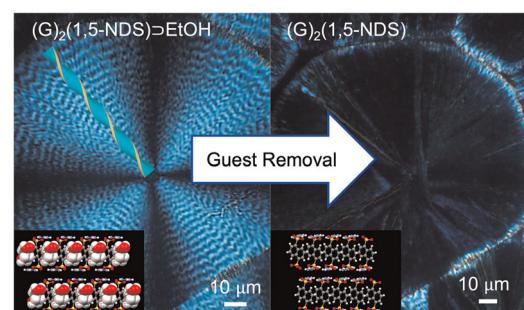
Vinit Kumar Malik, Chih-Tang Liao, Chenghao Xu, Abdallah Daddi-Moussa-Ider, On Shun Pak, Yuan-Nan Young and Jie Feng\*



13727

**Guest removal from ring-banded guanidinium organosulfonate hydrogen-bonded frameworks**

Rochelle B. Spencer, Anna Yusov, Alexandra M. Dillon, Akash Tiwari, Oriol Arteaga, Sophia Sburlati, St. John Whittaker, Wantong Wu, Sixian Chen, Alexander G. Shtukenberg, Michael D. Ward,\* Bart Kahr\* and Stephanie S. Lee\*



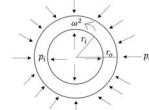
## PAPERS

13737

COMPARATIVE ANALYSIS OF STEADY STATE CREEP IN SUS-ZrO<sub>2</sub> AND Al-ZrO<sub>2</sub> FUNCTIONALLY GRADED PRESSURIZED CYLINDERS WITH ITS IMPLICATIONS

Sahni et al., 2025 | Nanoscale

BACKGROUND  
Secondary Creep Analysis in Rotating Anisotropic Functionally Graded Cylinder (axisymmetric) Under Internal/External Pressure.



**RESULT 1**  
Al-ZrO<sub>2</sub> FG cylinder undergoes a lower tangential creep strain rate under an external pressure compared to the SUS-2rO<sub>2</sub> FG cylinder.

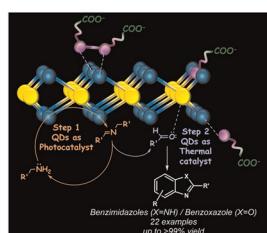
MATERIAL AND METHOD  
Functionally Graded Material.  
Exponentially Graded Reinforcement of ZrO<sub>2</sub> in SUS and Al Metal Matrix.  
Closed Form Analytical Solution Using Norton's Creep Law.

**RESULT 2**  
Al-ZrO<sub>2</sub> FG cylinder has lower creep strain rate than SUS-2rO<sub>2</sub> FG cylinder at the outer radius under external pressure. This helps in minimizing deformation caused by angular body force, which is crucial for maintaining structural integrity over time.

**CONCLUSION**  
Al-ZrO<sub>2</sub> FG cylinder appears to be the more convenient choice compared to the SUS - 2rO<sub>2</sub> FG cylinder for applications involving external pressure and angular body force.

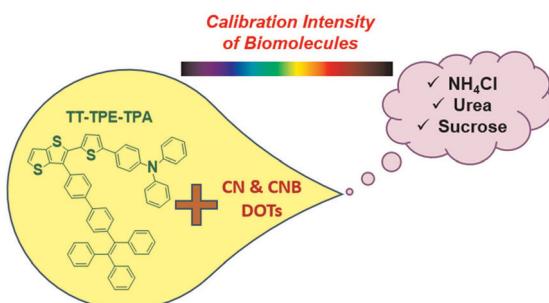
**RESULT 3**  
Al-ZrO<sub>2</sub> FG cylinder is superior because it manages stress more efficiently, resists creep deformation better, and enhances long-term durability.

13746



- ✓ Facile protocol for generation of a diverse range of bioactive benzimidazoles/benzoxazole.
- ✓ Application of surface-engineered TMD as bifunctional catalyst.
- ✓ Reusable, economical and easy-to-prepare catalyst.
- ✓ Benign reaction conditions.
- ✓ Nanocatalyst mediates the formation of active ingredients *in situ*.

13756

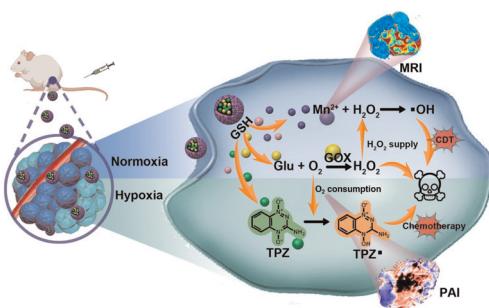
Comparative analysis of steady-state creep in SUS-ZrO<sub>2</sub> and Al-ZrO<sub>2</sub> functionally graded pressurized cylinders and its implications

Manoj Sahni,\* Parth Dinesh Mehta and Sandeep Kumar Paul

## Thiolated molybdenum diselenide quantum dots as a bifunctional catalyst towards the synthesis of benzimidazoles

Komal Jaiswal, Rushikesh Jagtap and Mrinmoy De\*

13767



## Thienothiophene-based quantum dots: calibration of photophysical properties via carbon dot and biomolecular interactions

Recep Isci,\* Ozge Ibis, Garen Suna, Caner Unlu\* and Turan Ozturk\*

## Smart self-assembly of a multifunctional theranostic nanzyme for self-enhanced precise chemo/chemodynamic therapy

Jin Tao, Junhui Wei, Junnan Kan, Kai Qi, Tingting Wang, Ailing Wang, Wenxin Pei, Haiyan Gao, Caixia Yang\* and Xianglin Li\*

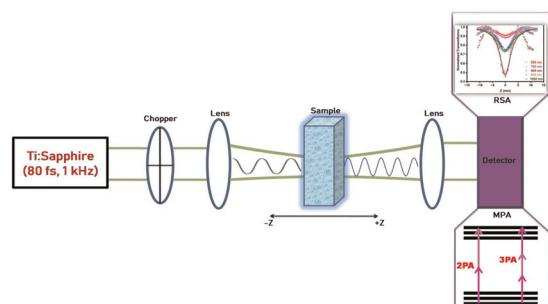


## PAPERS

13777

**Broadband laser protection and enhanced nonlinear optical response of samarium–metal–organic framework-based white/black carbon hybrids**

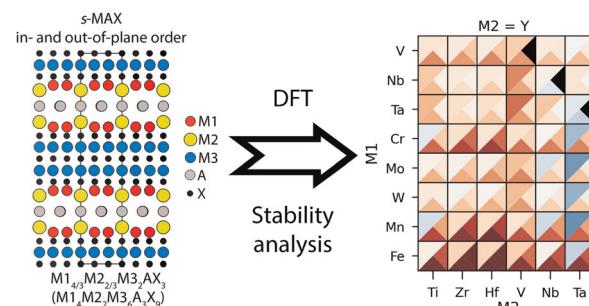
M. Saravanan,\* Vinod K. Rajput, K. Suresh, Sri Ram G. Naraharisetty, Sajan D. George, I. Vetha Potheher,\* Marek Brzeziński and B. N. Vedha Hari



13787

**Combined in- and out-of-plane chemical ordering in super-ordered MAX phases (*s*-MAX)**

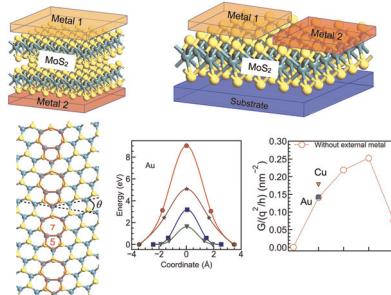
Martin Dahlqvist\* and Johanna Rosen\*



13797

**Effect of grain boundaries on metal atom migration and electronic transport in 2D TMD-based resistive switches**

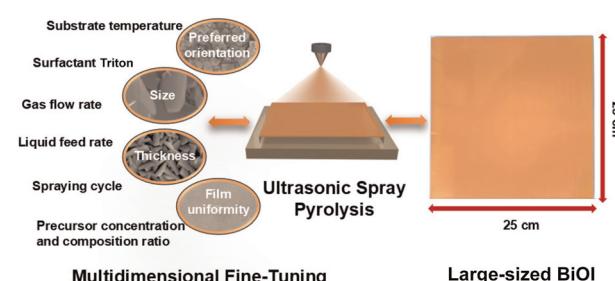
Mohit D. Ganeriwala,\* Daniel Luque-Jarava, Francisco Pasadas, Juan J. Palacios, Francisco G. Ruiz, Andres Godoy\* and Enrique G. Marin



13808

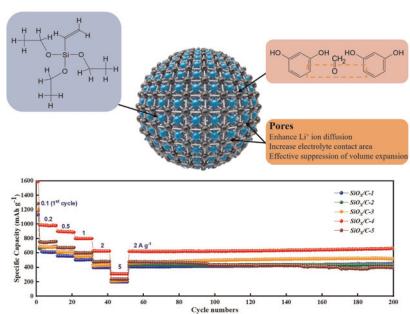
**Enabling multidimensional fine-tuning of large-sized BiOI films using ultrasonic spray pyrolysis**

Hao Wang, Weilong Qin, Qitao Liu, Neway Belachew, Jianming Li, Qinglu Liu, Jiabo Le and Yongbo Kuang\*



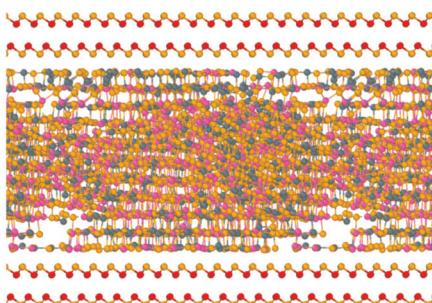
## PAPERS

13818

**SiO<sub>x</sub>/C composite spheres as an anode material for high-performance lithium-ion batteries**

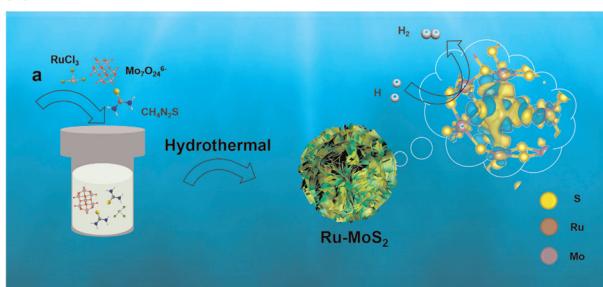
Ho Jin Yoo, Eun Mi Kim\* and Sang Mun Jeong\*

13828

**Simulation of the crystallization process of Ge<sub>2</sub>Sb<sub>2</sub>Te<sub>5</sub> nanoconfined in superlattice geometries for phase change memories**

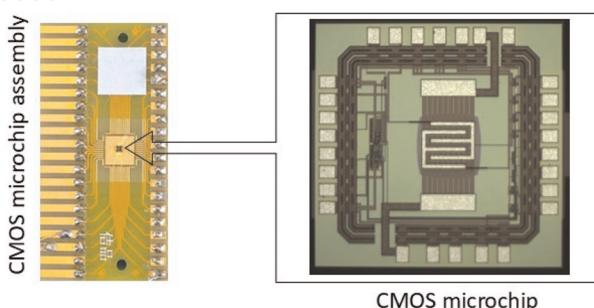
Debdipto Acharya, Omar Abou El Kheir, Simone Marcorini and Marco Bernasconi\*

13842

**Ru doping induces phase transition and in-plane S-site electronic modulation in ternary MoS<sub>2</sub> heterostructures to enhance hydrogen evolution in water/seawater**

Jianpeng Sun, Jianan Rao, Shiyu Qin, Xiang Li, Ru Jia, Kelei Huang, Yu Zheng and Xiangchao Meng\*

13850

**Low temperature inkjet-printed metal oxide sensors for sensitive and selective NO<sub>2</sub> detection**

P. K. Shihabudeen, Shivam Gupta, Yu-Hsien Lin, Shih-Wen Chiu, Yu Ting Chuang, Yuan Fu Tang, Nyan-Hwa Tai and Kea-Tiong Tang\*

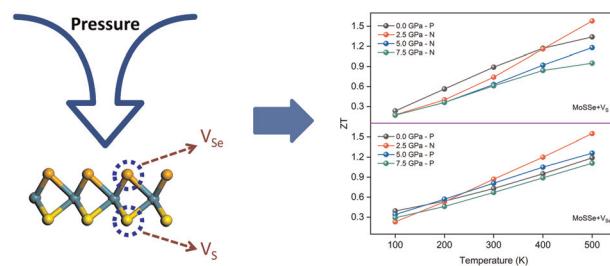


## PAPERS

13861

**Effect of pressure on the thermoelectric performance of monolayer Janus MoSSe materials with different native vacancy defects**

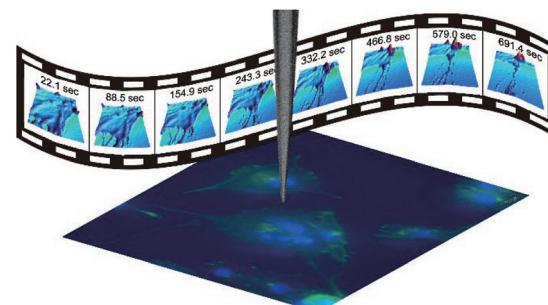
Yuan Shang, Xiaopeng Pan, Yanxing Jia, Yuqiang Wu and Mengtao Sun\*



13869

**Nanoscale structural dynamics of cell edges in breast tumour cells revealed by scanning ion conductance microscopy**

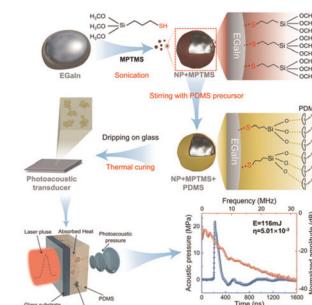
Masahiro Yamazaki, Linhao Sun, Tatsunori Nishimura, Tsunaki Hongu, Shigeyuki Takamatsu, Toshifumi Gabata, Noriko Gotoh\* and Shinji Watanabe\*



13880

**High-efficiency photoacoustic transducers based on plasmonic EGaIn liquid metal nanoparticles**

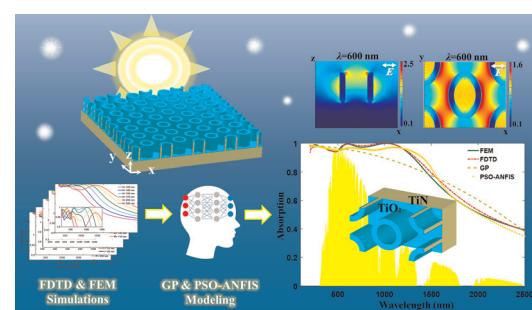
Cheng Luo, Rui Zhou, Yihao Li, Min Li, Xiaoyan Wen, Ming-Yu Li, Shuo Deng, Sisi Liu, Hongyun Gao\* and Haifei Lu\*



13888

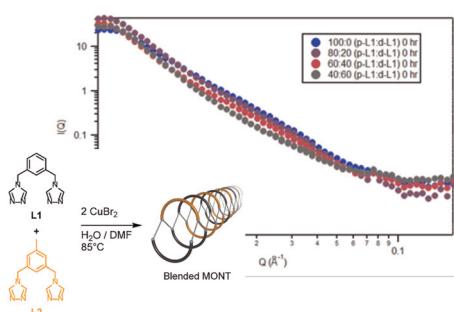
**Machine-learning-empowered FDTD/FEM simulations for predictive solar energy absorption in plasmonic metamaterial nanocavity arrays**

Zahra Ashrafi-Peyman, Amir Dashti, Amir Jafargholi, John L. Zhou\* and Alireza Z. Moshfegh\*



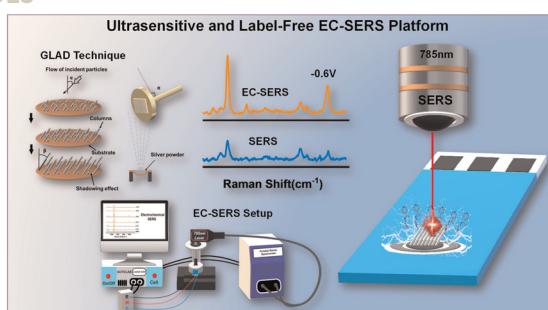
## PAPERS

13905

**Insights into the copolymerization of metal–organic nanotubes from ligand mixtures using small angle neutron scattering**

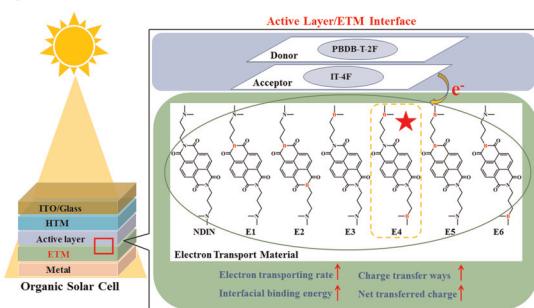
Md Ashraful Haque, Jacob A. Barrett, Xian B. Carroll, David M. Jenkins\* and Mark D. Dadmun\*

13915

**Potential-modulated SERS profiling via GLAD-fabricated Ag nanorod arrays for ultrasensitive and label-free spectroelectrochemical sensing**

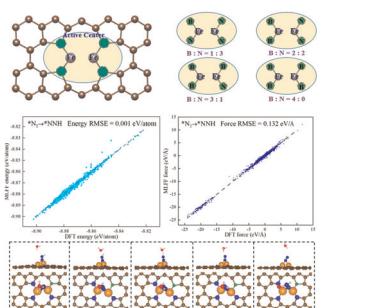
Lakshay Bhardwaj, Jyoti Yadav and J. P. Singh\*

13929

**Boron-containing electron transport materials based on naphthalene diimide for organic solar cells: a theoretical study**

Shu-Pu Yao, Jie Yang,\* Qian Guo, Xiao-Juan Yang and Quan-Song Li\*

13939

**Exploring dual-iron atomic catalysts for efficient nitrogen reduction: a comprehensive study on structural and electronic optimization**

Zhe Zhang,\* Wenxin Ma, Jiajie Qiao, Xiaoliang Wu, Shaowen Yu, Weiye Hou, Xiang Huang, Rubin Huo, Hongbo Wu\* and Yusong Tu\*



## PAPERS

13951

**Cuticular proteins (*crusticuls*) affect 3D chitin bundle nanostructure**

Shai A. Shaked, Simy Weil, Rivka Manor, Eliahu D. Aflalo, Sharon Moscovitz, Nitzan Maman, Raquel Maria, Benjamin Kruppke, Thomas Hanke, Jerry Eichler, Barak Ratzker, Maxim Sokol and Amir Sagi\*

