



## Front Cover

**CO<sub>2</sub> and ethylene vinyl acetate co-modification of solid waste-based filling materials: An integrated approach for carbon capture and recycling**

*Dedan Duan, Huiping Song\*, Xiaojuan Du, Quan An, Huaigang Cheng, Fangqin Cheng, Junpeng Xie, Yongzhen Yang*

## CONTENTS

### Special Topic

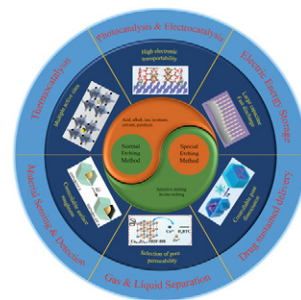
#### Innovations in Metal-Organic Frameworks

### Review articles

#### **Tailoring the Architecture of Metal-Organic Frameworks: Precision Etching for Engineered Defects and Surfaces**

Yunfei Jiang, Ziyi Zhang, Yongjian Du, Jinwen Jiao, Ya Bian, Di Cai, Houchao Shan\* ..... 2107

In this review, we systematically analyze recent advancements in MOF etching techniques and emphasize the underlying mechanisms that govern the formation of hierarchical pore structures, defect engineering, and heterojunction formation. Ultimately, this review underscores the transformative impact of etching on MOF properties.

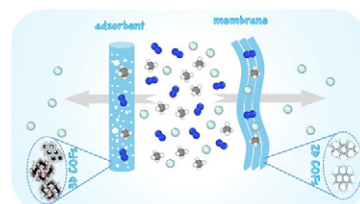


### Research papers

#### **Computational Screening of Covalent Organic Frameworks for He Purification with Adsorption or Membrane Separation**

Zenan Shi, Lijun Liao, Shujun Peng\*, Yanying Wei\*, Libo Li\* ..... 2143

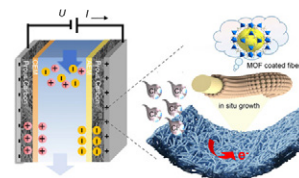
Herein, molecular simulation and machine learning (ML) were combined to screen 801 experimentally synthesized COFs for He/CH<sub>4</sub> and He/N<sub>2</sub> separation, either by means of adsorption or membrane separation. Top 10 COFs for 4 different gas separation purposes were identified respectively. Additionally, ML models were developed to predict separation performance, with key descriptors identified.



## High-efficiency Capacitive Deionization: Freestanding Carbon Electrodes Derived from Fungal Hyphae with In-situ Oriented MOF Growth

Jiao Chen, Kuichang Zuo, Jiajin Liang, Gang Wang, Lin Lin, Xiao-yan Li\* ..... 2156

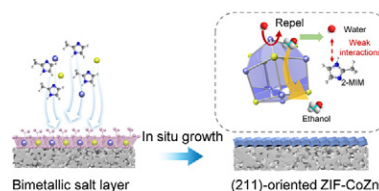
The fungal hyphae served as an ideal substrate for in-situ oriented growth of MOFs. MOF-Fhy-C exhibited excellent conductivity and a high effective surface area, resulting in a salt adsorption capacity of 40.8 mg/g, higher than most CDI carbon electrode.



## Oriented Superhydrophobic Bimetallic MOF Composite Membrane for Efficient Ethanol-Water Separation

Fengkai Wang, Yushan Zhang, Yiming Zhong, Mengxin Shen, Hao Sun, Jie Li, Naixin Wang\*, Hong Meng, Quan-Fu An ..... 2167

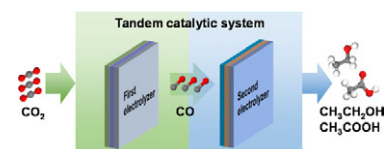
A (211)-oriented bimetallic MOF membrane for ethanol-water pervaporation separation has been developed. It leverages the hydrophobicity of 2-methylimidazole ligands to block water permeation while enlarging pore size through competitive coordination of bimetallic ions to enhance ethanol permeation.



## Highly Selective Electrocatalytic CO<sub>2</sub> Reduction to Liquid C<sub>2</sub> Products by Means of a Tandem Catalytic System

Nan Wang, Yuan Zhang, Xiaoxin Tian, Mingming Sun, Lei Yuan, Huiyong Wang\*, Jianji Wang\*... 2177

Ag NCs@Ag-MOF and Cu-O<sub>2</sub>N<sub>2</sub>-COF were synthesized and utilized in a tandem electrocatalytic CO<sub>2</sub> reduction system to significantly improve the Faradaic efficiency of liquid C<sub>2</sub> products (ethanol and acetate) to 90.9% with the partial current density of 120 mA cm<sup>-2</sup> by enhanced \*CO accumulation on the Cu catalyst.



## Converting Waste Polyimide into Porous Carbon Nanofiber for All-weather Freshwater and Hydroelectricity Generation

Lijie Liu, Huajian Liu, Huiyue Wang, Kuankuan Liu, Guixin Hu, Yan She, Xueying Wen, Hangyuan Du, Lingling Feng, Jiang Gong\* ..... 2187

An all-weather dual-functional evaporator/generator is constructed using recycled polyimide as the precursor. It not only exhibits a high evaporation rate of 2.93 kg m<sup>-2</sup> h<sup>-1</sup> under 1 kW m<sup>-2</sup> irradiation, but also displays high open-circuit voltage of 0.32 V.



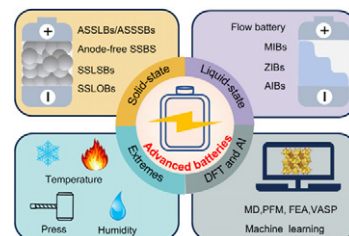
## Contributed Papers

### Review articles

#### Advanced batteries for sustainable energy storage

Wenbin Li, Changtai Zhao, Chang Yu\*, Yan Yu\*, Jia-Qi Huang\*, Yingying Lu\*, Hao Jiang\*, Shuai Gu, Zhouguang Lu\*, Xue Yang, Le Yu\*, Yuan Ren, Siqi Shi\*, Weihua Chen\* ..... 2201

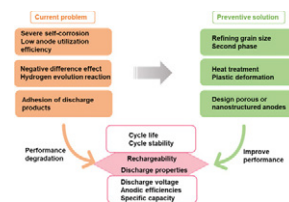
This review provides a comprehensive overview of various advanced battery technologies, including solid-state batteries, liquid-state batteries and battery technologies suitable for extreme conditions. The importance of theoretical calculations and artificial intelligence technology are emphasized to promote the development of advanced batteries.



#### Preparation, Microstructure and Corrosion Resistance of Novel Anode Materials Based on Magnesium-Air Batteries

Qi Sun, Shaohua Luo\*, Jun Cong, Xin Yan, Qiuyue Liu, Shengxue Yan, Pengwei Li, Xiaoping Lin... 2259

The review then delves into a variety of representative anode materials. Special attention is given to innovative material designs that mitigate the challenges typically encountered by Mg-air batteries.

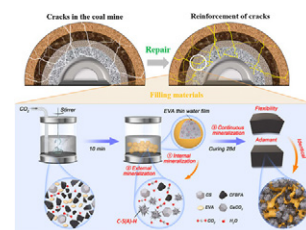


### Research papers

#### CO<sub>2</sub> and ethylene vinyl acetate co-modification of solid waste-based filling materials: An integrated approach for carbon capture and recycling

Dedan Duan, Huiping Song\*, Xiaojuan Du, Quan An, Huaigang Cheng, Fangqin Cheng, Junpeng Xie, Yongzhen Yang ..... 2279

This study employs CFBFA and CS activated by the synergistic effect of EVA and CO<sub>2</sub>, significantly enhancing the rigidity-flexibility balance of grouting filling materials. The composite system exhibits substantial improvements in flexural, bending, and compressive strengths by 166.7%, 48.76%, and 40.56%, respectively.



#### Robust Ambient-Stable 2D Heterostructure of Copper Oxides Intercalating Black Phosphorus for Flame Retardancy and Catalytic Removal of Carbon Monoxide

Xiaoyang Yu, Huan Li, Xuyang Miao, Ning Kang, Wenbin Yao, Mingjun Xu\* ..... 2297

In this work, an effective approach was proposed to fabricate 2D heterostructures of copper oxide intercalated with BP, which not only enhances flame retardancy but also improves the ambient stability of BP and the catalytic performance for CO elimination.



## Single sodium atoms anchored on N-doped porous carbon: Solid strongly basic catalysts with uncommon activity and stability

Sai Liu, Xiang-Bin Shao, Zhi-Wei Xing, Xing-Ru Song, Kai Zhang, Yang Wang, Peng Tan, Lin-Bing Sun\*.....

2311

A lychee-like Ni/C/ZnFe<sub>2</sub>O<sub>4</sub> catalyst with a double-shell hollow porous heterojunction structure achieves 98% Cr(VI) removal under microwave irradiation, leveraging enhanced electron transfer and accelerated H<sup>+</sup> ion dynamics for efficient heavy metal reduction.

