



Front Cover

Merging polymers of intrinsic microporosity and porous carbon-based zinc oxide composites in novel mixed matrix membranes for efficient gas separation

Muning Chen, Jiemei Zhou, Jing Ma, Weigang Zheng, Guanying Dong, Xin Li, Zhihong Tian, Yatao Zhang, Jing Wang*, Yong Wang*

CONTENTS

Short communication

Poly (lactic acid)/Poly (butylene adipate-co-terephthalate) films with simultaneous high oxygen barrier and fast degradation properties

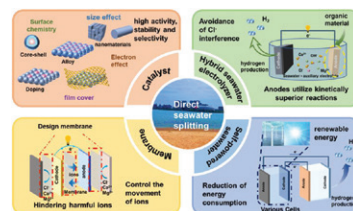
Mengjing Yang, Yuxi Mao, Penghui Zhang, Jie Li, Zeming Tong, Zhenguo Liu*, Yanhui Chen* 1

Review articles

Direct seawater splitting for hydrogen production: Recent advances in materials synthesis and technological innovation

Yilin Zhao¹, Zhipeng Yu¹, Aimin Ge*, Lujia Liu, Joaquim Luis Faria, Guiyin Xu*, Meifang Zhu... 11

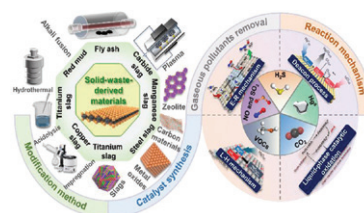
This review summarizes four strategies for designing highly active, selective, and chemically stable catalysts, hybrid seawater electrolysis systems, seawater corrosion-resistant membranes, and self-powered seawater splitting systems. It also points to the future direction of seawater hydrogen production.



Industrial solid wastes to environmental protection materials for removal of gaseous pollutants: A review

Jiacheng Bao¹, Xin Sun¹, Ping Ning*, Kai Li*, Jie Yang, Fei Wang, Lei Shi, Maohong Fan* 34

This review discusses the use of industrial solid wastes as functional materials for air pollutant removal, highlighting recent advancements and modifications to enhance performance. Challenges and future research directions in optimizing these materials for environmental applications are also explored.

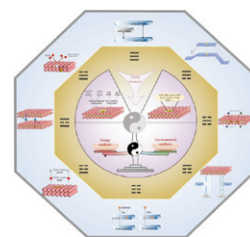


Recent advances of metal vacancies in energy and environmental catalysis: Synthesis, characterization, and roles

Long Sun¹, Shunzheng Zhao¹, Sirui Gao, Ronghui Zhu, Yiran Tan, Xiaolong Tang, Honghong Yi*...

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Using the concepts of Yin and Yang from Tai Chi to symbolize energy and environment, and based on the shapes and meanings of the Bagua, eight roles of metal vacancies are illustrated. For example, “☰” and “☷” embody possessing energy (generating defect energy levels) and imparting impetus (activating lattice oxygen).

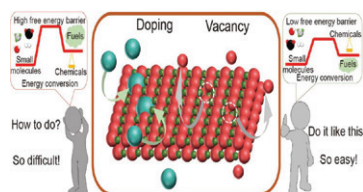


Optimizing electronic structure through point defect engineering for enhanced electrocatalytic energy conversion

Wei Ma¹, Jiahao Yao¹, Fang Xie, Xinqi Wang, Hao Wan*, Xiangjian Shen, Lili Zhang, Menggai Jiao*, Zhen Zhou.....

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This review systematically summarized the recent advances of different point defects in regulating the electronic structure, generating optimized reaction pathways, enhanced electrocatalytic selectivity and efficiency for the electrochemical energy conversion processes.



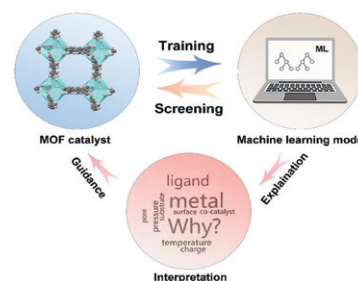
Research papers

High-throughput screening of CO₂ cycloaddition MOF catalyst with an explainable machine learning model

Xuefeng Bai, Yi Li, Yabo Xie, Qiancheng Chen, Xin Zhang*, Jian-Rong Li*.....

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High-throughput screening of MOFs catalysts for CO₂ cycloaddition has been accomplished in a relatively short period of time with a machine learning model. The combined high efficiency and accuracy of the model was attributed to the judicious choice of easily accessible descriptors based on the reaction mechanism. The experimental catalytic performance of MOF-76(Y) agrees well with the prediction results, as a top performing catalyst.

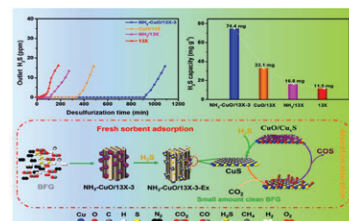


Ammonia-induced CuO/13X for H₂S removal from simulated blast furnace gas at low temperature

Erping Cao, Yuhua Zheng, Hao Zhang, Jianshan Wang, Yuran Li, Tingyu Zhu, Zhan-guo Zhang*, Guangwen Xu, Yanbin Cui*.....

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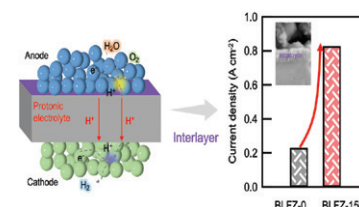
This study introduces an improved zeolite-based adsorbent, NH₃-CuO/13X, for low-temperature H₂S removal from blast furnace gas, offering enhanced desulfurization performance and sulfur capacity, vital for meeting strict emission standards.



Boosting high-performance in Zr-rich side protonic solid oxide electrolysis cells by optimizing functional interlayer

Chunmei Tang, Ning Wang, Sho Kitano, Hiroki Habazaki, Yoshitaka Aoki*, Siyu Ye*..... 150

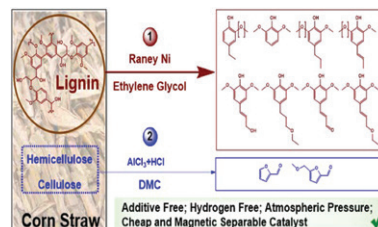
An efficient functional interlayer $\text{Ba}_{0.95}\text{La}_{0.05}\text{Fe}_{0.8}\text{Zn}_{0.2}\text{O}_{3-\delta}$ was fabricated between the anode and the electrolyte for Zr-rich side protonic solid oxide electrolysis cell, which improves the interfacial contact and greatly enhances the anode reaction kinetics, thus boosting high performances.



Atmospheric reductive catalytic fractionation of lignocellulose integrated with one-pot catalytic conversion of carbohydrate yielding valuable lignin monomers and platform chemicals from corn straw

Meng-Ying Liu, Zhe-Hui Zhang, Xue-Qi Wang, Qian Sun, Chen Zhang, Yu Li, Zhuohua Sun*, Katalin Barta, Feng Peng, Tong-Qi Yuan*..... 161

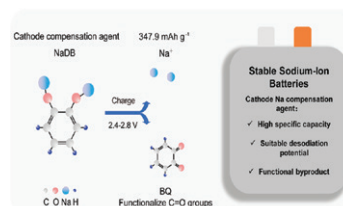
This research develops an eco-friendly, cost-effective process converting corn straw into chemicals like lignin monomers, furfural, and 5-methoxymethylfurfural using a magnetic Raney Ni catalyst and ethylene glycol, achieving significant yields in a streamlined, scalable system.



A functional cathode sodium compensation agent for stable sodium-ion batteries

Wei Wu¹, Zhenglin Hu¹, Zhengfei Zhao, Aoxuan Wang*, Jiayan Luo*..... 173

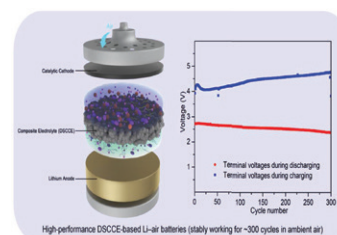
A 1,2-dihydroxybenzene Na salt was proposed as a cathode compensation agent with high specific capacity, lower desodiation potential and high utilization (99%). Its byproduct could functionalize HC with more C=O groups and promotes its reversible capacity.



Design of multifunctional interfaces on ceramic solid electrolytes for high-performance lithium-air batteries

Yunxin Shi, Ziyang Guo*, Changhong Wang, Mingze Gao, Xiaoting Lin, Hui Duan, Yonggang Wang, Xueliang Sun*..... 183

The differentiatingly surface-regulated ceramic-based composite electrolyte (DSCCE) is constructed and applied in Li-air batteries. Because of the antioxidative PMMA-based layer with LiI redox mediator catalyst, anode-friendly PVDF-HFP-based coating and compact/stable ceramic frameworks, the corresponding cells shows the excellent cycling life under ambient air.

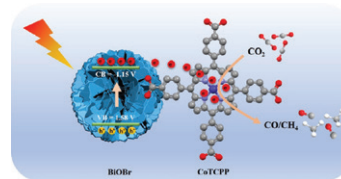


CoTCPP integrates with BiOBr microspheres for improved solar-driven CO₂ reduction performance

Lina Li, Yi Zhang, Gaopeng Liu, Tiange Wei, Junze Zhao, Bin Wang, Mengxia Ji, Yuanbin She*, Jiexiang Xia*, Huaming Li*.....

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The CoTCPP integrates with BiOBr microspheres exhibit significantly enhanced light absorption, improved photocarriers' separation and excellent CO₂ adsorption-activation, thus boosting the CO₂ photoreduction towards CO and CH₄.

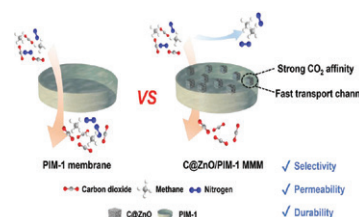


Merging polymers of intrinsic microporosity and porous carbon-based zinc oxide composites in novel mixed matrix membranes for efficient gas separation

Muning Chen, Jiemei Zhou, Jing Ma, Weigang Zheng, Guanying Dong, Xin Li, Zhihong Tian*, Yatao Zhang, Jing Wang*, Yong Wang.....

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This study explores incorporating a carbon-zinc oxide composite into polymers to enhance mixed matrix membranes (MMMs) for gas separation, significantly boosting CO₂ permeability and selectivity, and surpassing the Robeson upper bound.

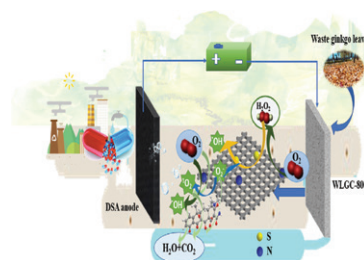


Synergistically S/N self-doped biochar as a green bifunctional cathode catalyst in electrochemical degradation of organic pollutant

Xuechun Wang, Huizhong Wu, Jiana Jing, Ge Song, Xuyang Zhang, Minghua Zhou*, Raf Dewil.....

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S, N self-doped biochar was derived from waste ginkgo leaves and used as bifunctional electrocatalyst for high selectivity of H₂O₂ electrosynthesis and efficient electrocatalytic activity in wider application pH, which was promising and stable for removing various pollutants in wastewater. The roles and synergetic effect of N, S doping played in H₂O₂ and ROS generation were proposed.



g-C₃N₄ nanosheets coupled with CoSe₂ as co-catalyst for efficient photooxidation of xylose to xylonic acid

Qi Hao¹, Yijun Liu¹, Ren Zou, Ge Shi, Shilian Yang, Linxin Zhong, Wu Yang, Xiao Chi, Yunpeng Liu, Shimelis Admassie, Xinwen Peng*.....

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This study demonstrates the synthesis of a CoSe₂/g-C₃N₄ photocatalysis system, enhancing the selective photooxidation of xylose to xylonic acid with a 50.12% yield. CoSe₂, as a non-precious, efficient cocatalyst, promotes the separation of photogenerated electron–holes and accelerates photooxidation, offering insights into the design of selective photocatalysts for high-value biomass utilization.

