



Front Cover

The crucial role of intrinsic properties in determining the biological effects of CeO₂ nanocrystals

Min Sun¹, Wanqin Dai¹, Yuhui Ma^{1}, Mengyao Liu, Xiao He, Zhuda Song, Yun Wang, Jiaqi Shen, Fang Yang*, Zhiyong Zhang**

CONTENTS

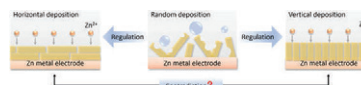
Viewpoint

Oriented crystallization of metal electrodeposition in aqueous zinc batteries

Lingxiao Ren, Yang Dong, Dalong Zhong, Zhijiang Su*, Aoxuan Wang*, Chengxin Peng, Jiayan Luo*.....

1819

Crystallographic control of electrodeposited Zn offers a fundamental solution by targeting the root cause of inhomogeneous and loose deposition. Herein, we take the morphological inconsistencies across studies as the starting point, discussing the mechanistic understanding of orientation-dependent electro-performance and underscoring the importance of tailoring electrode crystallography to balance kinetic requirements (e.g., ion transport) and thermodynamic stability (e.g., corrosion resistance).



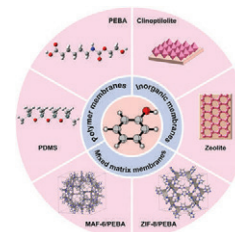
Review articles

Recent progress in hydrophobic pervaporation membranes for phenol recovery

Chao Sang¹, Chang Liu¹, Yunpan Ying, Lu Lu, Chenlin Zhang, Jan Baeyens, Zhihao Si*, Xinmiao Zhang*, Peiyong Qin*.....

1828

Phenol is frequently employed in the synthesis of high-valuable chemical products and intermediates. This review highlights recent advancements in hydrophobic pervaporation membranes for phenol recovery, focusing on polymer, inorganic, and mixed matrix membranes, along with fabrication techniques and performance enhancement methods.

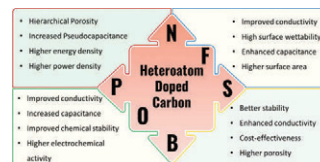


Heteroatom-functionalized carbon nanoarchitectonics: Unlocking the doping effects for supercapacitor electrode design

Pragati A. Shinde*, Lok Kumar Shrestha, Katsuhiko Ariga*.....

1838

Heteroatom-functionalized carbons, incorporating elements like nitrogen, sulfur, boron, and phosphorus, are promising for electrochemical energy storage applications due to their unique properties as mentioned.

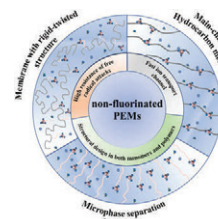


Recent progress on the development of non-fluorinated proton exchange membrane-A review

Peng Song, Yi Zhang, Xue Zhang, Jiaye Liu, Liang Wu, Adrian C. Fisher, Quan-Fu An*

1863

Non-fluorinated PEMs including main-chain-type hydrocarbon membranes, microphase separation membranes and membranes with rigid-twisted structure are comprehensively reviewed. Structural design of the polymer is reviewed for fast ion transport channels construction and high resistance of free radical attacks.



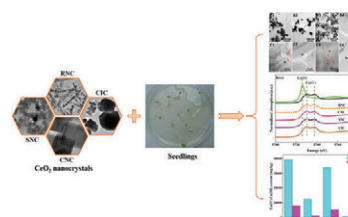
Research papers

The crucial role of intrinsic properties in determining the biological effects of CeO₂ nanocrystals

Min Sun¹, Wanqin Dai¹, Yuhui Ma*, Mengyao Liu, Xiao He, Zhuda Song, Yun Wang, Jiaqi Shen, Fang Yang*, Zhiyong Zhang*

1881

This study found that rod and spherical nano-CeO₂ significantly inhibit lettuce growth, while cubic and commercial forms show little effect. Material size, shape, and surface charge jointly influence reactivity, dissolution, and bioavailability, leading to varying Ce³⁺ levels in plants. Intrinsic properties are critical in assessing nano-CeO₂'s environmental effects.

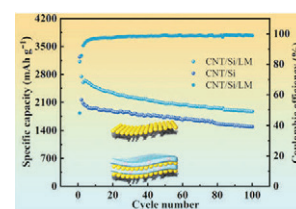


Freestanding and flexible CNT/Si/metal electrodes for high energy density lithium-ion batteries with enhanced electrochemical performance

Yanbin Wei, Yukang Zhu, Li Wang, Xiangming He*

1892

Flexible, self-supporting CNT/Si/liquid metal (LM) electrodes have been successfully fabricated. Serving as an anode material for lithium-ion batteries (LIBs), these electrodes demonstrate outstanding cycling stability and rate capability. The role of LM in enhancing the electrochemical stability of Si is thoroughly examined. This work introduces a novel flexible electrode design poised to advance the development of next-generation flexible LIBs.

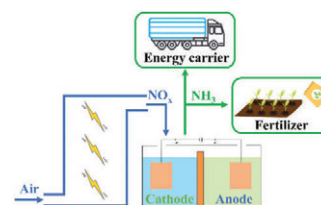


Techno-economic assessment of plasma-driven air oxidation coupled with electroreduction synthesis of ammonia

Lei Xiao¹, Shiyong Mou¹, Xiaoyu Lin, Keying Wu, Siyuan Liu, Weidong Dai, Weiping Yang, Chiyao Tang, Chang Long, Fan Dong*

1901

A technical and economic assessment of pAO-eNO_xRR technology suggests that, in terms of both environmental impact and energy efficiency, N₂-NO-NH₃ and N₂-NO₂--NH₃ are presently the most effective pathways. The pAO-eNO_xRR technology is competitive with commercial processes in achieving large-scale NH₃ synthesis. For the economic viability of NH₃ synthesis, an energy efficiency in the range of 33.8-38.6% must be attained. The expenses associated with plasma equipment, electrolyzer, catalysts, and NH₃ distillation also contribute significantly to the economic burden.

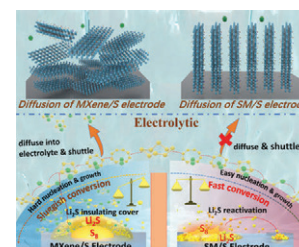


Construction of an adsorption-diffusion model reveals the conversion-deposition process of polysulfides

Wenhao Yang¹, Dan You¹, Zhicong Ni, Yongshun Liang, Yingjie Zhang, Yunxiao Wang, Qingsong Liu, Xue Li*, Yiyong Zhang*, Jiajun Wang*.....

1911

In this research, an MXene-based array architecture integrating 2D structural advantages and strong polysulfide affinity is designed to regulate diffusion pathways. The sodium alginate-constructed MXene array enables three synergistic mechanisms: (1) Enhanced ion/electron delocalization reduces diffusion barriers, (2) Continuous ion transport channels facilitate charge transfer, and (3) Exposed polar surfaces promote polysulfide aggregation/conversion. This work provides fundamental insights that reshape our understanding of diffusion-mediated phase transformation in complex multi-step electrochemical systems.

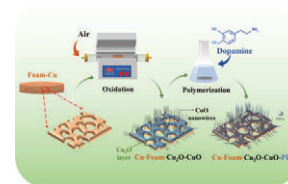


The in-situ growth of Cu₂O–CuO on Cu foam coated with carbon derived from polydopamine as the flexible high-voltage cathode for thermal batteries

Xin-ya Bu, Yan-li Zhu*, Ting Quan*, Bin-chao Shi, Shu Zhang, Xiao-yu Wei, Qi Xia.....

1922

The in-situ synthesis of copper oxide nanowires through high-temperature thermal oxidation, combined with the development of PDA-coated Cu₂O–CuO composite flexible electrodes, offers a promising advancement for high-performance cathodes in next-generation thermal batteries.

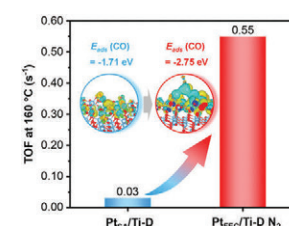


N₂ treatment triggered self-reorganization into fully exposed platinum cluster catalysts for efficient low-temperature CO oxidation

Yang Zou, Xue Li, Yongqi Zhao, Xiaolong Liu*, Tingyu Zhu.....

1934

N₂ treatment triggered the reorganization of single atoms into fully exposed Pt clusters on low-load Pt defect catalysts, modulating the coordination environment of Pt and significantly enhancing the low-temperature oxidative activity of the catalyst, resulting in a CO conversion frequency increase to a factor of 18.3.



Atomically dispersed Co sites on BiOCl nanosheets for efficient CO₂ photoreduction

Ting Peng, Yiduo Wang, Ke Wang, Kaini Zhang, Yiqing Wang, Yufei Xu, Qingqing Guan, Guofu Wang, Wenjie Zhang, Binglan Wu, Shaohua Shen*.....

1948

Single Co atoms were highly dispersed on BiOCl nanosheets to achieve a distinctly improved photocatalytic activity for CO₂ photoreduction, with CO evolution rate ~4 times that of the pristine BiOCl nanosheets, attributed to the introduced Co–O₄ coordination structures accelerating charge separation and activating CO₂ molecules for CO production.

