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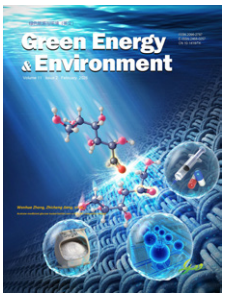

Front Cover

Acetone-mediated mlucose msomerization over a ZrO_2-NC composite catalyst

Mi Gao, Hongquan Fu, Wenhua Zhang, Zhicheng Jiang*, Bi Shi*

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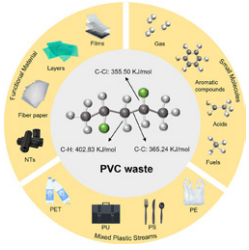
Review articles

Degradation and utilization of polyvinyl chloride (PVC): Challenges and opportunities toward a circular economy

Rui Huang, Jiaolong Meng, Xuefeng Jiang*..... 283

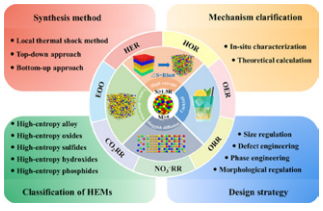
This review systematically summarizes three emerging pathways for polyvinyl chloride (PVC) transformation. Across all pathways, emphasis is placed on structure–property correlations, chlorine management, additive compatibility, and downstream utility. By integrating mechanistic understanding with materials innovation, this review highlights how PVC can be reimagined as a tunable molecular platform rather than a persistent pollutant.



Entropy-driven design of multifunctional electrocatalysts: Advances and perspectives in high-entropy materials

Ning Wei, Sufeng Zhang*, Xue Yao*, Scott Renneckar*..... 317

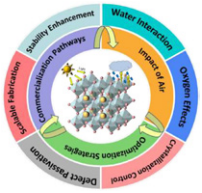
This paper provides a systematic and comprehensive review of high-entropy materials (HEMs), covering their classification, structural regulation, and advancements in electrocatalytic applications, emphasizing preparation techniques, structure-function relationships, and entropy engineering mechanisms, outlining future challenges and directions.



Ambient-air fabrication of perovskite solar cells: Challenges, progress, and perspectives

Xinyu Gu[1], Xiang Zhang[1], Dongxu Ren, Yixin Zhao*, Hao Chen*..... 359

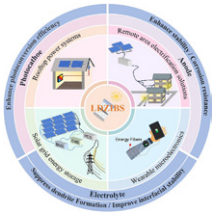
This review focuses on oxygen and moisture effects on perovskite formation, device performance, and stability, alongside strategies for improvement via state-of-the-art engineering, highlighting their path toward commercial viability and sustainable energy applications.



From photo-assisted to photo-rechargeable: Advancing Zn-ion batteries with light-driven energy storage

Dan Yang, Chen Xin, Hua-Kun Liu, Yaoxin Zhang, Ting Xiong*..... 387

This review explores light-driven zinc-ion batteries (LDZIBs), encompassing photo-assisted (PAZIBs) and photo-rechargeable (PRZIBs) types. We examine their mechanisms, materials, and integration strategies for direct solar energy conversion and storage, highlighting challenges and future directions.



Exploring critical development in photocatalytic overall water splitting: Recent trend, races predictions and environmental impacts

Zeeshan. Ajmal[1], Muhammad Haseeb Ullah[1], Abdul Qadeer, Huanhuan Zhang, Muhammad Abubaker Khan, Shenjie Shen, Yasin Orooji, Mohd. Imran, M.K.M. Ali, Ramadan Taha, Junmin Li, Shirong Lu, Waseem Abbas, Shuhang Wang*..... 401

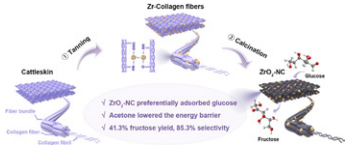
This review scientifically and comprehensively summarizes the Photocatalytic overall splitting (POWS) process with critically highlighting various kinds of photocatalyst characteristics, different suitable reaction methods and key methods to improve their photocatalytic properties of for photocatalysts.

Research papers

Acetone-mediated glucose isomerization over a ZrO_2-NC composite catalyst

Mi Gao, Hongquan Fu, Wenhua Zhang*, Zhicheng Jiang*, Bi Shi..... 454

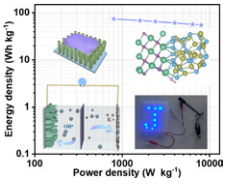
The highly dispersed ZrO_2 in ZrO_2-NC, featuring a hierarchical fiber structure, significantly enhanced the accessibility of the active sites. ZrO_2-NC preferentially adsorbed glucose, and acetone lowered the reaction energy barrier, thereby promoting glucose isomerization to fructose.



Boosting redox kinetics in CoS/Ti_3C_2 heterostructure via interfacial charge redistribution for high-energy-density supercapacitors

Yu Liu, Mengjie Pan, Mengqin Gong, Huachen Lin, Yulong Ying*, Longhua Li*, Hong Jia*..... 464

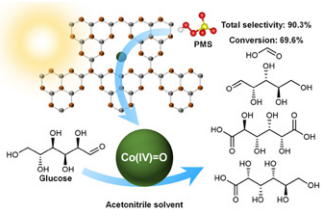
A novel CoS/Ti_3C_2@CC electrode featuring a Co-Ti heterointerface enables enhanced Faradaic kinetics in alkaline media, while the resulting supercapacitor demonstrates superior energy density and practical viability.



High-valent cobalt-oxo species mediated selective oxidation of glucose to chemicals in photocatalytic Fenton-like system

Tianliang Xia, Chengxu Wang, Xinyu Bai, Meiting Ju*, Hengli Qian, Ruite Lai, Chao Xie, Guanjie Yu, Yao Tang, Fei Qu, Chaojie Zhang, Shuwen Zhou, Haijiao Xie, Shaolan Song, Qidong Hou*…… 478

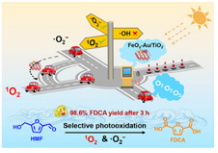
Single-atom Co supported on carbon nitride enables the high-valent-oxo cobalt species (Co(IV)=O) mediated oxidation of glucose into value-added products in acetonitrile. This photocatalytic Fenton-like system achieved an overall selectivity of gluconic acid, glucaric acid, arabinose, and formic acid up to 90.3% at glucose conversion of 69.6%, outperforming most of previously reported catalytic systems.



Manipulating and unveiling contributions of the reactive oxygen species dramatically promote selective photo-oxidation of 5-hydroxymethylfurfural into 2,5-furandicarboxylic acid in aqueous solution

Runqing Xiao[1], Qingmao Yang[1], Yanjie Li[1], Wei Zhang, Gang Xiao, Chun Shen*…… 488

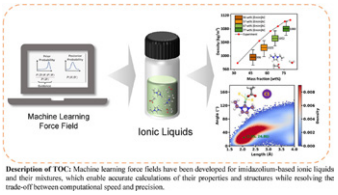
This work manipulates and unveils contributions of the reactive oxygen species (ROS) over the as-prepared FeOx-Au/TiO_2 catalyst, achieving high FDCA yield of 98.6% after 3 hours of visible light irradiation.



Insight into properties and structures of ionic liquids by machine learning molecular dynamics simulation

Yaxi Yu, Zhenlei Wang, Xiaochun Zhang, Kun Dong*…… 500

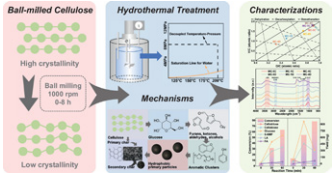
Ionic liquids (ILs) have exhibited great application potential in many fields. Herein, we report the Bayesian-based MLFFs which can be successfully applied in IL systems and accelerate MD simulation. Our results confirmed that MLFFs presented the strong feasibility to investigate the large and complex systems, especially to predict structures and properties of the ILs.



Enhancing carbonization of microcrystalline cellulose through ball milling under decoupled temperature and pressure hydrothermal conditions

Kaile Li, Jiahui Hu, Zhiqiang Xu, Shijie Yu*, Qinghai Li, Yanguo Zhang*, Hui Zhou*…… 511

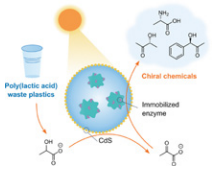
Ball milling (0–8 h, 1000 r/min) reduces crystallinity to enhance hydrothermal reactivity. Multi-scale characterizations reveal how decoupled temperature and pressure hydrothermal conditions dictate reaction mechanisms, unlocking pathways for efficient biomass valorization.



CdS-enzyme composite promotes photobiocatalytic conversion of plastic-derived lactate to chiral chemicals

Willy W.L. See[1], Phuc T.T. Nguyen[1], Heng Yih Tan, Jie Fu Jeff Zhou, Sie Shing Wong, Kang Zhou*, Ning Yan*…… 523

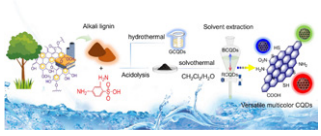
CdS–enzyme composites enable one-pot visible-light-driven conversion of plastic-derived lactate into chiral chemicals, addressing photocatalyst–biocatalyst incompatibility and offering a sustainable route to upgrade poly(lactic acid) waste into value-added products.



Harnessing tunable lignin-based carbon quantum dots for sustainable water purification

Xinyan Hou[1], Pengfei Zhou[1], Jun Guo, Shenao Yuan, Shiman Chen, Heyu Chen, Xiao Xiao, Jikun Xu*, Feng Peng*…… 531

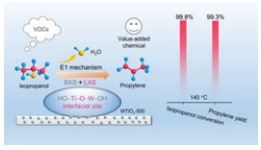
With the global trend of developing on-demand biomass valorization, a versatile solvent-engineering is proposed to construct multicolor carbon quantum dots in single lignin-derivative system with the triple functions of bimodule pollutant sensing, metal-ionic visualization, and photocatalytic antibiotic decomposition.



Synergistic Brønsted and Lewis acid sites for selective catalytic valorization of isopropanol from VOC streams

Honghong Zhang, Zhiwei Wang*, Lu Wei, Zhiquan Hou, Yuxi Liu, Hongxing Dai, Zhenxia Zhao, Jiguang Deng*…… 545

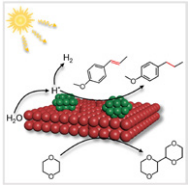
Highly active Ti−O−W interfacial sites catalyze the selective isopropanol transformation to high-value olefin with 99.3% propylene yield, achieving pollution abatement, CO_2 emission reduction, and VOC valorization.



Defect engineering of TiO_2 for efficient photocatalytic transfer hydrogenation with palladium as cocatalyst and water as a hydrogen source

En Zhao, Jingyuan Su, Hehe Fan, Bing Nan*, Lina Li, Haifeng Qi, Weiwei Fang, Wenjun Zhang*, Zupeng Chen*…… 557

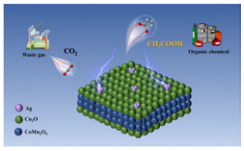
We report an oxygen-defective TiO_2-supported palladium catalyst for efficient photocatalytic transfer hydrogenation using water as the proton source, which exhibits high functional group tolerance and broad substrate applicability, enabling the complete conversion of sixteen substrates.



Boosting efficient C–C coupling toward electrocatalytic acetate synthesis from CO_2 via close Cu^+/Ag dual active sites

Ruifeng Wang, Yuchang Liu, Yandong Li, Yafen Kong, Qizhi Chen, Shuangliang Zhao*…… 565

The Cu^+/Ag bimetallic active sites constructed on the surface of NF@$CoMn_2O_4$@Cu_2O-Ag synergistically catalyze the C-C bond coupling, thereby significantly enhancing the efficiency of CO_2 electroreduction to CH_3COOH.



Structure–activity relationship in periodate activation by Fe-MOFs: Why MIL-101(Fe) outperforms other MIL-series in antibiotic degradation
Ning Liu, Jingwen Xu, Yixuan Zhai, Ziyi Zhang, Yi Dang, Yusong Cao, Zhe Li, Wenyuan Huang*, Xiaodong Zhang*, Liang Tang*…… 578

MIL-101 (Fe) can effectively interact with PI to form Fe(III)-O-O$^{\cdot-}$ due to its unique Fe_3O-OH nodes. The synergy between Fe(III)-O-O$^{\cdot-}$ formation and the pore accessibility of MIL-101(Fe) accounts for its superior tetracycline degradation rate.