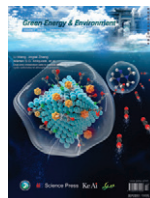




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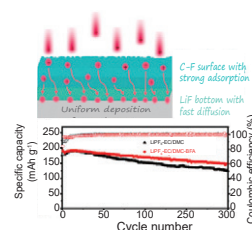
## CONTENTS

### Research highlight

#### Designing gradient solid electrolyte interphase for stable lithium metal batteries

Wenjing Deng, Xiaolei Wang\* ..... 1129

A gradient solid electrolyte interphase is designed with rich C-F bonds surface and rich LiF species bottom, which can uniformly adsorb and then fast transport Li ions to anode, resulting in more stable Li metal batteries.

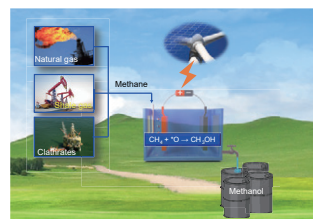


### Review articles

#### Direct conversion of methane to methanol by electrochemical methods

Haomin Jiang<sup>1</sup>, Luting Zhang<sup>1</sup>, Zhiwei Han, Yang Tang, Yanzhi Sun, Pingyu Wan, Yongmei Chen\*,  
Morris D. Argyle, Maohong Fan ..... 1132

The direct conversion of methane to methanol by electrochemical methods maybe an alternative pathway to use natural gas, shale gas, and combustible ice resources. This mini-review focuses on the challenges of electrochemical methane conversion to methanol by summarizing the design strategies and the conversion effects reported in the literature.



#### Sprayed separation membranes: A systematic review and prospective opportunities

Guangjin Zhao, Wenjing Han, Liangliang Dong\*, Hongwei Fan\*, Zhou Qu, Jiahui Gu, Hong Meng\* ... 1143

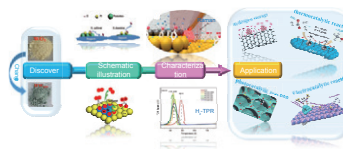
The progress in separation membranes using the spray technique, including the fundamentals, important features, applications, present challenge and future consideration, is summarized.



#### Magic of hydrogen spillover: Understanding and application

Haifang Shen, Hao Li\*, Zhensheng Yang, Chunli Li ..... 1161

The application of hydrogen spillover effect in hydrogen storage and catalysis was comprehensively summarized.

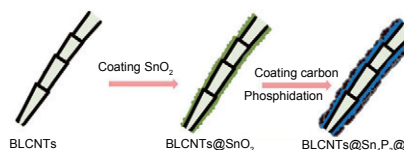


## Research papers

### Novel design and synthesis of 1D bamboo-like CNTs@Sn<sub>4</sub>P<sub>3</sub>@C coaxial nanotubes for long-term sodium ion storage

Qianyu Zhang, Yuling Xu, Lifeng Qiu, Axue Liu, Rui Wang, Longhai Zhang, Chaofeng Zhang\*, Yan-Jie Wang\*, JiuJun Zhang\* ..... 1199

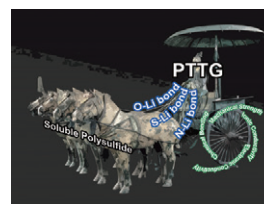
Novel bamboo-like carbon nanotubes@Sn<sub>4</sub>P<sub>3</sub>@carbon coaxial nanotubes are successfully prepared using a newly developed hydrothermal method followed by a phosphidation process, which can serve as advanced anode with excellent reversible capacity and a long cycling in sodium ion storage.



### Poly(thiourea triethylene glycol) as a multifunctional binder for enhanced performance in lithium-sulfur batteries

Luke Hencz, Chen Hao, Zhenzhen Wu, Xingxing Gu\*, Meng Li, Yuhui Tian, Su Chen, Cheng Yan, Abdulaziz S.R. Bati, Joseph G. Shapter, Milton Kiefel, Dong-Sheng Li, Shanqing Zhang\* ..... 1206

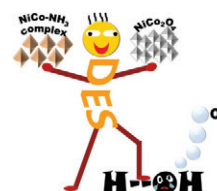
Poly(thiourea triethylene glycol) PTTG polymer used as a lithium-sulfur battery (LSB) binder shows strong chemical interaction with soluble polysulfides. Sulfur-PTTG cathodes possess high electronic and ionic conductivity as well as robust mechanical properties to provide excellent LSB performance.



### Deep eutectic solvent strategy enables an octahedral Ni-Co precursor for creating high-performance NiCo<sub>2</sub>O<sub>4</sub> catalyst toward oxygen evolution reaction

Chenyun Zhang, Bingwei Xin, Tingting Chen, Hao Ying, Zhonghao Li\*, Jingcheng Hao ..... 1217

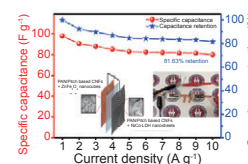
An innovative DES strategy was proposed for synthesizing water-sensitive NiCo-NH<sub>3</sub> complex precursor, which was effectively converted into NiCo<sub>2</sub>O<sub>4</sub> nanooctahedrons via thermal decomposition, realizing a high-performance OER electrocatalyst.



### Engineered NiCo-LDH nanosheets- and ZnFe<sub>2</sub>O<sub>4</sub> nanocubes-decorated carbon nanofiber bonded mats for high-rate asymmetric supercapacitors

Jae-Gyoung Seong, Tae Hoon Ko\*, Danyun Lei, Woong-Ki Choi, Yun-Su Kuk, Min-Kang Seo, Byoung-Suhk Kim\* ..... 1228

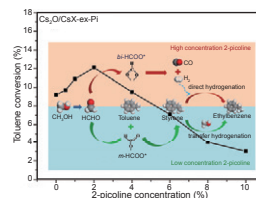
The core-shell NiCo-LDH nanosheet- and ZnFe<sub>2</sub>O<sub>4</sub> nanocube-decorated carbon nanofiber composites with bonded network structure as cathode and anode electrode materials were prepared. The fabricated supercapacitor device delivered a specific capacitance of ~98 F g<sup>-1</sup> at 1 A g<sup>-1</sup> and excellent



## Enhancing the side-chain alkylation of toluene with methanol to styrene over the Cs-modified X zeolite by the assistance of basic picoline as a co-catalyst

Zhe Hong, Guoqing Zhao, Fangtao Huang, Xiaoxia Wang, Zhirong Zhu\* ..... 1241

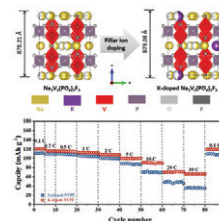
The addition of suitable amount of 2-picoline facilitated the activity for toluene side-chain alkylation on Cs-modified zeolite catalyst.



## Boosting rate and cycling performance of K-doped Na<sub>3</sub>V<sub>2</sub>(PO<sub>4</sub>)<sub>2</sub>F<sub>3</sub> cathode for high-energy-density sodium-ion batteries

Jiexin Zhang<sup>1</sup>, YangYang Lai<sup>1</sup>, Peng Li, Yanxia Wang, Faping Zhong, Xiangming Feng, Weihua Chen, Jianjun Liu, Xinping Ai, Hanxi Yang, Yuliang Cao\* ..... 1253

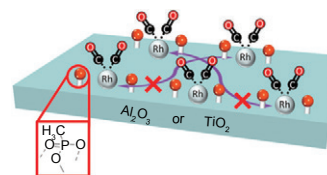
A novel cathode, K doped Na<sub>3</sub>V<sub>2</sub>(PO<sub>4</sub>)<sub>2</sub>F<sub>3</sub> is synthesized by a facile ball-milling method. With the structural advantages and the suitable K doping site, the K-doped Na<sub>3</sub>V<sub>2</sub>(PO<sub>4</sub>)<sub>2</sub>F<sub>3</sub> cathode exhibits enhanced sodium storage performance in terms of high specific capacity, excellent rate capability, and superior cycling stability.



## Enhancing sintering resistance of atomically dispersed catalysts in reducing environments with organic monolayers

Jing Zhang, Chithra Asokan, Gregory Zakem, Phillip Christopher\*, J. Will Medina\* ..... 1263

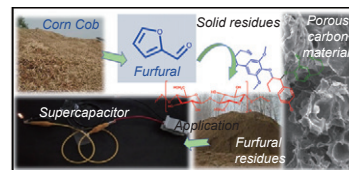
Methyl phosphonic acid monolayers suppress the migration of isolated Rh atoms on metal oxide supports, improving catalyst thermal stability under reducing conditions.



## Converting furfural residue wastes to carbon materials for high performance supercapacitor

Xiaoying Guo, Xusheng Zhang, Yingxiong Wang, Xiaodong Tian\*, Yan Qiao\* ..... 1270

Furfural residues-derived porous carbon with excellent electrochemical performance was prepared by changing components.

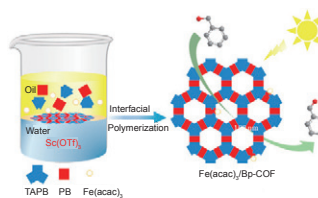


## Ferric acetylacetonate/covalent organic framework composite for high performance photocatalytic oxidation

Mingzhao Xu, Lifei Liu, Jianling Zhang\*, Fanyu Zhang, Gang Chen, Qiang Wan, Yufei Sha, Xiuyan Cheng, Zhuizhui Su ..... 1281

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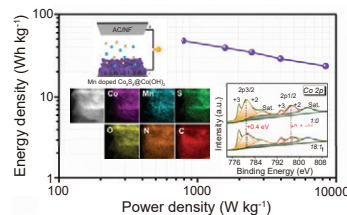
Here, we synthesized  $\text{Fe}(\text{acac})_3/\text{Bp-COF}$  composite photocatalyst in one step under mild conditions. Compared with Bp-COF, composite photocatalyst has facile preparation and exhibits highly improved light absorbance and transformation of photogenerated electron-hole pairs. The composite photocatalyst can efficiently convert benzyl alcohol into benzaldehyde under the condition of room temperature and air as oxidant without producing other by-products.



## Manganese doping to boost the capacitance performance of hierarchical $\text{Co}_9\text{S}_8@\text{Co}(\text{OH})_2$ nanosheet arrays

Lingxia Zheng, Weiqing Ye, Pengju Yang, Jianlan Song, Xiaowei Shi, Huajun Zheng\* ..... 1289

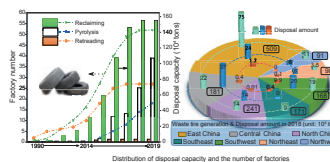
The introduction of Mg dopants endows tuned electronic structure of  $\text{Co}_9\text{S}_8@\text{Co}(\text{OH})_2$  nanosheets and enhanced interfacial activities as well as facilitated reaction kinetics, leading to ultrahigh capacity and outstanding long-term stability. The encouraging results might offer an effective strategy to optimize the electrodes for high-performance energy-storage devices.



## Disposal methods for used passenger car tires: One of the fastest growing solid wastes in China

Biaohua Chen, Dahai Zheng, Ruinian Xu\*, Shuai Leng, Lili Han, Qianqian Zhang, Ning Liu, Chengna Dai, Bin Wu, Gangqiang Yu, Jie Cheng ..... 1298

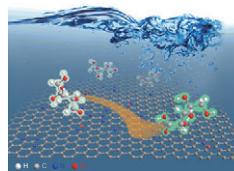
Waste tire generation and disposal methods in China were investigated. Tire retreading and tire rubber reclaiming had no longer sufficient to recycle those waste tires. Pyrolysis technology is regarded as a promising way to solve this fast increasing solid wastes.



## Biomass-based N doped carbon as metal-free catalyst for selective oxidation of D-xylose into D-xylonic acid

Zengyong Li, Yiming Huang, Xiao Chi, Di Li, Linxin Zhong, Xuehui Li, Chuanfu Liu\*, Xinwen Peng\* ..... 1310

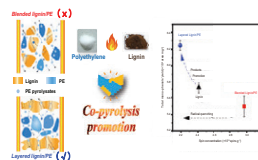
A defect-rich N doped carbon catalyst exhibits high catalytic activity for selective oxidation of D-xylose into D-xylonic acid. With graphitic N as the intrinsic active sites, D-xylonic acid yield of 57.4% could be obtained.



## A new perspective on polyethylene-promoted lignin pyrolysis with mass transfer and radical explanation

Yuyang Fan<sup>1</sup>, Chao Liu<sup>1</sup>, Xiangchen Kong, Yue Han, Ming Lei\*, Rui Xiao\* ..... 1318

Mass transfer and radical reactions together controlled the co-pyrolysis of lignin and PE. Good mass transfer in layered lignin/PE co-pyrolysis approach promoted the radical quenching reactions and favored the formation of lignin-derived phenols.

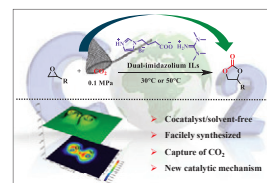


## Dual-ionic imidazolium salts to promote synthesis of cyclic carbonates at atmospheric pressure

Tengfei Wang, Danning Zheng, Beibei An, Yi Liu, Tiegang Ren, Hans Ågren, Li Wang\*, Jinglai Zhang\*, Mårten S.G. Ahlquist\*.....

1327

A novel dual-ionic imidazolium salt displays the excellent catalytic activity for cycloaddition of carbon dioxide and epoxides at ambient temperature and CO<sub>2</sub> pressure under solvent free conditions without any additional catalysts.

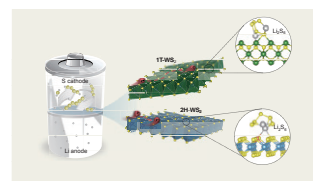


## Enhanced catalytic conversion of polysulfides using high-percentage 1T-phase metallic WS<sub>2</sub> nanosheets for Li-S batteries

Changyu Yang, Ning Gong, Tao Chen, Yang Li, Wenchao Peng, Fengbao Zhang, Xiaobin Fan\*.....

1340

The conversion mechanism of S on the surface of 1T-WS<sub>2</sub> and 2H-WS<sub>2</sub> in Li-S battery.

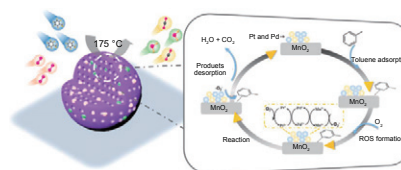


## Pt-Pd bimetallic nanoparticles anchored on uniform mesoporous MnO<sub>2</sub> sphere as an advanced nanocatalyst for highly efficient toluene oxidation

Jiaqin He, Dongyun Chen\*, Najun Li, Qingfeng Xu, Hua Li, Jinghui He, Jianmei Lu\*.....

1349

Uniform mesoporous MnO<sub>2</sub> nanosphere-supported bimetallic Pt-Pd nanoparticles were successfully fabricated using hard templates for the total catalytic degradation of volatile organic compounds at low temperature. The introduction of mesopores into the MnO<sub>2</sub> support induces a large specific surface area and pore size, thus providing numerous accessible active sites and enhanced diffusion properties. Moreover, the addition of a secondary noble metal can adjust the O<sub>ads</sub>/O<sub>latt</sub> molar ratios, resulting in high catalytic activity.

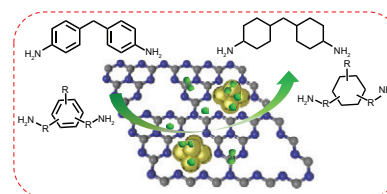


## Green and selective hydrogenation of aromatic diamines over the nanosheet Ru/g-C<sub>3</sub>N<sub>4</sub>-H<sub>2</sub> catalyst prepared by ultrasonic assisted impregnation-deposition method

Huanhuan Yang, Ligu Wang\*, Shuang Xu, Yan Cao, Peng He, Jiaqiang Chen, Zheng Zheng, Huiquan Li\*.....

1361

Nanosheet g-C<sub>3</sub>N<sub>4</sub>-H<sub>2</sub> was derived from thermal exfoliation of bulk g-C<sub>3</sub>N<sub>4</sub> under hydrogen atmosphere, then a green catalyst with ultrafine Ru species supported on the nanosheet g-C<sub>3</sub>N<sub>4</sub>-H<sub>2</sub> was prepared by facile ultrasonic assisted impregnation-deposition method and the Ru/g-C<sub>3</sub>N<sub>4</sub>-H<sub>2</sub>



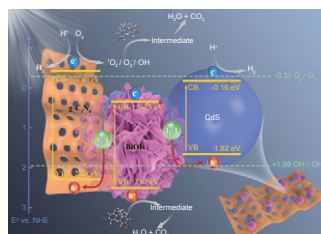


catalyst displayed excellent performance towards selective hydrogenation of aromatic diamines to alicyclic diamines without any alkaline additives.

## Double Z-Scheme g-C<sub>3</sub>N<sub>4</sub>/BiOI/CdS heterojunction with I<sub>3</sub><sup>-</sup>/I<sup>-</sup> pairs for enhanced visible light photocatalytic performance

Yan Zhang, Yixiao Wu, Liang Wan, Wenfeng Yang, Huijun Ding, Chongyang Lu, Weihao Zhang\*, Zipeng Xing\* ..... 1377

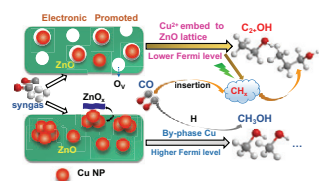
Double Z-Scheme g-C<sub>3</sub>N<sub>4</sub>/BiOI/CdS Heterojunction is fabricated through calcination, solvothermal and chemical bath deposition approaches, which exhibits excellent photocatalytic performances due to providing adequate surface active-sites, accelerating spatial charge separation, and enhancing visible light absorption.



## Electron promoted ZnO for catalytic synthesis of higher alcohols from syngas

Fang Li, Qian Zhang, Jing Liu, Nan Cui, Guoqing Guan, Wei Huang\* ..... 1390

The band structure and Fermi level of ZnO can be electronically-modulated by adjusting Cu doping amount achieving a higher fraction of straight chain higher alcohols from syngas, which promoted the donor reaction for the formation of key intermediates CH<sub>x</sub> species by enhancing thermally excited electron transfer.



## Ultrafast battery heat dissipation enabled by highly ordered and interconnected hexagonal boron nitride thermal conductive composites

Zhuoya Wang, Kaihang Zhang, Bing Zhang, Zheming Tong, Shulan Mao, Hao Bai, Yingying Lu\* ..... 1401

A h-BN/PW composite with ordered and interconnected thermal network derived from ice template combined freeze-drying method shows excellent heat dissipation performance in the application for heat dissipation management of battery.

