

# Green Chemistry

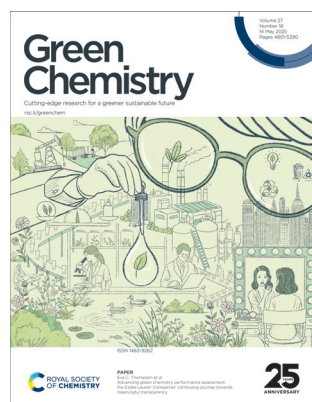
Cutting-edge research for a greener sustainable future

[rsc.li/greenchem](https://rsc.li/greenchem)

The Royal Society of Chemistry is the world's leading chemistry community. Through our high impact journals and publications we connect the world with the chemical sciences and invest the profits back into the chemistry community.

## IN THIS ISSUE

ISSN 1463-9262 CODEN GRCHFJ 27(18) 4801-5390 (2025)



### Cover

See Eva C. Thompson *et al.*, pp. 5015–5026.

Image reproduced by permission of Scientific Communications & Translational Media, The Estée Lauder Companies from *Green Chem.*, 2025, **27**, 5015.

Artwork by Keyue Zhang, Designer, Scientific Communications & Translational Media, The Estée Lauder Companies.



### Inside cover

See Kaige Wang *et al.*, pp. 5027–5039.

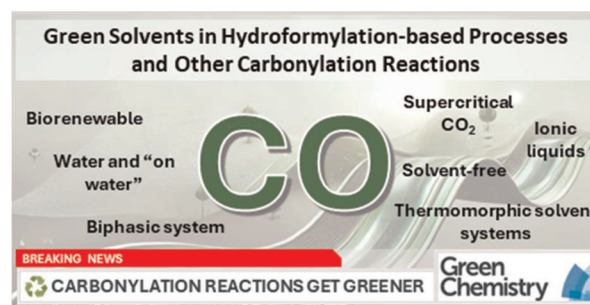
Image reproduced by permission of Kaige Wang from *Green Chem.*, 2025, **27**, 5027.

## CRITICAL REVIEWS

4816

### Green solvents in hydroformylation-based processes and other carbonylation reactions

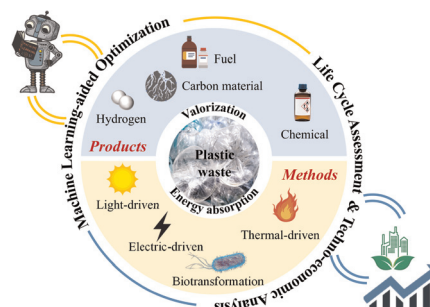
Fábio G. Delolo,\* Leandro D. Almeida, Gabriel M. Vieira, Eduardo N. dos Santos\* and Elena V. Gusevskaya\*



4867

### Sustainable thermochemical plastic valorization towards a circular economy: a critical review

Liang Chen, Can Zhao, Xiangzhou Yuan,\* Huiyan Zhang, Maheshika Senanayake, Ondřej Mašek, Chao He and Yong Sik Ok\*



**GOLD  
OPEN  
ACCESS**

# EES Batteries

**Exceptional research on  
batteries and energy storage**

Part of the EES family

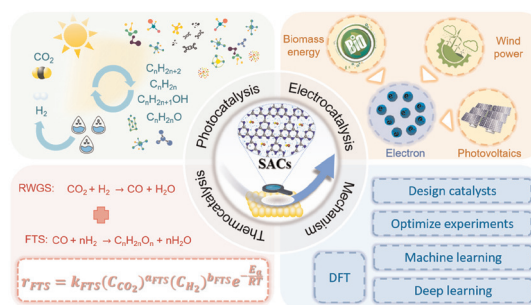
**Join  
in** | Publish with us  
[rsc.li/EESBatteries](https://rsc.li/EESBatteries)

## TUTORIAL REVIEWS

4898

### Machine learning-driven design of single-atom catalysts for carbon dioxide valorization to high-value chemicals: a review of photocatalysis, electrocatalysis, and thermocatalysis

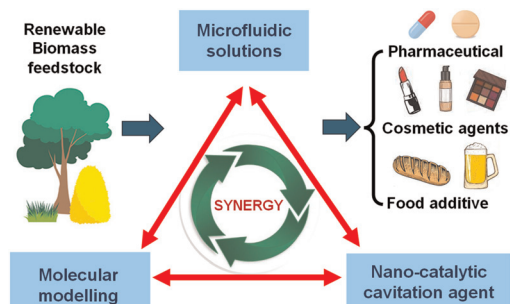
Xiangyu Wen, Xiao Geng, Guandong Su, Yizheng Li, Qidong Li, Yuxuan Yi and Lifan Liu\*



4926

### Sonochemistry and sonocatalysis: current progress, existing limitations, and future opportunities in green and sustainable chemistry

Quang Thang Trinh,\* Nicholas Golio, Yuran Cheng, Haotian Cha, Kin Un Tai, Lingxi Ouyang, Jun Zhao, Tuan Sang Tran, Tuan-Khoa Nguyen, Jun Zhang, Hongjie An, Zuojun Wei, Francois Jerome, Prince Nana Amaniampong\* and Nam-Trung Nguyen\*



4959

### Demystify the unique hydrogen spillover effect in electrocatalytic hydrogen evolution

Xiaodong Chen, Xiaofei Wei, Xingheng Zhang, Jianye Wang, Zhaojie Wang,\* Shuxian Wei, Siyuan Liu, Bo Liao, Zhe Sun\* and Xiaoqing Lu\*

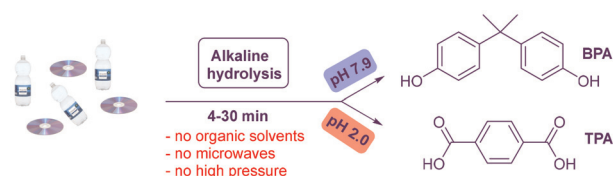


## COMMUNICATIONS

4986

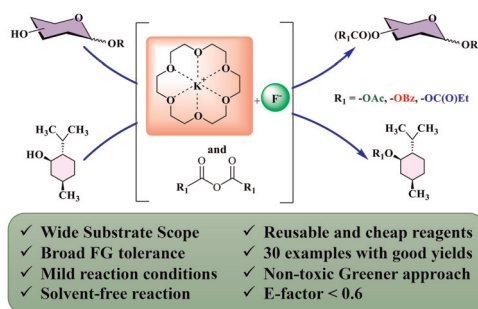
### Catalytic alkaline hydrolysis of PET and BPA-PC waste in minutes at atmospheric pressure without microwaves or organic solvents

Anshul Jain and Stephen J. Connon\*



## COMMUNICATIONS

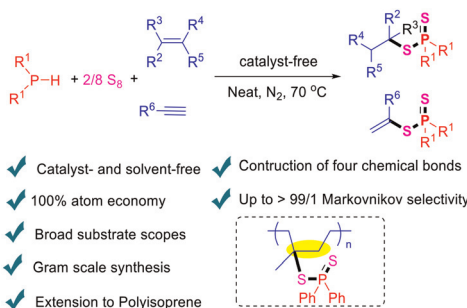
4995



## Supramolecular assisted O-acylation of carbohydrates

Soumyadip Dey, Debabrata Giri, Adrita Nandy and Abhijit Sau\*

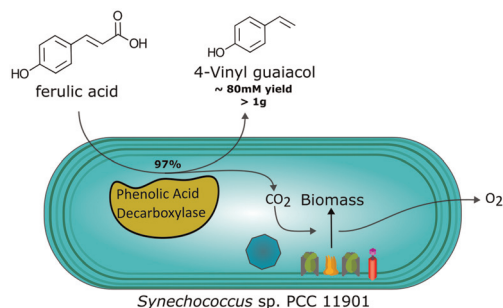
5001



## Catalyst- and solvent-free, atom- and step-economical synthesis of dithiophosphinates by one-pot domino introduction of sulfur atoms

Xiantao Ma,\* Xiaoyu Yan, Shangyuan Li, Xinyu Chen, Sifan Chen and Jing Yu

5007

Gram-scale production of 4-vinyl guaiacol in the fast-growing phototrophic cyanobacterium *Synechococcus* sp. PCC 11901

Thomas Rohr and Florian Rudroff\*

## PAPERS

5015



## Advancing green chemistry performance assessment: the Estée Lauder Companies' continuing journey towards meaningful transparency

Eva C. Thompson,\* Paul Anastas, Heidi Bialk, Deanna D'Alessandro, Voravee P. Hoven, Timothy J. Kedwards, Zhimin Liu, Anja-Verena Mudring, Kei Saito, Vânia Zuin Zeidler and George Daher

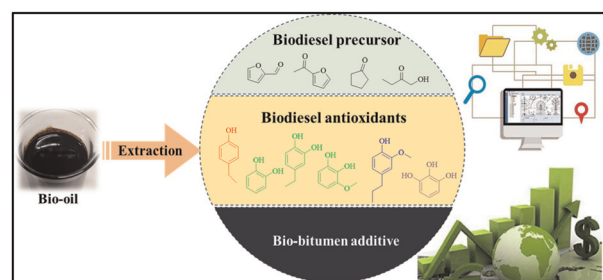


## PAPERS

5027

### Biochemicals to enable biorefining: a case study of polyphenol extraction from bio-oil for utilization as a biodiesel antioxidant

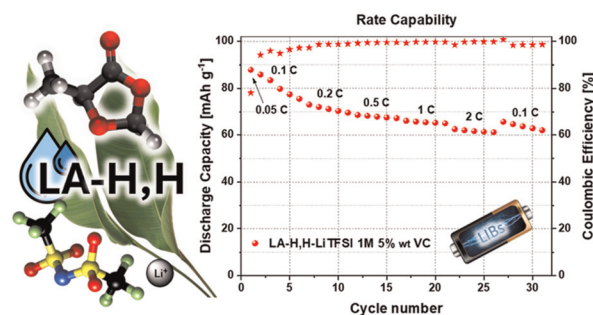
Xiaopeng Shi, Haotong Lin, Qi Ouyang, Guanqun Luo, Xianghong Lu, Jianbing Ji and Kaige Wang\*



5040

### A lactic acid dioxolane as a bio-based solvent for lithium-ion batteries: physicochemical and electrochemical investigations of lithium imide-based electrolytes

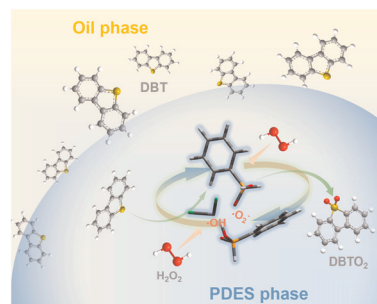
Massimo Melchiorre, Khai Shin Teoh, Juan Luis Gómez Urbano, Francesco Ruffo\* and Andrea Balducci\*



5051

### Tuning the electronic structure of phosphonic acid-based deep eutectic solvents for synergistic catalytic oxidative desulfurization

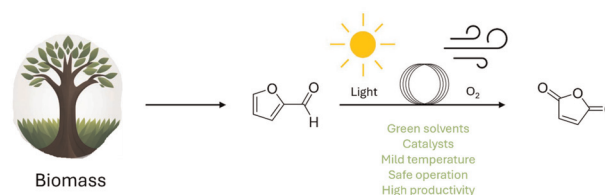
Lixian Xu, Jie Yin, Dongao Zhu, Beibei Zhang, Linhua Zhu, Hongping Li, Jing He, Huaming Li and Wei Jiang\*



5063

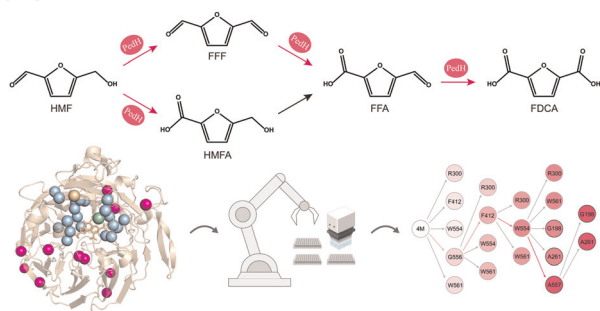
### Efficient continuous flow oxidation of furfural to maleic anhydride using O<sub>2</sub> as a green oxidant

Jonas Mortier, Christian V. Stevens and Thomas S. A. Heugebaert\*



## PAPERS

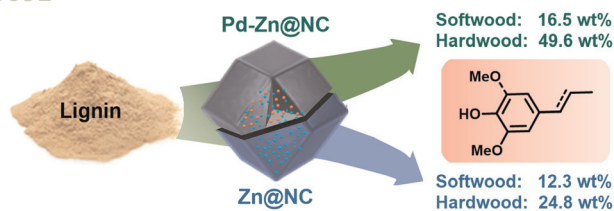
5073



### Sequential single-enzyme oxidation of 5-hydroxymethylfurfural to 2,5-furandicarboxylic acid by an engineered lanthanide-dependent alcohol dehydrogenase

Ke Liu, Ling Jiang, Lun Wang, Qunfeng Zhang, Lirong Yang, Jianping Wu and Haoran Yu\*

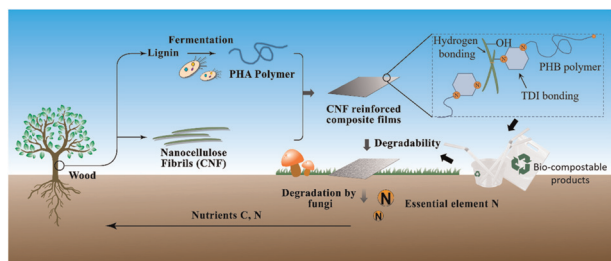
5091



### Insights into the reductive catalytic deconstruction of lignin over ultralow-loading palladium–zinc catalysts derived from zinc imidazolate frameworks

Yi-Hui Lv, Qiang Wang,\* Wen-Zheng Yin, Xue-Jie Gao, Ling-Ping Xiao\* and Run-Cang Sun\*

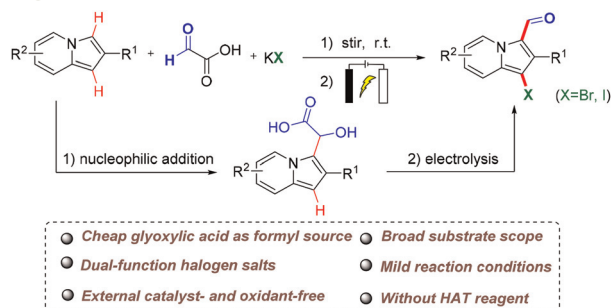
5104



### Integrated design of multifunctional reinforced bioplastics (MReB) to synergistically enhance strength, degradability, and functionality

Jinghao Li, Wei Liu, Alex Chang, Zachariah Foudeh, Jiali Yu, Peiran Wei, Kainan Chen, Cheng Hu, Dhatt Puneet, Susie Y. Dai\* and Joshua S. Yuan\*

5119



### Electrochemical difunctionalization of indolizines with glyoxylic acid and halide salts

Chenglong Feng, Xin Liu, Peipeng Zhang, Meichao Li\* and Zhenlu Shen\*

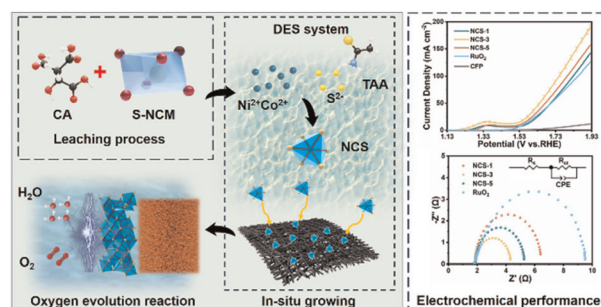


## PAPERS

5126

## Efficient metal recovery and electrocatalyst fabrication from spent lithium-ion batteries via green solvent extraction

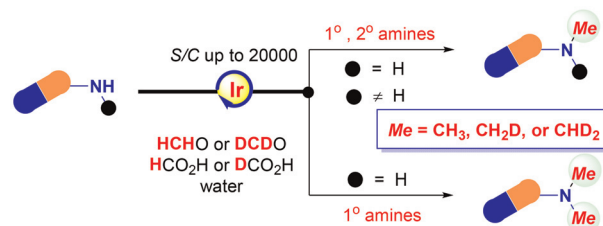
Mingfei Chen, Yaping Wang,\* Yixin Zhou, Bin Guo, Li Wang and Jinsheng Liang\*



5136

Iridium-catalyzed *N*-methylation of drug molecules

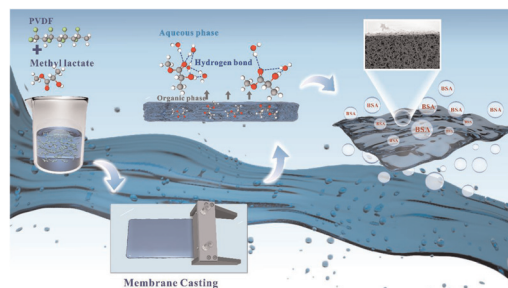
Yujie Zhang, Kangjia Zhang, Jiayi Xu and Zhanhui Yang\*



5149

## Fabrication of PVDF ultrafiltration membranes with methyl lactate: enhancing performance through green solvent practices

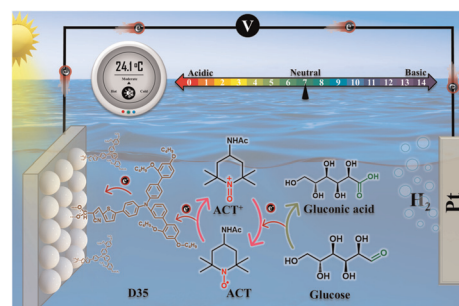
Manyao Zhu, Deyi Han, Shujuan Yang,\* Yong Zhang\* and Haichuan Zhang\*



5163

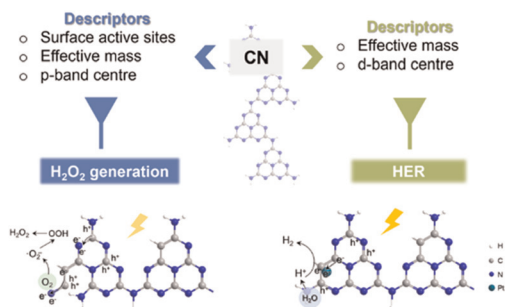
## Selective oxidation of glucose to gluconic acid in aqueous media using dye-sensitized photoelectrochemical cells

Muhammad Zain Qamar, Hyeong Cheol Kang, Francis Kwaku Asiam, Raghisa Shahid, Muhammad Sadiq, Ashok Kumar Kalamurthy and Jae-Joon Lee\*



## PAPERS

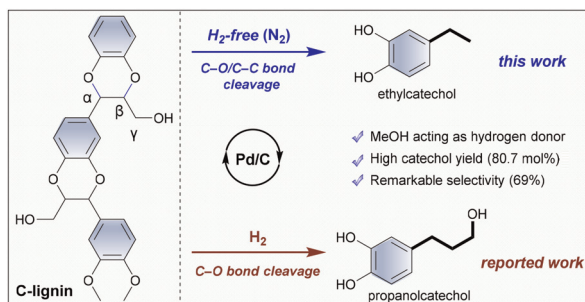
5171



### Descriptor-driven design of carbon nitride for visible light photocatalysis

Xuying Li, Haoxin Mai,\* Tsuyoshi Takata, Nicholas Cox, Qi Li, Junlin Lu, Xiaoming Wen, Edwin L. H. Mayes, Salvy P. Russo, Takashi Hisatomi, Kazunari Domen, Dehong Chen\* and Rachel A. Caruso\*

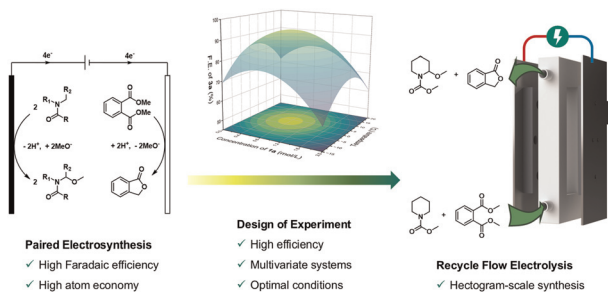
5184



### Selective catalytic depolymerisation of C-lignin into ethylcatechol using commercial Pd/C under hydrogen-free conditions

Xuening Li, Shuizhong Wang\* and Guoyong Song

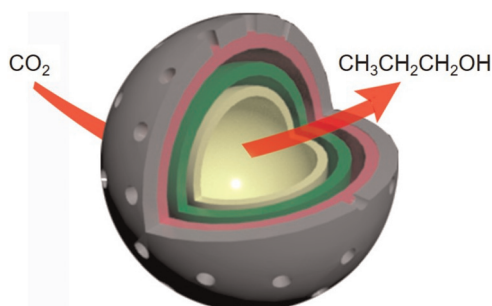
5193



### Pairing Shono-type electro-oxidation with the electro-reduction of dimethyl phthalate in a recycle flow reactor

Zonghan Li, Chaoren Shen and Kaiwu Dong\*

5202



### Multi-layered CuO/SiO<sub>2</sub> core-shell structure improves electrocatalytic CO<sub>2</sub>-to-*n*-propanol conversion

Sha Wang, Jiangling Zhang,\* Yingzhe Zhao, Jiajun Zhong, Zhongjun Chen, Yisen Yang, Buxing Han, Yongxin Cheng, Meiling Li and Qian Li

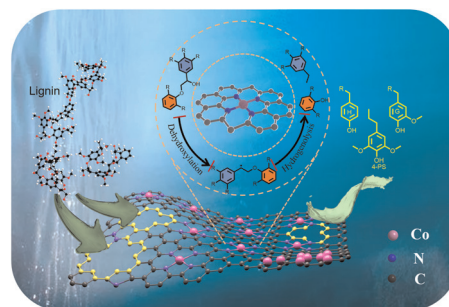


## PAPERS

5210

### Selective hydrogenolysis of lignin over hierarchical CoNC catalysts for the sustainable production of 4-propylsyringol

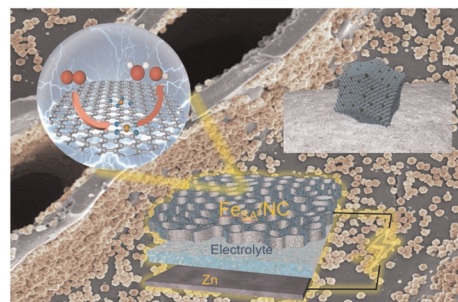
Mengqiao Gao, Yun Tian, Sijie Liu,\* Wanying He, Xinjun He, Kejia Wu, Jinxing Long, Qiang Zeng and Xuehui Li\*



5224

### Highly active Fe–N<sub>4</sub> sites confined in ordered carbon nanotube arrays as a self-supporting cathode catalyst for oxygen conversion

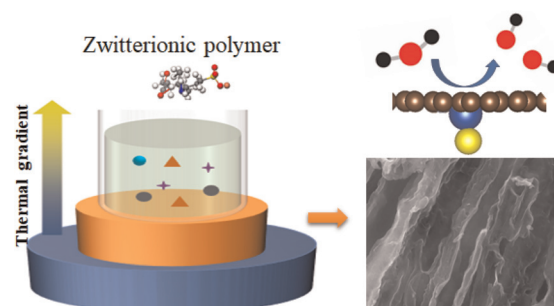
Shuling Liu, Tongjun Li, Guozheng Dong, Xinao Wei, Keke Zhao, Bangan Lu, Yu Chen, Yanyan Liu,\* Jianchun Jiang and Baojun Li



5236

### Zwitterionic polymer-assisted asymmetrically coordinated Cu atoms on aligned carbonous microchannels for efficient electroreduction of CO<sub>2</sub> to CO

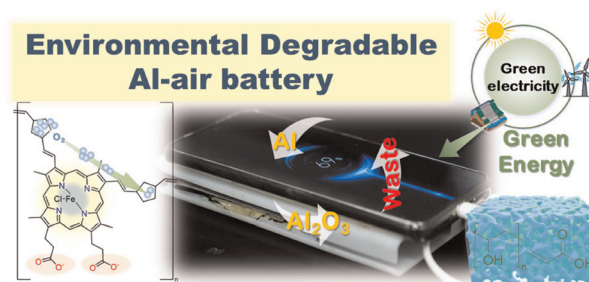
Congwei Wang,\* Kun Zhang, Xiaoxiang Zhang, Jianmei Wang, Xinglin Luo, Gang Li and Kaiying Wang



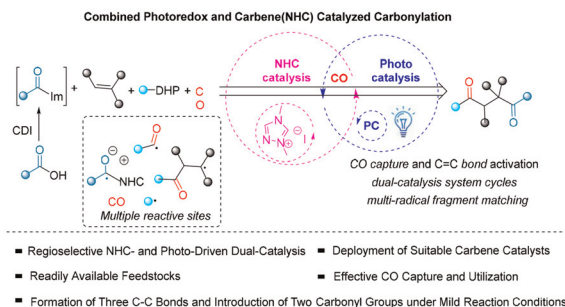
5246

### An environmentally degradable Al–air battery to realize future green energy–matter flow

Jinrui Li, Yunhao Xu, Senlin Wei, Cheng Tong,\* Minhua Shao, Cunpu Li\* and Zidong Wei



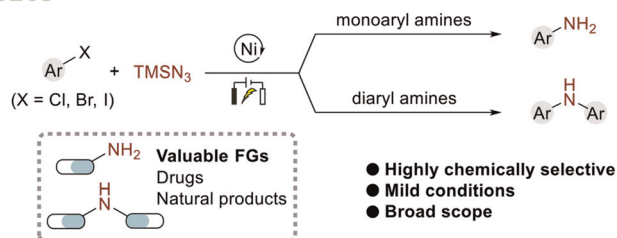
5257



### N-Heterocyclic carbene-/photoredox-catalyzed regioselective carbonylation of alkenes

Mao-Lin Yang and Xiao-Feng Wu\*

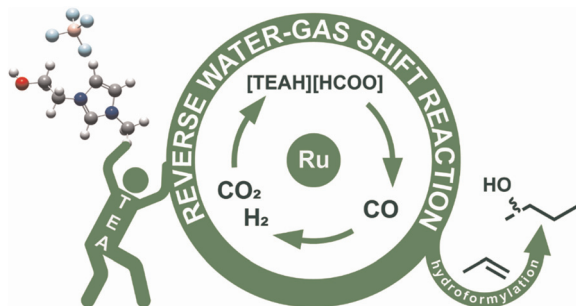
5265



### Electrochemically enabled nickel-catalyzed controllable synthesis of monoaryl or diaryl amines from aryl halides and trimethylsilyl azides

Jiawei Huang, Xiaoman Li, Xue Zhao, Yu Wei\* and Liang Xu\*

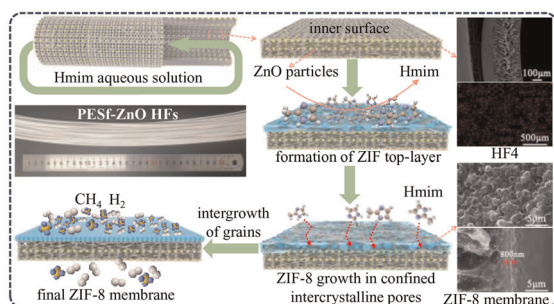
5273



### A highly efficient ruthenium catalytic system for the direct synthesis of butanol from propylene and CO<sub>2</sub>: a low-temperature reverse water–gas shift route

Chenfei Yao, Boyu Zhu, Peng Zheng and Xingbang Hu\*

5282



### Green *in situ* synthesis of ZIF-8 membranes on the inner-surface of PESf hollow fibers and application in hydrogen separation

Yifan Yang, Tengfei Yang, Lu Liu, Hanhan Chen, Wenxiu Zhang, Shaomin Liu and Xiaobin Wang\*

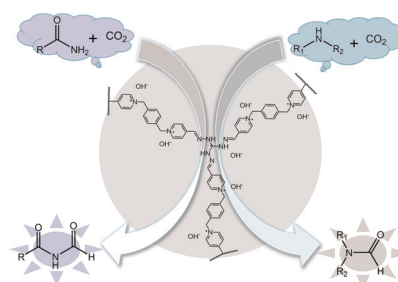


## PAPERS

5295

### An ionic porous organic polymer gel with hydroxide anions as an efficient catalyst for *N*-formylation of amines and amides with carbon dioxide

Jie Xu, Di Chen, Zhaobin Ye, Shasha Ma, Yuanlong Wang and Jianyong Zhang\*

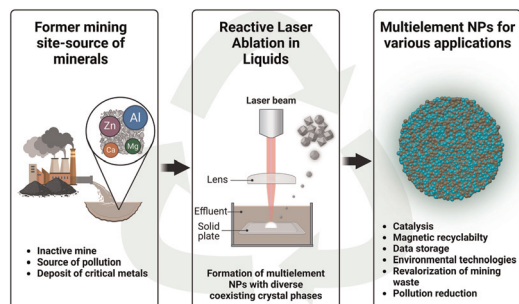


Metal-free ionic porous organic polymer gel catalyst

5303

### Reactive laser ablation in liquids as a promising approach for repurposing effluents from former mining sites

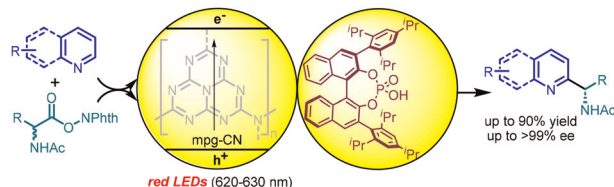
Rafael Torres-Mendieta,\* Sabrin Abdallah, Miguel Angel Ruiz-Fresneda, Mohamed L. Merroun and Miroslav Černik



5315

### Red-light-driven enantioselective Minisci-type addition to heteroarenes via recyclable semi-heterogeneous catalysis

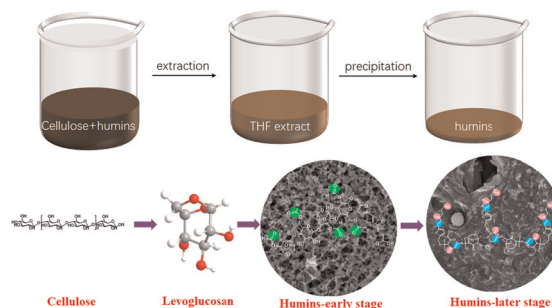
Yajun Sun, Geyang Song, Yonggang Yan, Tengfei Kang,\* Jiayang Dong, Gang Li and Dong Xue\*



5322

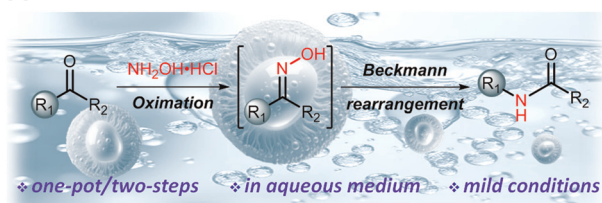
### Evolution process of humins derived from cellulose by a humin extraction approach

Xianda Li, Zhongping Shao, Haozhe Shan and Li Liu\*



## PAPERS

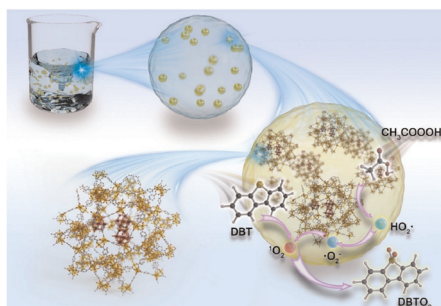
5332



### One-pot oximation-Beckmann rearrangement under mild, aqueous micellar conditions

Maryam Nabi, Kirti Sharma, Raj S. Wandre and Amol B. Gade\*

5340

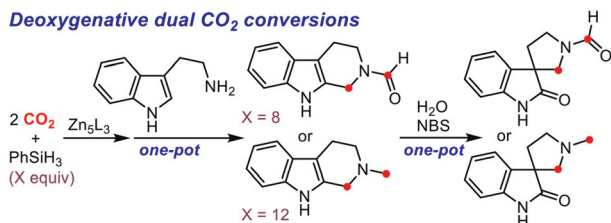


### Design of a cage–core–chain structure catalyst for deep catalytic oxidative desulfurization with enhanced substrate enrichment

Ran Liu, Chang Wang, Xiangxiang Gao, Chen Liu, Jianmin Lv, Yusheng Zhang, Xinying Liu, Ndzonelelo Bingwa, Yali Yao\* and Fa-tang Li\*

5359

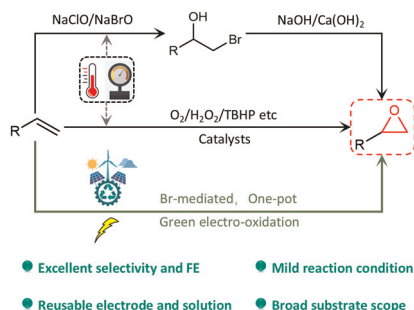
#### Deoxygenative dual CO<sub>2</sub> conversions



### Deoxygenative dual CO<sub>2</sub> conversions: methylation and switchable *N*-formylation/*N*-methylation of tryptamines

Kazuto Takaishi,\* Hajime Morishita, Kosuke Iwaki and Tadashi Ema\*

5366



### Highly efficient electro-epoxidation of olefins coupled with bromine recycling

Haoqiong Zhu, Menglu Cai,\* Xiaozhong Wang and Liyan Dai\*

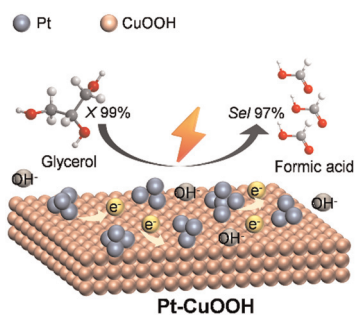


## PAPERS

5376

### Construction of a $\text{Cu}^{3+}\text{-OH-Pt}$ interface for enhancing glycerol electrooxidation coupled with hydrogen evolution

Kaiwei Meng, Ziyi Fan, Huiming Wen, Yujie Hu,\*  
Wenjun Zhang\* and Zupeng Chen\*



## CORRECTION

5388

### Correction: Chitosan-based inks for 3D printing and bioprinting

Mohsen Taghizadeh, Ali Taghizadeh, Mohsen Khodadadi Yazdi, Payam Zarrintaj, Florian J. Stadler, Joshua D. Ramsey, Sajjad Habibzadeh, Somayeh Hosseini Rad, Ghasem Naderi, Mohammad Reza Saeb, Masoud Mozafari\* and Ulrich S. Schubert\*

