

Green Chemistry

Cutting-edge research for a greener sustainable future

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 28(1) 1–596 (2026)



Cover

See Javier Pérez-Ramírez et al., pp. 174–185.

Image reproduced by permission of Javier Pérez-Ramírez from *Green Chem.*, 2026, **28**, 174.

Cover artwork created by Constance Ko, Antonio J. Martín, and Javier Pérez-Ramírez.



Inside cover

See Eun Yeol Lee et al., pp. 21–36.

Image reproduced by permission of Eun Yeol Lee from *Green Chem.*, 2026, **28**, 21.

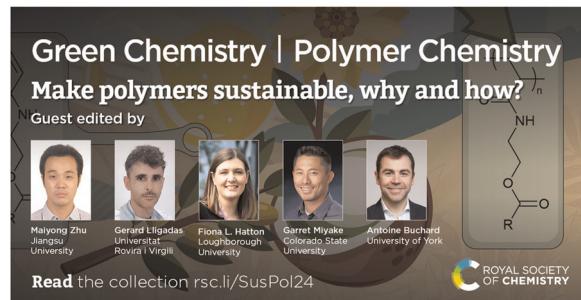
Cover image generated with Adobe Firefly.

EDITORIAL

17

Introduction to "Make polymers sustainable, why and how?"

Maiyong Zhu,* Gerard Lligadas, Fiona L. Hatton, Garret Miyake and Antoine Buchard

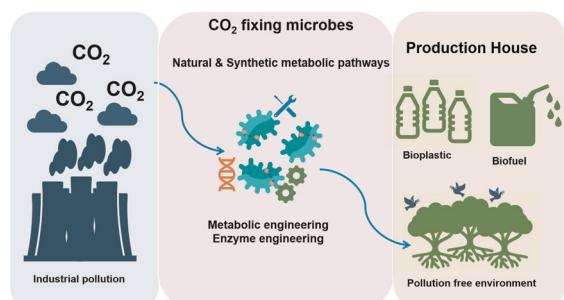


TUTORIAL REVIEWS

21

Recent advancements in microbial carbon dioxide fixation: metabolic engineering strategies

Zeehan Mustafa, Naeem Auroona, Arslan Sarwar and Eun Yeol Lee*



EES Batteries

**Exceptional research on
batteries and energy storage**

Part of the EES family

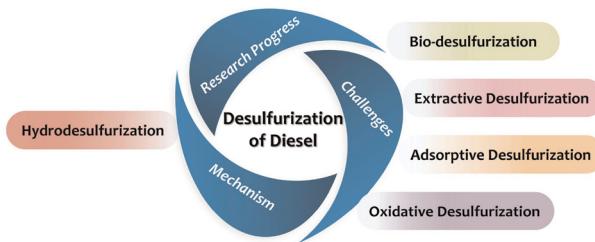
**Join
in** | Publish with us
rsc.li/EESBatteries

TUTORIAL REVIEWS

37

Green pathways to low-sulfur diesel: advances and challenges in desulfurization technologies

Peiwen Wu,* Shaojie Ma and Wenshuai Zhu*



96

Tandem depolymerization-electrocatalysis for plastic waste upcycling

Yingxin Ma, Mingzhu Han, Yufeng Qian, Dan Xing, Jizhe Ma, Yadong Yu, Bocheng Qiu* and Yu Zhang*

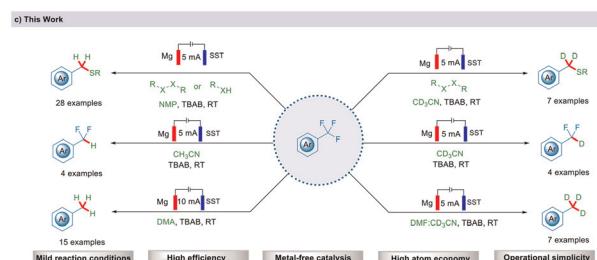


COMMUNICATIONS

120

Electrochemical metal-free functionalization of ArCF_3 : efficient construction of C–S, C–Se, C–D, C–H, and C–C bonds

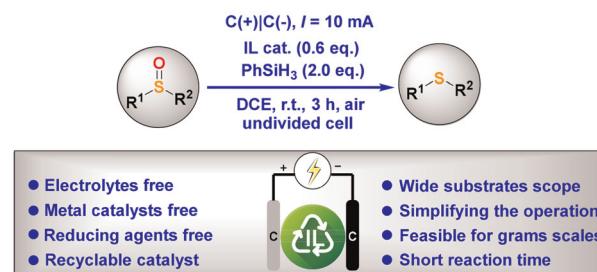
Zhimin Xu, Zonghao Zhou, Xiaochen Wang, Yuxia Yang, Yi Pan and Yi Wang*



132

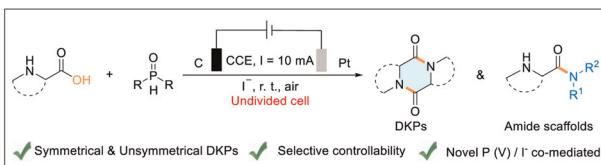
Electrochemical reduction of sulfoxides to thioethers with hydrosilanes catalyzed by a recyclable ionic liquid

Zhaoxin Wei, Ziren Chen, Fei Xue, Bin Wang, Yu Xia, Shaofeng Wu, Yonghong Zhang, Weiwei Jin, XueFeng Jiang* and Chenjiang Liu*



COMMUNICATIONS

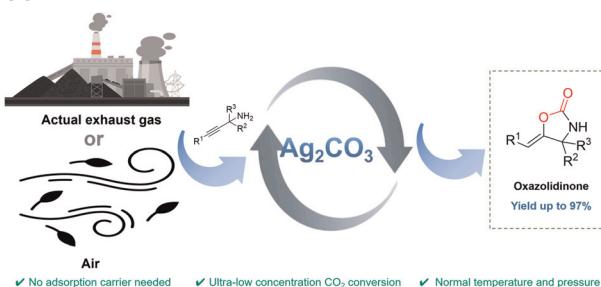
138



Divergent electrosynthesis of diketopiperazines and amides

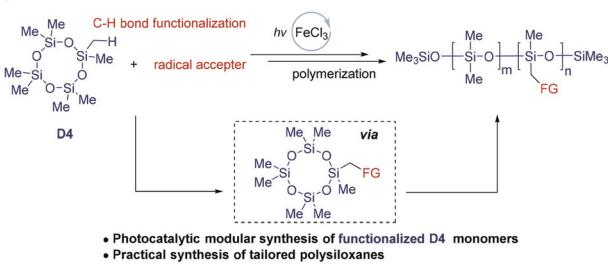
An-Li Long, QiuHong Liang, JianJing Yang, ZiPing Cao, Kelu Yan, Dan Wang* and Jiangwei Wen*

144

Carrier-free silver carbonate catalysis: *in situ* conversion of low-concentration CO_2 in air and actual exhaust gas to oxazolidinones

Pei-Bo Chen, Wang Chen, Jia-Wen Yang, Chan-Cui Wu, Hai-Tao Tang, Ying Liang* and Ying-Ming Pan*

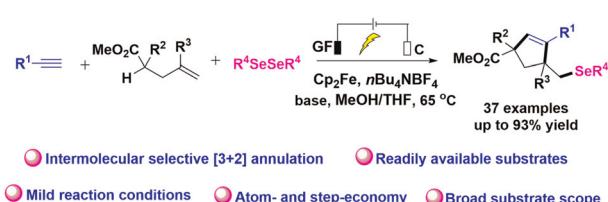
154



Photocatalytic modular synthesis of functionalized cyclotetrasiloxane (D4) monomers toward tailored polysiloxanes

Shaowei Chen, Zhiqiang Fang, Xiaoqian He, Qi Jia, Yanchuan Zhao and Xiao Shen*

159



An electrocatalytic three-component cyclization reaction: synthesis of selenium-containing cyclopentenes via intermolecular selective [3 + 2] annulation of terminal alkynes, unsaturated propionates, and diselenides

Zu-Yu Mo, Yi Zhang, Xin-Yu Tang, Lei Gao, Ying-Ming Pan, Mu-Xue He* and Xian-Li Ma*

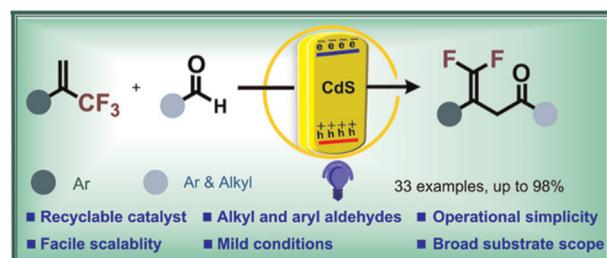


COMMUNICATIONS

166

Visible light-driven heterogeneous semiconductor CdS photocatalyzed defluorinative acylation reaction for the synthesis of γ,γ -difluoroallylic ketones

Kashif Hussain, Fukai Xie and Wen Dai*

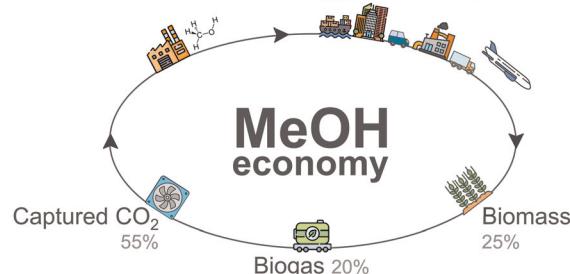


PAPERS

174

A feasible methanol economy for a green future

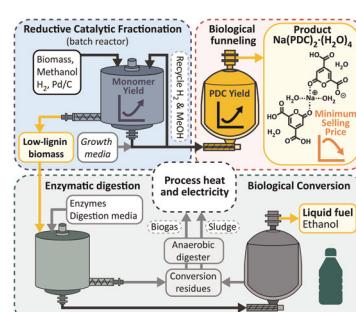
Hidde Kolmeijer, Abhinandan Nabera, Antonio J. Martín, Gonzalo Guillén-Gosálbez* and Javier Pérez-Ramírez*

Net-zero in 2050 • 32 USD₂₀₂₅ per person per month

186

Integrating catalytic fractionation and microbial funneling to produce 2-pyrone-4,6-dicarboxylic acid and ethanol

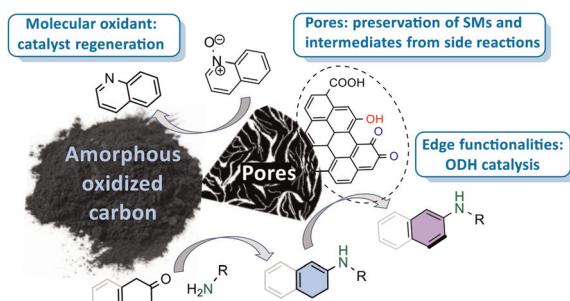
Canan Sener,* Emmanuel A. Aboagye, Steven D. Karlen, Jose M. Perez, German E. Umana, Yaoping Zhang, José Serate, Timothy J. Donohue, Daniel R. Noguera and Christos T. Maravelias



199

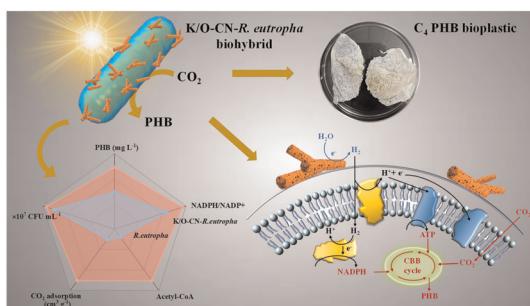
Cascade synthesis of diarylamines catalyzed by oxygen-rich and porous carbon

Anna Lenarda,* Itisha Jain, Aleksi Kaleva, Valtteri Oksanen, Sami Heikkilä, Risto Koivula, Tom Wirtanen, Michele Melchionna, Tao Hu and Juho Helaja*



PAPERS

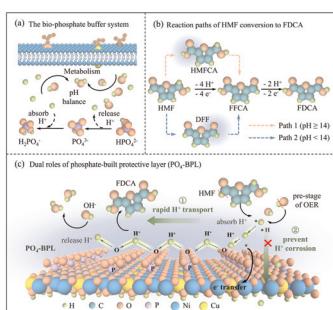
213



Low indoor light-driven CO_2 conversion into visible C_4 bioplastic *via* homogeneous non-metal-based biohybrids under photoexcitation

Wenjing Wang,* Mingzhi Zhang, Meng Guo, Jiaxin Wang, Xuelian Wang, Jianheng Yin, Liang Chen and Yaguang Lin*

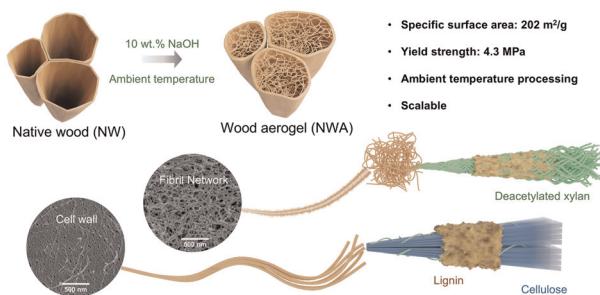
225



Rapid proton transport through a bio-inspired PO_4 -built protective layer for stabilizing 5-hydroxymethylfurfural conversion at high current densities

Wei Ji, Wenjie Zhang, Chen Deng,* Yuwei Xiong, Qi Hao, Hao Zhang, Bing Song, Wenlei Zhu, Dekui Shen, Jason Chun-Ho Lam* and Richen Lin*

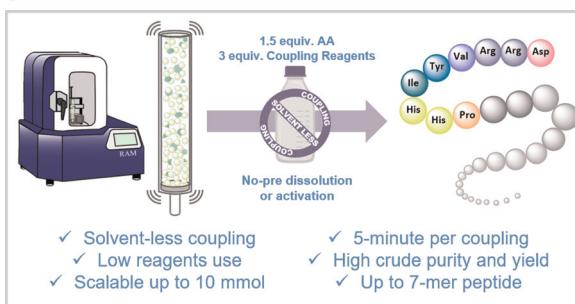
242



Green and efficient cell wall nano-reconstruction under ambient temperature towards strong cellulosic aerogels

Xiaoying Xu, Arezu Sehati, Lukas Marcos Celada, Peter Olsén, Lars Berglund and Yuanyuan Li*

255



Resonant acoustic mixing enables solvent-less amide coupling in solid-phase peptide synthesis

Alice Nanni, Panayiotis Bilalis and Magnus Rueping*



PAPERS

264

Solvent-less environmentally benign amino ester, amide, and peptide synthesis enabled by resonant acoustic mixing

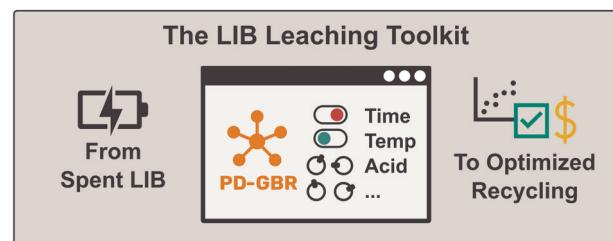
Nassim Maarouf-Mesli, Justin Desjardins-Michaud, Zeynab Imani, Kinshuk Ghosh, Felix Polyak* and William D. Lubell*



277

An applied machine learning framework for waste lithium-ion battery leaching with integrated preliminary environmental and economic assessment

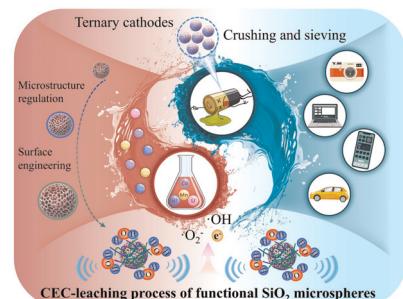
André Nogueira, Filipe H. B. Sosa, Ana C. Dias, João A. P. Coutinho and Nicolas Schaeffer*



295

A green and efficient strategy for leaching critical metals from spent $\text{LiNi}_x\text{Co}_y\text{Mn}_z\text{O}_2$ cathodes: modulating the dielectric SiO_2 contact-electrocatalytic activity

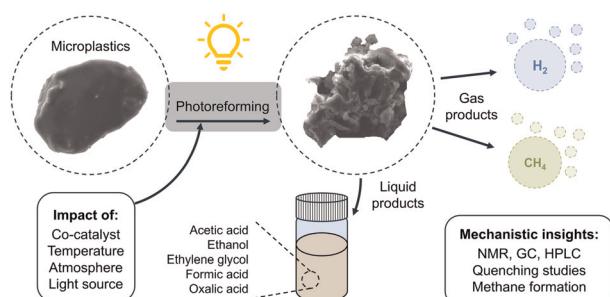
Man Yang, Shuhao Qin,* Youchang Yang, Mingmi Wu, Ting Lei, Yufei Liu and Huiju Shao*



309

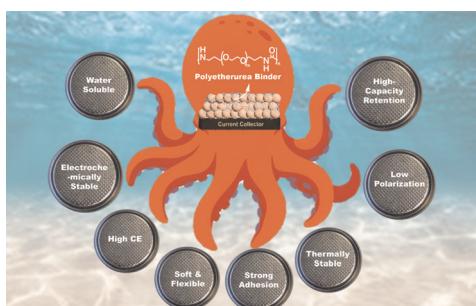
Photocatalytic upcycling of PET into methane, hydrogen and high-value liquid products

Madeline Weisweiller, Adrian Ertl, Cornelia von Baeckmann, Anil Kumar Sihag, Christian M. Pichler, Freddy Kleitz, Dominik Eder and Alexey Cherevan*



PAPERS

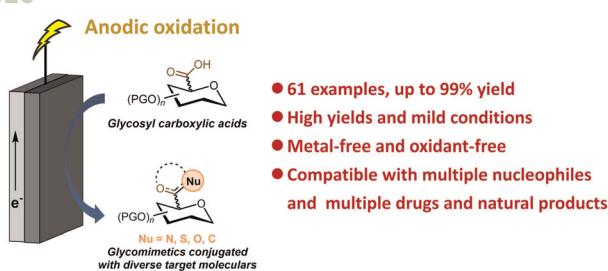
318



Polyetherureas as aqueous binders for Li ion batteries

Garima Saini, Mei Jun Tan, Maximillian G. Stanzione, Ketan Pancholi, Harini Sampathkumar, Matthew Walker, Charlie Patterson, Massimo Vassalli, Aaron B. Naden, Oxana V. Magdysyuk, Jiyu Tian, A. Robert Armstrong* and Amit Kumar*

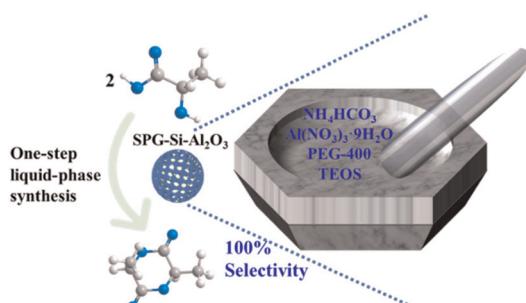
326



An electrochemically promoted modular synthesis of diverse glycomimetics via acyloxyphosphonium ions

Yi-Min Jiang, Cheng-Lin Ding, Guizhen Zhang, Hongbao Sun* and Jie Liu*

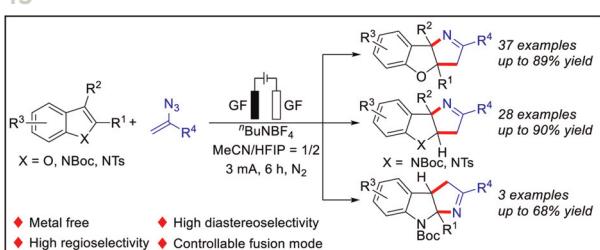
336



Si-doped γ -Al₂O₃ from solid-phase grinding for highly efficient one-step production of L,L-lactide

Min-Min Wang, Hong Guo, Zheng-Wu Wang, Yu-Quan Yan, Yi-Zhou Zhu* and He-Fang Wang*

343



Linear paired electrolysis enabled dearomatic [3 + 2] cycloadditions of indoles and benzofurans with vinyl azides

Shaoxiong Yang, Yanren Zhu, Enfan Pu, Piaopiao Jiang, Xiong Li, Hongbin Zhang* and Jingbo Chen*



PAPERS

351

Lithium extraction from spinel LiMn_2O_4 with simultaneous preparation of $\lambda\text{-MnO}_2$ under mild conditions using sodium hypochlorite

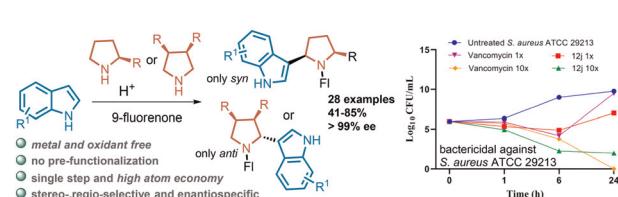
Yanhui Kong, Yutaro Takaya, Mauricio Córdova-Udaeta and Chiharu Tokoro*



365

Metal-free stereoselective $\text{C}(\text{sp}^3)\text{-H}$ indolation of N -heterocycles to potent antimicrobial non-canonical tryp–pro hybrids

Subhajit Saha, Soumya Ranjan Bag, Abdul Akhir, Deepanshi Saxena, Rahul Maitra, Sidharth Chopra* and Chandan K. Jana*



375

Bi-doped directional spin-polarised electron injection modulates MBene surface d–d coupling to promote nitrogen reduction kinetics

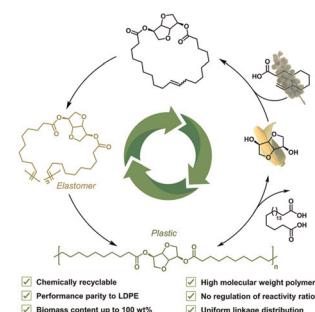
Kun Cheng, Shaobin Li,* Qingyu Cheng, Li Zhang,* Yufeng Jiang, Fengbo Li and Xiaoqing Lv



387

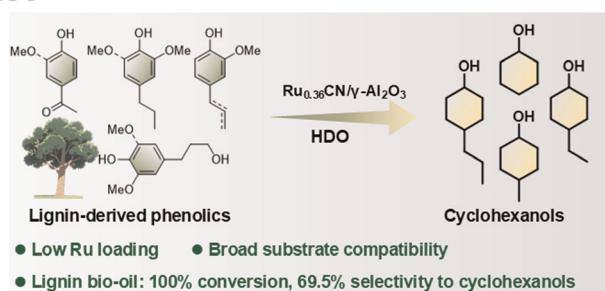
Chemically recyclable, fully biobased polyolefins with performance parity to low-density polyethylene

Wei Sun, Yuzhe Pang, Yucheng He, Zhenyang Luo, Puyou Jia,* Yonghong Zhou* and Ye Sha*



PAPERS

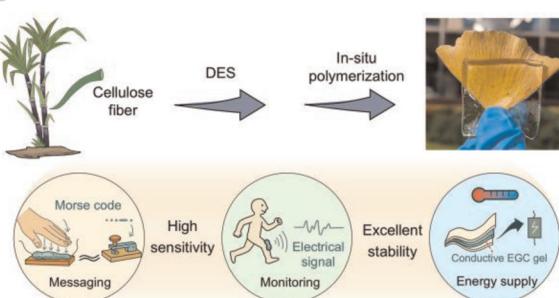
396



Selective hydrodeoxygenation of lignin phenolics to cyclohexanols over low-Ru catalysts

Rumin Ma, Xueying Gao, Xiancheng Li, Shuizhong Wang* and Guoyong Song*

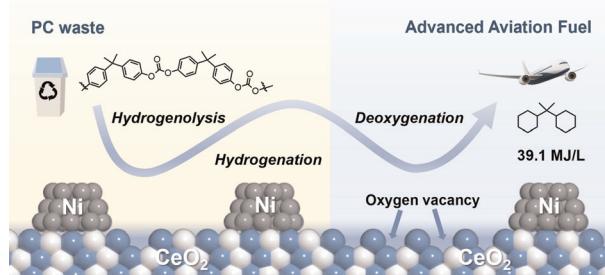
405



Eco-designed cellulose-reinforced deep eutectic gels with synergistic mechanical strength, ionic conductivity, and freezing tolerance for flexible electronics

Xiangyu Lin, Jie Li, Fei Fu, Ziming Zhu, Yuandong Xu,* He Liu* and Xu Xu*

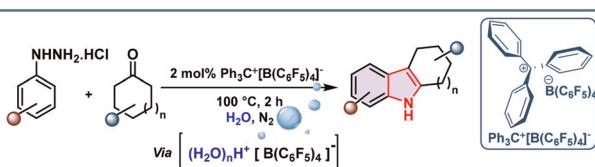
415



Chemical recycling of polycarbonate waste into advanced aviation fuel candidates via nickel–oxygen vacancy dual sites

Yushuang Huang, Jiawei Xie,* Yisong Zhou, Qianqian Song, Yuan Lei, Chang-an Zhou, Chao Wang, Kui Ma, Lei Song, Hairong Yue and Ji-Jun Zou

424



- Superacidic Bronsted acid precatalyst
- Natural product scaffolds
- Aqueous conditions
- Non-Metal mediated approach
- First report ion-pair-catalyzed Fischer indole synthesis
- Metal-free & Aqueous conditions
- Structurally diverse library
- Sustainability toolbox
- Operational simplicity
- 45 examples from good to excellent yields of carbazole derivatives

An ion-pair as a superacidic precatalyst for the synthesis of indole alkaloids: a novel entry into the Fischer indole synthesis

Pooja Sivaganesan, Chibisree Elanchezhian, Diksha Bansal, Mrinal Kanti Das* and Saikat Chaudhuri*

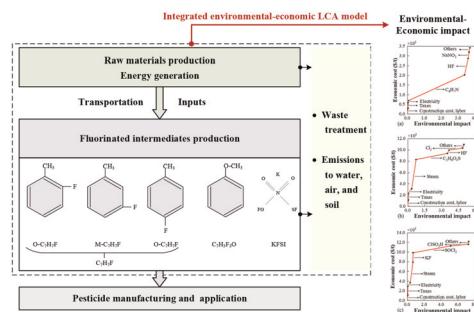


PAPERS

433

Exploring the environmental and economic performance of fluorinated intermediates in pesticide manufacturing: a life cycle assessment perspective

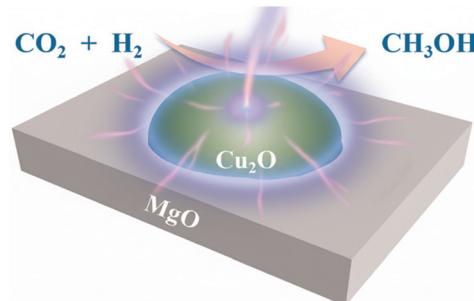
Yunzhi Zhao, Tianzuo Zhang, Jinglan Hong, Ruiqi Jin and Xiaotian Ma*



447

CO_2 hydrogenation to CH_3OH promoted by strong $\text{Cu}_x\text{O}-\text{MgO}$ interactions and non-thermal plasma under mild conditions

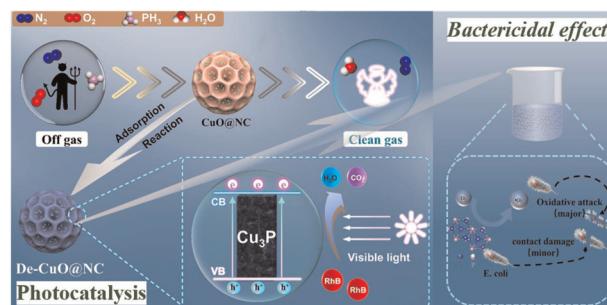
Qian Chen, Shengyan Meng, Xiaohan Zhai, Li Wang, Zhaolun Cui, Dongxing Li, Chuang Li, Chong Peng and Yanhui Yi*



461

Low-temperature purification of phosphine (PH_3) using $\text{CuO}@\text{NC}$ sorbents: simultaneous pollutant removal and Cu_3P resource recovery

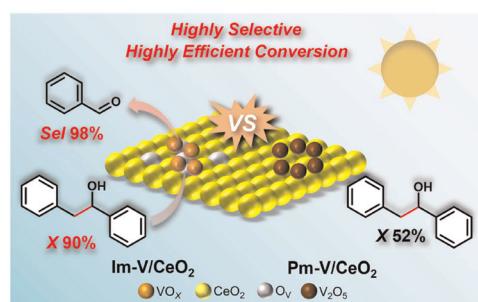
Zhongxian Wang, Jiuyang He, Jiayu Feng, Chaoyang Peng, Can Niu, Yixing Ma, Xin Sun, Fei Wang,* Lian Wang,* Ping Ning and Kai Li*



471

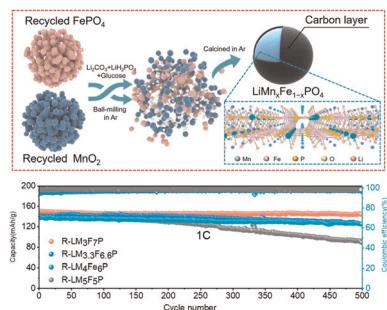
Engineering oxygen vacancies on ceria via vanadium oxide dispersion for selective photocatalytic cleavage of lignin C–C bonds

Yongqi Zhuang, Yuguo Dong, Yanmei Zheng, Wenjun Zhang, Lin Dong and Zupeng Chen*



PAPERS

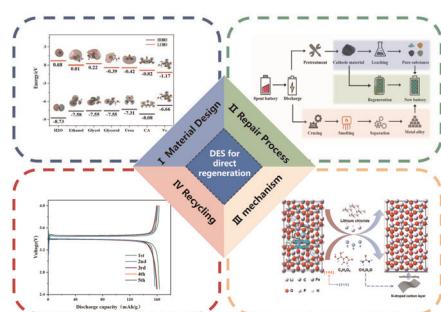
483



Upcycling lithium extraction by-products from spent lithium-ion batteries into high-voltage polyanionic $\text{LiMn}_x\text{Fe}_{1-x}\text{PO}_4$

Fan Xiao, Lehan Zhu, Zhangjun Wu, Haotian Zhu, Juan Xia, Jiannan Zhu,* Zeheng Yang* and Weixin Zhang*

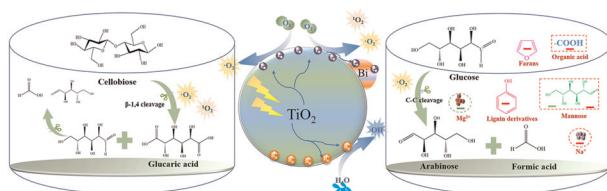
496



Using green deep eutectic solvents for targeted regeneration to improve the cycle life of spent lithium iron phosphate batteries

Jin Wu, Lin Chen,* Ruichao Zhu, Yixuan Zhou, Chuqing Cao, Liang Zhu and Jun Zhang

510



Cellobiose and glucose photorefining over non-noble Bi^0 -modified TiO_2 with oxygen vacancies: unraveling the effects of lignocellulosic derivatives and oxidation mechanism

Tingting Zhang, Xinyao Zhang, Suhang Cheng, Dong Tian, Li Zhao, Jiufu Chen, Jinguang Hu and Fei Shen*

524



Constructing recyclable biomass-derived thermosetting polymers via a solvent-free and catalyst-free Knoevenagel condensation reaction

Yaowei Zhu, Tongtong Man, Jiayi Chen, Xiaonong Zhang, Mingming Zhao, Li Chen* and Chunsheng Xiao*

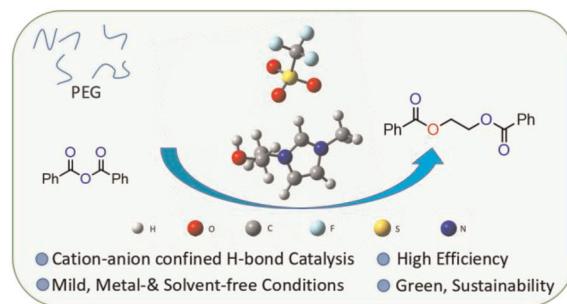


PAPERS

532

A strategy of H-bond confinement catalysis for efficient degradation of polyethylene glycol into glycol diester over an OH-functionalized ionic liquid

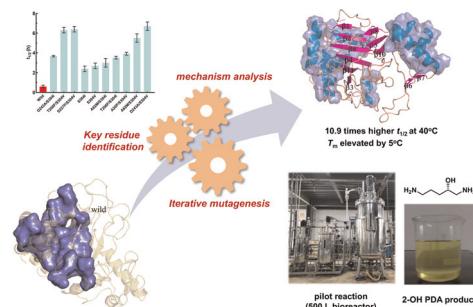
Xiaoqian Chang,* Yunpeng Xu, Chunliang Hou, Ruihan Wang and Xiaoyang Chang



545

Engineering the thermostability of lysine hydroxylase for scalable production of (2S)-hydroxy-1,5-pentanediamine from L-lysine

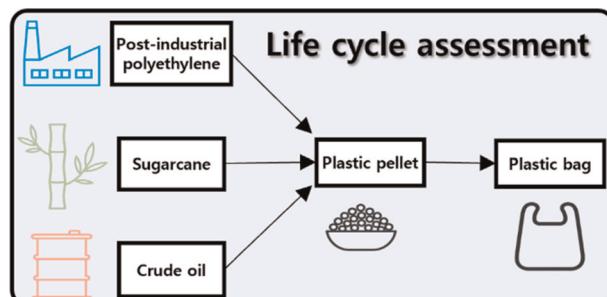
Alei Zhang, Zhijie Zheng, Yangyang Li, Feifei Chen, Chaoqiang Wu and Kequan Chen*



556

Comparative life cycle assessment study of virgin polyethylene and bio-polyethylene, with recycled polyethylene from uncontaminated post-industrial film

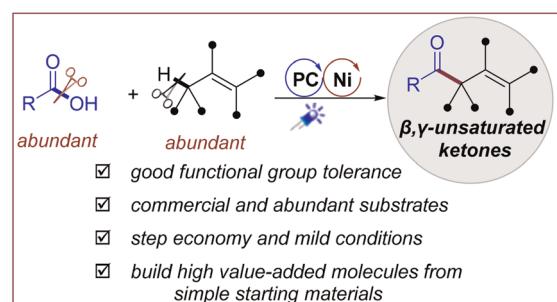
Ahdo Kim, Teuku Naraski Zahari, Nobuteru Edayoshi, Pin Juo Chou, Toshiki Yamamoto, Pin Yen Chou, Kei Saito* and Benjamin McLellan*



571

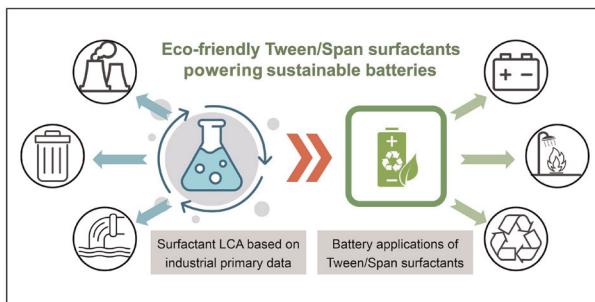
Direct allylic C(sp³)-H acylation of alkenes via metallaphotoredox catalysis using carboxylic acids

Xin Ge, Can-Quan Ye, Mei Huang, Meng-Ning Wang, Jie-Yu Chen, Ri-Yuan Tang* and Bo Yang*



PAPERS

581



Green surfactants powering sustainable batteries: industrial-scale life cycle assessment of Tween and Span surfactants for battery systems

Shiyu Wang, Likun Zhao, He Ye, Zhan Shi, Huakui Zhang, Fengyin Zhou, Simin Xu, Lei Xing, Dihua Wang* and Huayi Yin*

CORRECTION

594

Correction: Deep eutectic solvent engineering: a novel ternary system for efficient lignocellulose extraction

Guanzheng Wu, Yu Cheng, Caoxing Huang, Cheng Yong* and Yu Fu*

