

# Green Chemistry

Cutting-edge research for a greener sustainable future

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## IN THIS ISSUE

ISSN 1463-9262 CODEN GRCHFJ 26(8) 4223-4890 (2024)



**Cover**  
See Mélanie Hall *et al.*,  
pp. 4498–4505.

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2024, **26**, 4498.

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**Inside cover**  
See Michiel Dusselier,  
Bert F. Sels *et al.*,  
pp. 4242–4269.

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from *Green Chem.*,  
2024, **26**, 4242.

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## EDITORIAL

4240

### Advances in electrosynthesis for a greener chemical industry

Season S. Chen, Vassiliki-Alexandra Glezakou, Adam Holewinski, Juan Lopez-Ruiz and Jean-Philippe Tessonier

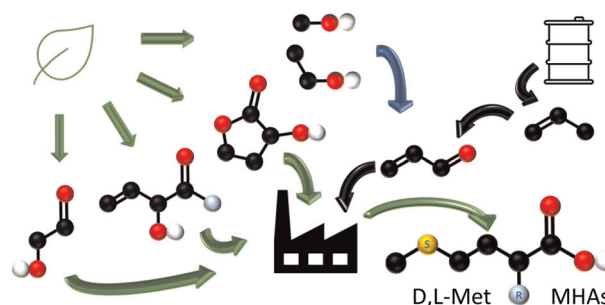


## CRITICAL REVIEWS

4242

### Methionine and its hydroxy analogues: the paths toward their sustainable chemical synthesis

Sergio Calderon-Ardila, Didier Morvan, Olivier Péruch, Virginie Bellière-Baca, Michiel Dusselier\* and Bert F. Sels\*



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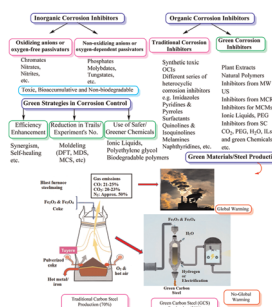
Fundamental questions  
Elemental answers

## CRITICAL REVIEWS

4270

## Principles and theories of green chemistry for corrosion science and engineering: design and application

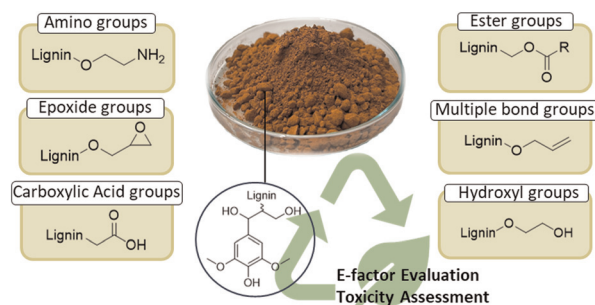
Chandrabhan Verma,\* Dheeraj Singh Chauhan, Ruby Aslam, Priyabrata Banerjee, Jeenat Aslam, Taiwo W. Quadri, Saman Zehra, Dakeshwar Kumar Verma, Mumtaz A. Quraishi, Shikha Dubey, Akram AlFantazi and Tahir Rasheed



4358

## From waste to resource: advancements in sustainable lignin modification

Celeste Libretti, Luis Santos Correa and Michael A. R. Meier\*

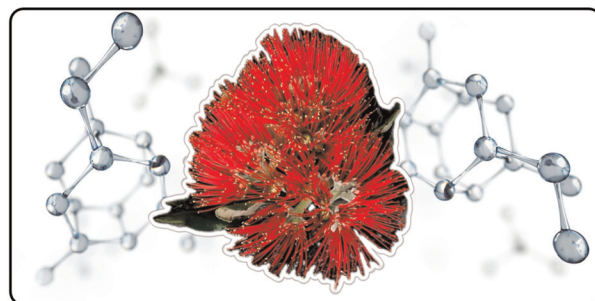


## TUTORIAL REVIEWS

4387

## Syntheses and polymerization of monoterpene-based (meth)acrylates: IBO(M)A as a relevant monomer for industrial applications

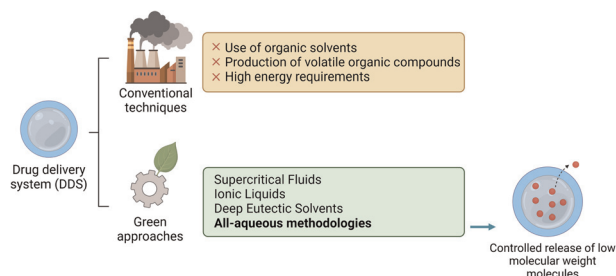
Franziska Obermeier, Dominik Hense, Paul N. Stockmann\* and Oliver I. Strube\*



4417

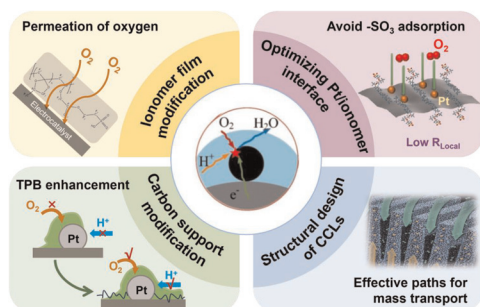
## Controlling the diffusion of small molecules from matrices processed by all-aqueous methodologies: towards the development of green pharmaceutical products

Bárbara S. Neves, Raquel C. Gonçalves, João F. Mano\* and Mariana B. Oliveira\*



## TUTORIAL REVIEWS

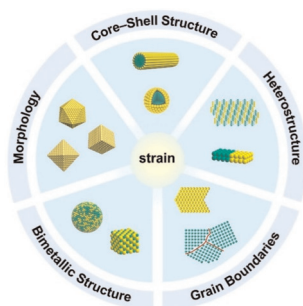
4432



### Optimized mass transfer in a Pt-based cathode catalyst layer for PEM fuel cells

Min Wang, Juejin Teng, Shahid Zaman, Shilin Zhang, Xue Chen, Kunye Zhang, Xiuyue Wang, Zhongtao Li\* and Mingbo Wu\*

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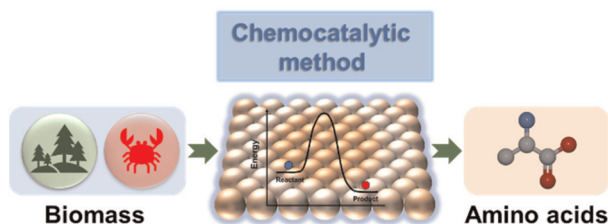


### Constructing strain in electrocatalytic materials for CO<sub>2</sub> reduction reactions

Junshan Lin and Ning Zhang\*

## PERSPECTIVE

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### A perspective on renewable production of amino acids from biomass through the chemocatalytic method

Maofeng Ding, Song Song\* and Xingang Li\*

## COMMUNICATIONS

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### Visible-light-driven three-component annulation for the synthesis of highly functionalized 2-iminothiazolidin-4-ones without photocatalysts

Beijing Yang, Yatang Wang, Xiaojuan Yang, Yinyin Li, Zhiying Zhang, Xiaofeng Hua, Lu Ouyang, Lvyin Zheng\* and Wei Guo\*

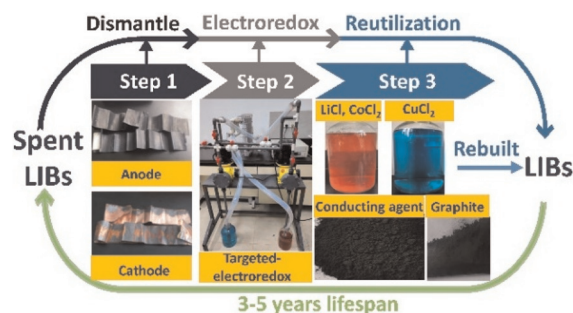


## COMMUNICATIONS

4484

Comprehensive recycling of spent lithium-ion battery cathodes and anodes *via* a targeted electrochemical redox process

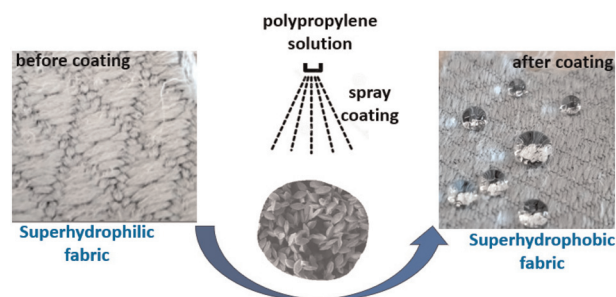
Shuai Gu,\* Jiao Kong and Baizeng Fang\*



4493

## Scalable superhydrophobic coatings with recycled polypropylene

Xiukai Li,\* Jinqian Wang, Shook Pui Chan, Siew Ping Teong and Yugen Zhang\*

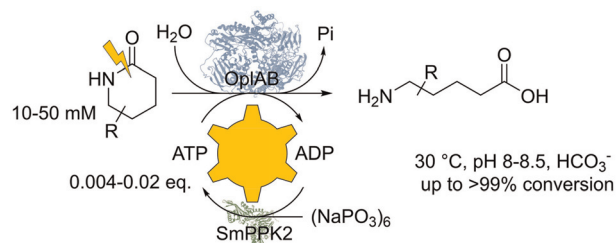


## PAPERS

4498

## Mild hydrolysis of chemically stable valerolactams by a biocatalytic ATP-dependent system fueled by metaphosphate

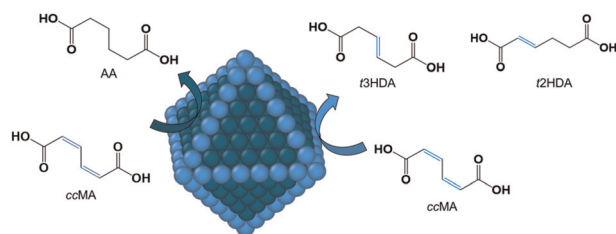
Sebastian Roth, Somayyeh Gandomkar, Federico Rossi and Mélanie Hall\*



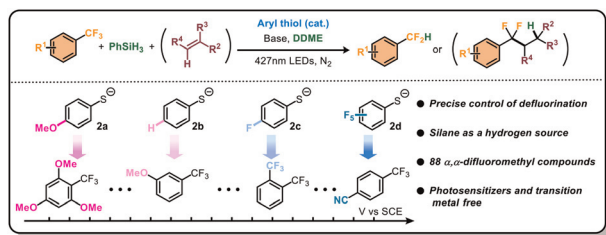
4506

Structure sensitivity of the electrochemical hydrogenation of *cis,cis*-muconic acid to hexenedioic acid and adipic acid

Deep M. Patel, Prathamesh T. Prabhu, Geet Gupta, Marco Nazareno Dell'Anna, Samantha Kling, Huy T. Nguyen, Jean-Philippe Tessonnier\* and Luke T. Roling\*



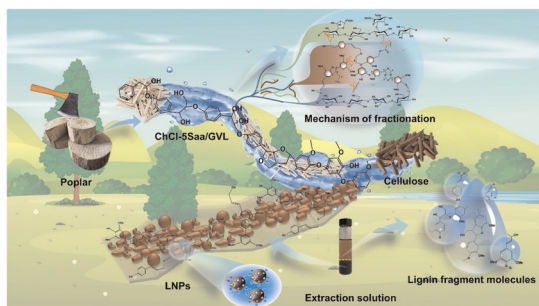
4518



### A general photocatalytic hydrodefluorination and defluoroalkylation of electronically-variable $\text{ArCF}_3$ by changing commercially-available arenethiolates

Yuanyang Jiang, Chenxiu Han, Zipeng Guo, Zhenyang Dai, Guangchao Liang,\* Shuo Guo,\* Nathaniel K. Szymczak and Pingping Tang

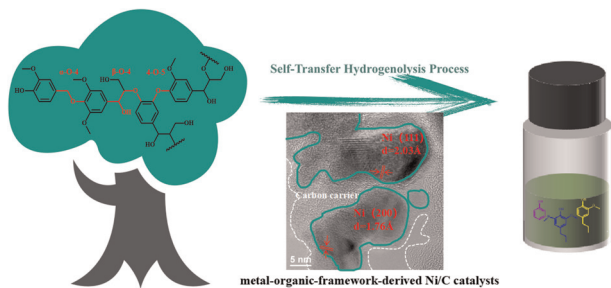
4528



### Preparation of homogeneous lignin nanoparticles by efficient extraction of lignin and modification of its molecular structure using a functional deep eutectic solvent containing $\gamma$ -valerolactone

Mingzhu Yao, Baojie Liu, Lina Qin, Zicheng Du, Zenglin Wang, Chengrong Qin, Chen Liang, Caoxing Huang and Shuangquan Yao\*

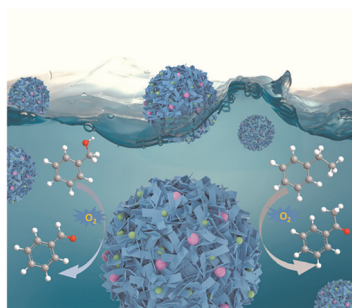
4544



### Catalytic self-transfer hydrogenolysis of lignin over Ni/C catalysts

Xuelei Mei, Huizhen Liu,\* Haihong Wu,\* Wei Wu, Bingxiao Zheng, Yani Liu, Xinrui Zheng, Yaqin Wang, Wanying Han and Buxing Han\*

4552



### Solvent-free aerobic photocatalytic oxidation of $\text{C}(\text{sp}^3)\text{-H}$ and $\text{C}(\text{sp}^3)\text{-OH}$ to $\text{C}=\text{O}$ bonds

Xulu Jiang, Weitao Wang,\* Huan Wang, Zhen-Hong He, Yang Yang, Kuan Wang, Zhao-Tie Liu\* and Buxing Han\*

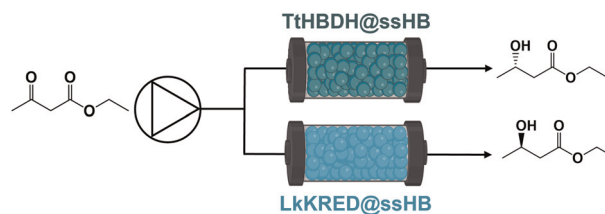


## PAPERS

4563

### Enantiodivergent biosynthesis of $\beta$ -hydroxy esters by self-sufficient heterogeneous biocatalysts in a continuous flow

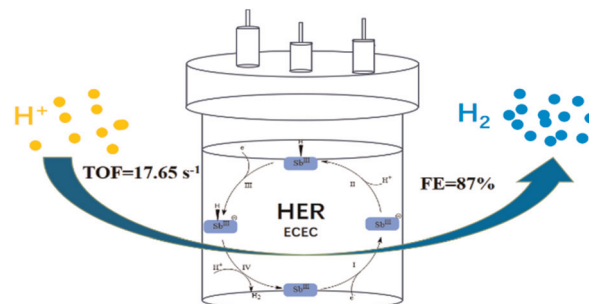
Daniel Andrés-Sanz, Ainhoa Maiz-Iginitz, Juan M. Bolivar, Alejandro H. Orrego, Haritz Sardon and Fernando López-Gallego\*



4574

### First application of antimony(III) corrole for electrocatalytic hydrogen evolution

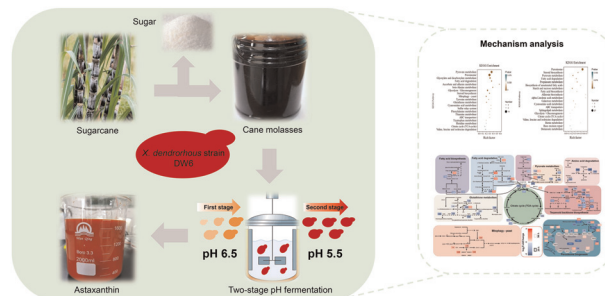
Qiao-Wei Yan, Ling-Wei Wu, Zhen-Wu Liu, Feng Chen, Chen Ling, Hai-Yang Liu,\* Xin-Yan Xiao\* and Li-Ping Si\*



4582

### High astaxanthin production by *Xanthophyllomyces dendrorhous* strain DW6 from cane molasses using two-stage pH strategies

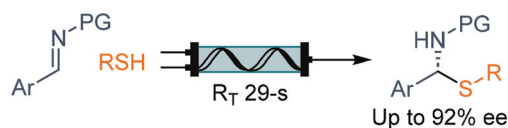
Dawei Zhou, Lixin Yang, Fang Guo, Wankui Jiang, Yujia Jiang, Wenming Zhang,\* Fengxue Xin\* and Min Jiang



4593

### A robust heterogeneous chiral phosphoric acid enables multi decagram scale production of optically active *N,S*-ketals

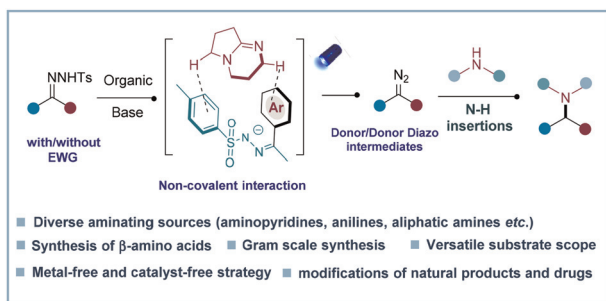
Aitor Maestro,\* Bhanwar K. Malviya, Gerald Auer, Sándor B. Ötvös and C. Oliver Kappe\*



- ◆ Continuous flow
- ◆ New reactor design
- ◆ Immobilized Chiral Phosphoric Acid
- ◆ Turnover number >812
- ◆ Space time yield 1493 kg m<sup>-3</sup> h<sup>-1</sup>



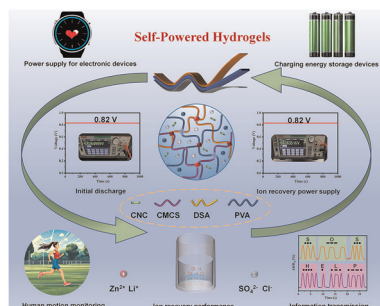
4600



### A visible-light-promoted metal-free approach for N–H insertions by using donor/donor diazo precursors

Yu Zhang,\* Qiannan Li, Ping Wang, Jinxin Wang, Jingchuan Lin, Dingding Xia, Er-Jun Hao, Xin Luan, Shoubhik Das\* and Wei-Dong Zhang\*

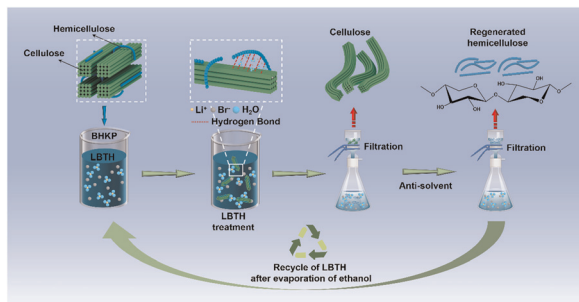
4609



### Constructing robust and recyclable self-powered polysaccharide-based hydrogels by adjusting Zn<sup>2+</sup>/Li<sup>+</sup> bimetallic networks

Qi Zhou, Weijun Yang,\* Shengxu Lu, Debora Puglia, Daqian Gao, Pengwu Xu, Yunpeng Huang, Tianxi Liu, Li Wu, Chenjing Huang and Piming Ma\*

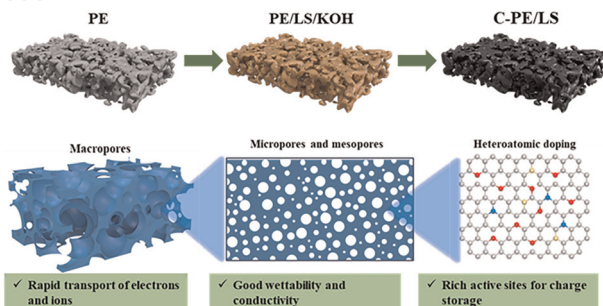
4622



### Efficient fractionation of pure hemicellulose with high DP from bleached hardwood pulp using LiBr·3H<sub>2</sub>O and co-production of dissolving pulp

Runzhu Gong, Chao Liu, Meiyuan Wu, Rui Tian, Guang Yu, Xitao Luo, Bin Li,\* Feng Peng\* and Yanjun Tang\*

4633



### Heteroatom-doped hierarchically porous thick bulk carbon derived from a *Pleurotus eryngii*/lignin composite: a free-standing and high mass loading electrode for high-energy-density storage

Weisheng Yang, Danning Wang, Shu Feng, Shuijian He, Huining Xiao, Hongqi Dai and Jingquan Han\*

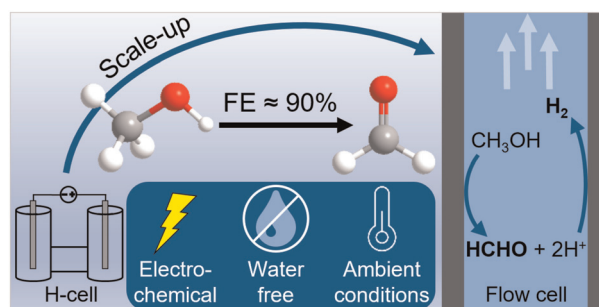




4645

### Sustainable electrochemical synthesis of dry formaldehyde from anhydrous methanol

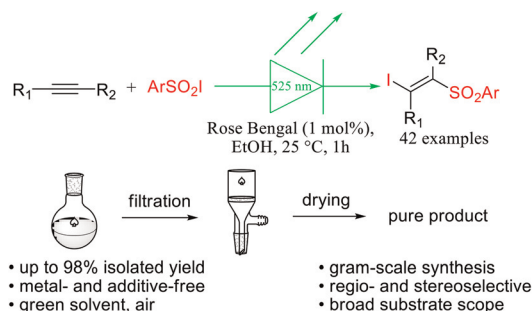
Florian Schwarz, Elizabeth Larenz and Anna K. Mechler\*



4653

### Photocatalytic iododisulfonation of internal alkynes under green conditions

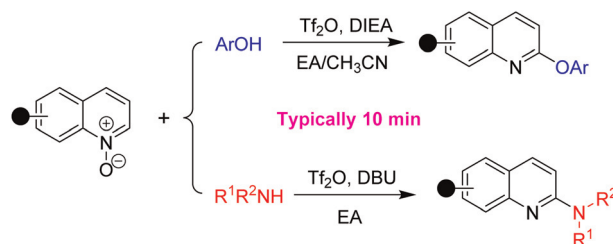
Vladimir A. Abramov, Maxim A. Topchiy, Maria A. Rasskazova, Egor A. Drokin, Ekaterina S. Tarasova, Olga V. Shurupova, Anna S. Malysheva, Sergey A. Rzhavskiy, Irina P. Beletskaya and Andrey F. Asachenko\*



4659

### Green and fast 2-aryloxylation/amination of quinolines

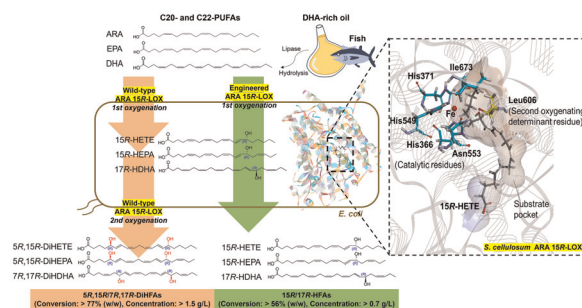
Changna Bu, Kaijuan Wang, Chengcheng Gong and Dong Wang\*



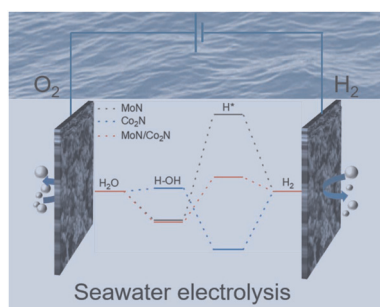
4665

### Biotransformation of C20- and C22-polyunsaturated fatty acids and fish oil hydrolyzates to *R,R*-dihydroxy fatty acids as lipid mediators using double-oxygenating 15*R*-lipoxygenase

Jin Lee, Yoon-Joo Ko, Jin-Byung Park and Deok-Kun Oh\*



4677



### A hierarchical bimetallic nitride hybrid electrode with strong electron interaction for enhanced hydrogen production in seawater

Kaihua Liu,\* Xinzeng Zhang, Jing Li, Yuanyuan Liu, Meiri Wang and Hongtao Cui

4684

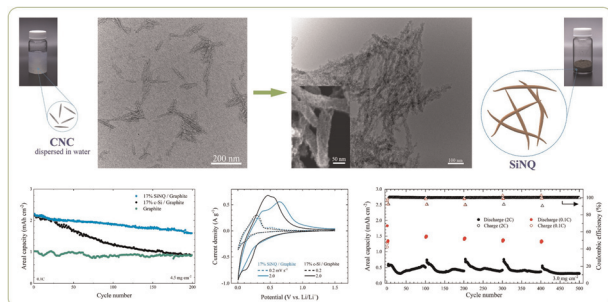


- Yield up to 75%
- Broad substrate scope
- Kind conditions
- Online electrochemical mass spectra test

### Electrochemical oxidative dehydrogenation aromatization of cyclohex-2-enone and amines to 1,4-phenylenediamine

Jiayu Hu, Rui Ma, Jingcheng Hu, Xing Liu, Xue Liu, Haoyu He, Hong Yi\* and Aiwen Lei\*

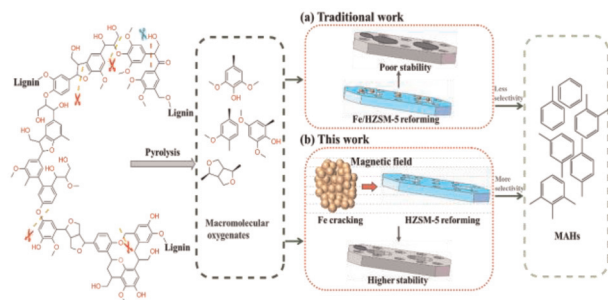
4691



### Bioderived silicon nano-quills: synthesis, structure and performance in lithium-ion battery anodes

Nancy Chen, Morteza Sabet,\* Nawraj Sapkota, Mihir Parekh, Shailendra Chiluwal, Kelliann Koehler, Craig M. Clemons, Yi Ding, Apparao M. Rao\* and Srikanth Pilla\*

4703



### Enhanced aromatics production through Fe and HZSM-5 catalytic lignin pyrolysis with magnetic field assistance

Qing Yao, Baofeng Zhao,\* Haibin Guan, Di Zhu,\* Bari Wulan, Laizhi Sun, Angang Song, Qiaoling Liu, Anguo Zhang, Shuyuan Han and Xiang Ji

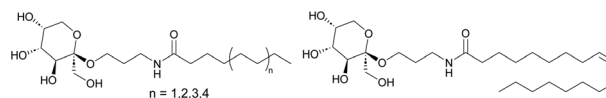


## PAPERS

4715

## The synthesis of fructose-based surfactants

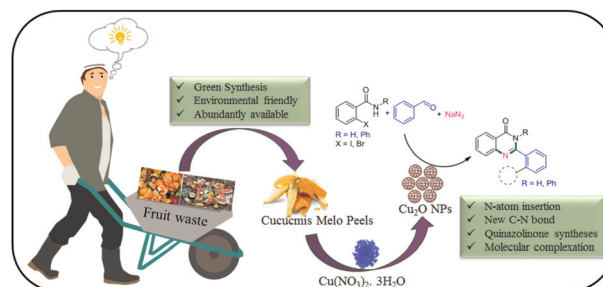
Hung-Chien Lin, Marios Kidonakis, J. P. Kaniraj, Ihor Kholomieiev, Balint Fridrich, Marc C. A. Stuart and Adriaan J. Minnaard\*



4723

Biomass derived Cu<sub>2</sub>O nanoparticles for N-atom insertion reactions: a base-free synthesis of quinazolinones with a green approach

Thrilokraj R., Jan Grzegorz Matecki, Srinivasa Budagumpi, Umesh A. Kshirsagar and Ramesh B. Dateer\*



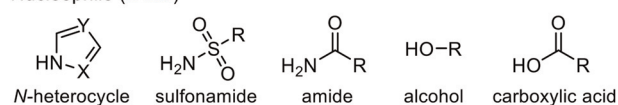
4733

Electrochemical dehydroxymethylative functionalization of alkanols for forging C(sp<sup>3</sup>)-heteroatom bonds

Lulu Zhao, Jian Tian, Qilin Yuan, Qiwen Zhong, Mengqi Luo, Chao Yang, Lin Guo\* and Wujiong Xia\*



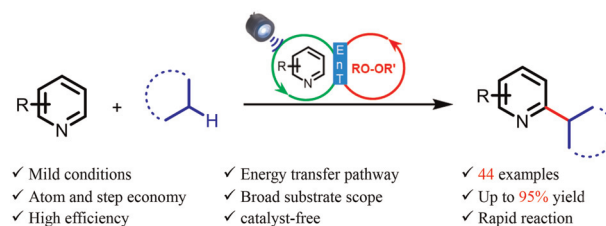
Nucleophile (H-Nu)



4742

## Metal- and photosensitizer-free cross-dehydrogenative coupling through photoinduced energy transfer

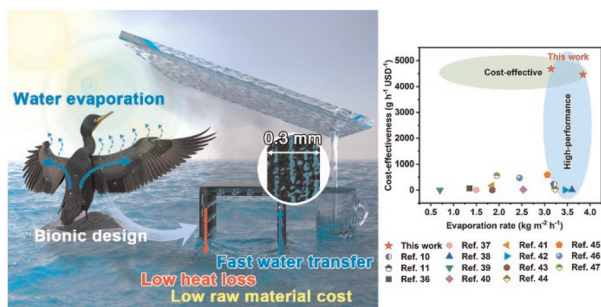
Bo Liu, Qiong Wang, Bin Cheng, Taimin Wang, Hongze Liao\* and Hou-Wen Lin\*



- ✓ Mild conditions
- ✓ Atom and step economy
- ✓ High efficiency
- ✓ Energy transfer pathway
- ✓ Broad substrate scope
- ✓ catalyst-free
- ✓ 44 examples
- ✓ Up to 95% yield
- ✓ Rapid reaction



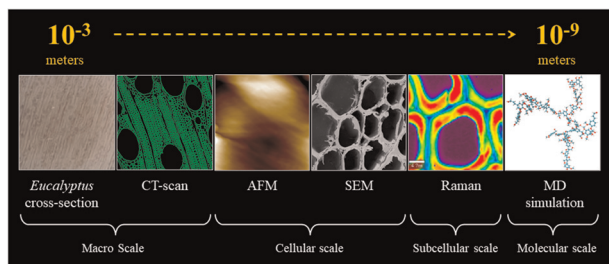
4749



### Cormorant-inspired macro-porous hydrogel thin film evaporators for boosting cost-effective solar water purification

Guang-Lei Ma, Xi-Yan Qi, Qing-Cong Wei, Xiao-Fang Shi, Yi Chang, Yu-Ming Guo,\* Zhi-Guo Hu\* and Xiao-Ming Ma\*

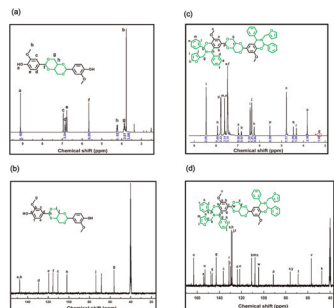
4758



### Multiscale investigation of the mechanism of biomass deconstruction in the dimethyl isosorbide/water Co-solvent pretreatment system

Shuang Yang, Mood Mohan, Xiangbo Gao, Xianpeng Yang, Jiawei Zhu, Jeremy C. Smith and Lei Wang\*

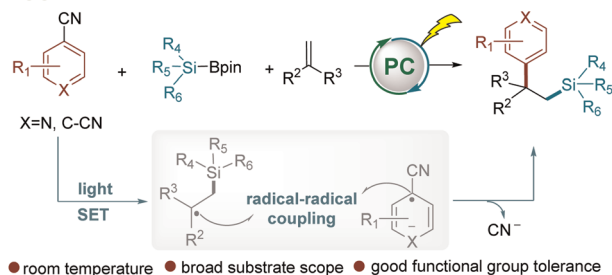
4771



### Nature's empowerment: unraveling superior performance and green degradation closed-loop in self-curing fully bio-based benzoxazines

Mingyuan Yang, Tiancheng Wang, Yazhou Tian, Haobo Zhang, Junying Zhang\* and Jue Cheng\*

4785



### Visible light catalyzed arylsilylation of alkenes to construct silicon-containing 1,1-diaryl moieties

Jia Cao, Liuzhou Gao, Guoqiang Wang\* and Shuhua Li\*

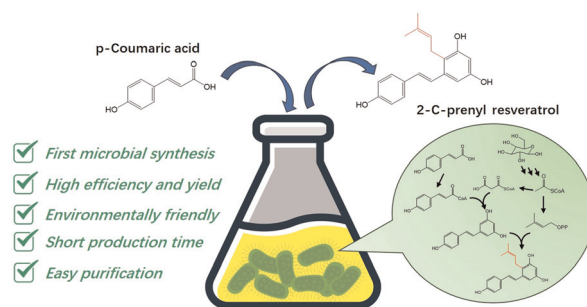


## PAPERS

4792

### Heterologous biosynthesis of prenylated resveratrol through multiplex metabolic engineering in *Escherichia coli*

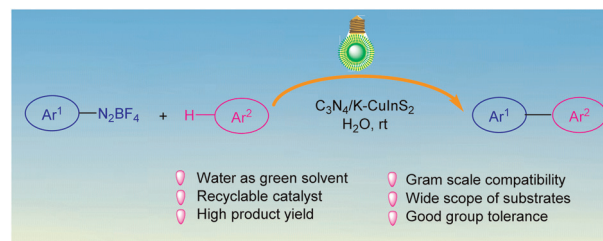
Haijiao Wang, Ting Zhou, Hui Liu, Lingrong Wen, Yueming Jiang and Bao Yang\*



4803

### Visible light-driven C–H arylation of heteroarenes with aryl diazonium salts in water catalyzed by a Z-scheme $\text{CuInS}_2/\text{K-C}_3\text{N}_4$ heterojunction

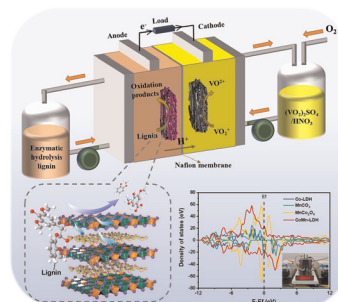
Qian-Hui Liu, Shi-Long Kang, Zhen-Shui Cui, Yu-Heng Liu,\* Mo Zhang\* and Zhan-Hui Zhang\*



4811

### A low temperature and high-power density lignin flow fuel cell via an efficient CoMn-LDH electrocatalyst with superhydrophilic intercalation

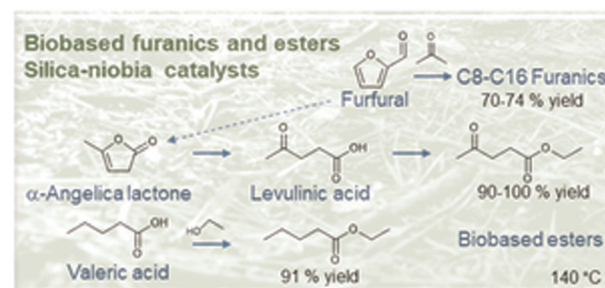
Tengda Liang, Xihong Zu,\* Bowen Liu, Xueqing Qiu,\* Zixin Xie, Xiaofei Wang and Dongjie Yang



4820

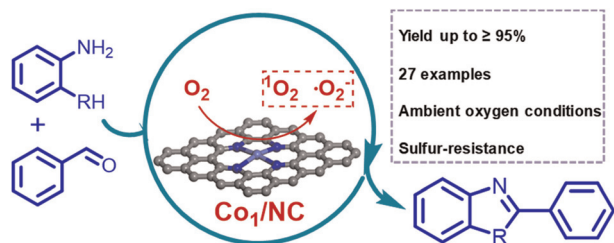
### Chemical valorisation of biomass derived furanics and carboxylic acids over niobium-based catalysts

Margarida M. Antunes,\* Kai Skrodzky, Pedro S. Cabanelas, Nicola Pinna, Patricia A. Russo and Anabela A. Valente\*



## PAPERS

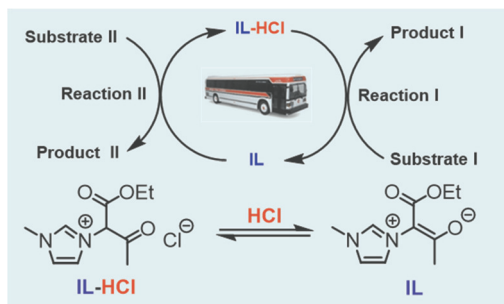
4834



### An atomically dispersed Co catalyst for efficient oxidative fabrication of benzoheterocycles under ambient oxygen conditions

Jia-Yue Chen, Ke-Ming Li, Yu-Xuan Sun, Yao Xiao, Feng-Shuo Guo, Yao-Bing Huang\* and Qiang Lu\*

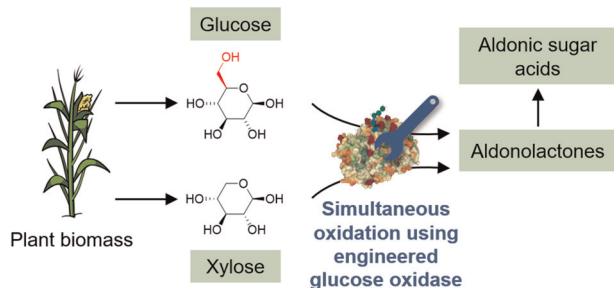
4844



### Ionic liquids as a shuttle for releasing and capturing hydrogen chloride: a new way to utilize waste HCl generated in organic reactions

Fanzeng Kong, Minghao Li, Rongxian Bai\* and Yanlong Gu\*

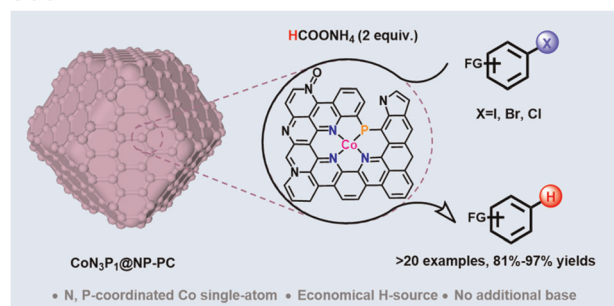
4851



### Engineering the substrate preference of glucose oxidase for the enzymatic oxidation of xylose

Yue Wang, Xueting Cao, Shanshan Jiang, Liwei Gao, Xiaolong Han, Jingyao Qu, Xukai Jiang, Guodong Liu\* and Yinbo Qu

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### Asymmetric $\text{CoN}_3\text{P}_1$ single-atom catalytic sites for enhanced transfer hydrodehalogenation

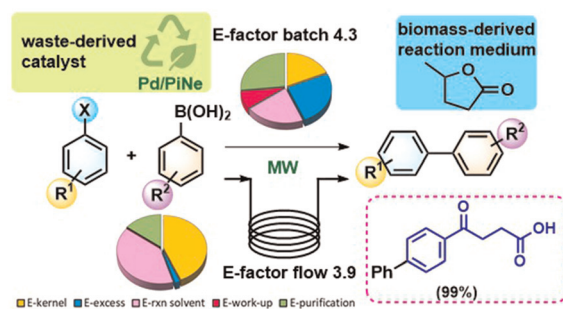
Wendi Guo, Zehui Sun, Mengjiao Xu, Kaizhi Wang, Mugeng Chen, Conglin Zhu, Heyong He, Yongmei Liu\* and Yong Cao\*



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### Microwave assisted batch and continuous flow Suzuki–Miyaura reactions in GVL using a Pd/PiNe biowaste-derived heterogeneous catalyst

Federica Valentini, Benedetta Di Erasmo, Marta Ciani, Shaomin Chen, Yanlong Gu and Luigi Vaccaro\*



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### Catalyst-free aerobic photooxidation of sensitive benzylic alcohols with chemoselectivity controlled using DMSO as the solvent

Ivana Weisheitelová, Naisargi Varma, Josef Chudoba, Gotard Burdziński, Marek Sikorski\* and Radek Cibulka\*

