

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 26(8) 4223–4890 (2024)



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

Image reproduced
by permission of
Federico Rossi
from *Green Chem.*,
2024, **26**, 4498.

Image by Federico Rossi.



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

Image reproduced
by permission of
Bert F. Sels – KU Leuven
from *Green Chem.*,
2024, **26**, 4242.

Image by Dr. Joris Snaet.

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

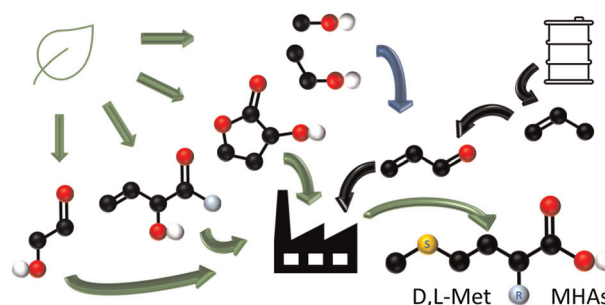


CRITICAL REVIEWS

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*



GOLD
OPEN
ACCESS

RSC Applied Polymers

**The application of polymers,
both natural and synthetic**

Interdisciplinary and open access

rsc.li/RSCApplPolym

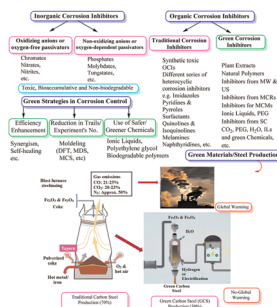
**Fundamental questions
Elemental answers**

CRITICAL REVIEWS

4270

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

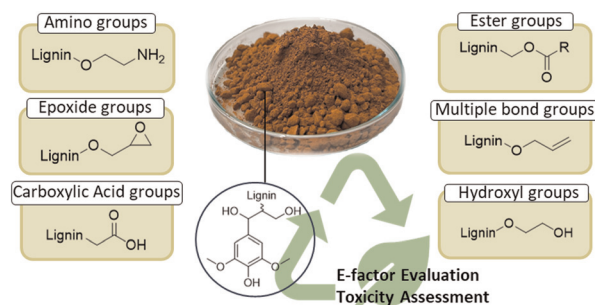
Chandrabhan Verma,* Dheeraj Singh Chauhan, Ruby Aslam, Priyabrata Banerjee, Jeenat Aslam, Taiwo W. Quadri, Saman Zehra, Dakeshwar Kumar Verma, Mumtaz A. Quraishi, Shikha Dubey, Akram AlFantazi and Tahir Rasheed



4358

From waste to resource: advancements in sustainable lignin modification

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

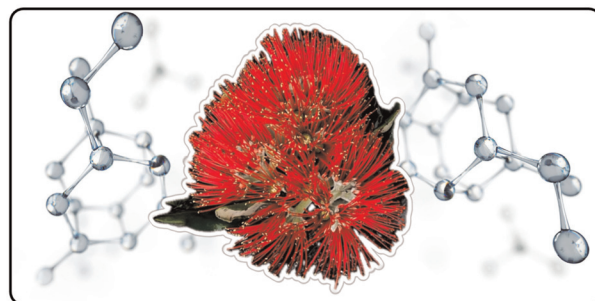


TUTORIAL REVIEWS

4387

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

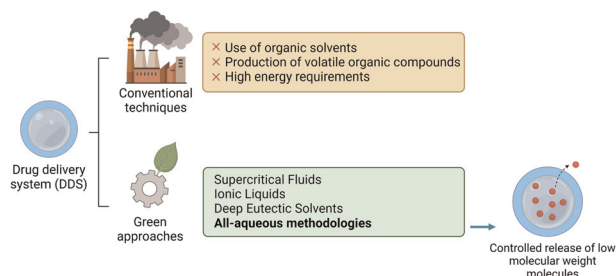
Franziska Obermeier, Dominik Hense, Paul N. Stockmann* and Oliver I. Strube*



4417

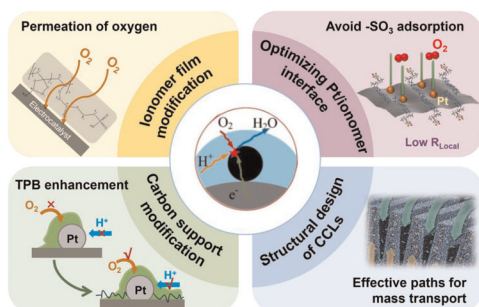
Controlling the diffusion of small molecules from matrices processed by all-aqueous methodologies: towards the development of green pharmaceutical products

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



TUTORIAL REVIEWS

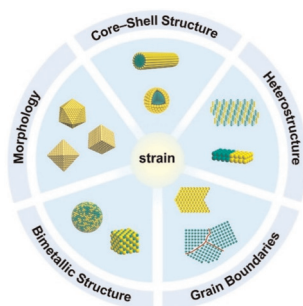
4432



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*

4449

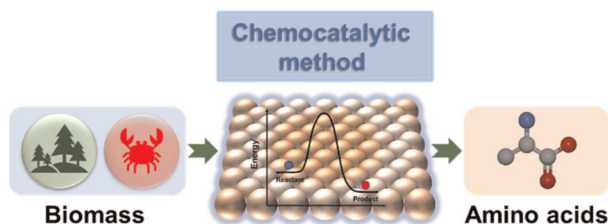


Constructing strain in electrocatalytic materials for CO₂ reduction reactions

Junshan Lin and Ning Zhang*

PERSPECTIVE

4468



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

Maofeng Ding, Song Song* and Xingang Li*

COMMUNICATIONS

4477



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

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

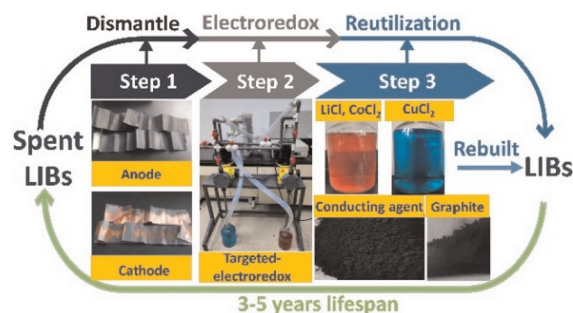


COMMUNICATIONS

4484

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

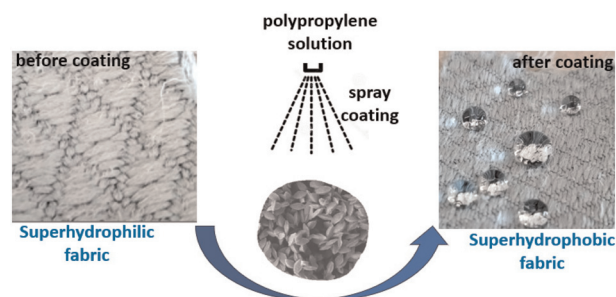
Shuai Gu,* Jiao Kong and Baizeng Fang*



4493

Scalable superhydrophobic coatings with recycled polypropylene

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

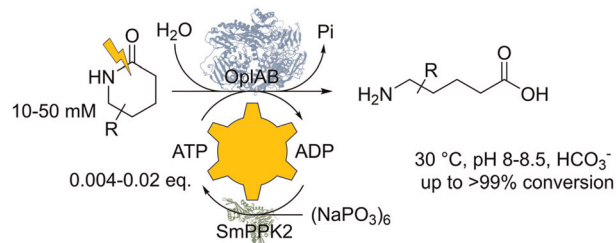


PAPERS

4498

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

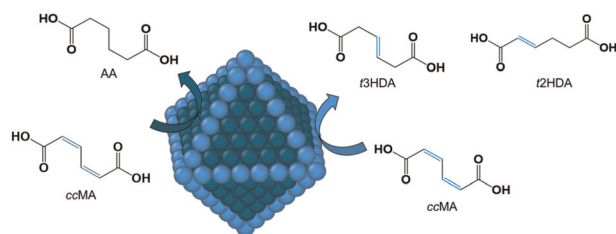
Sebastian Roth, Somayyeh Gandomkar, Federico Rossi and Mélanie Hall*



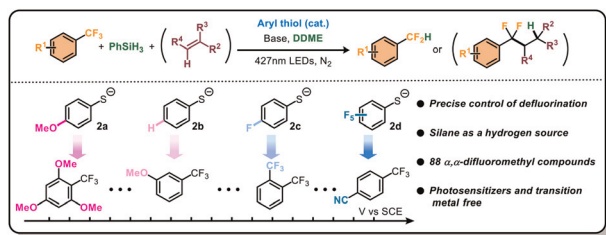
4506

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 Tessonier* and Luke T. Roling*



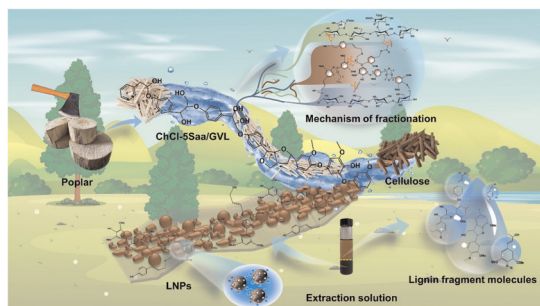
4518



A general photocatalytic hydrodefluorination and defluoroalkylation of electronically-variable 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

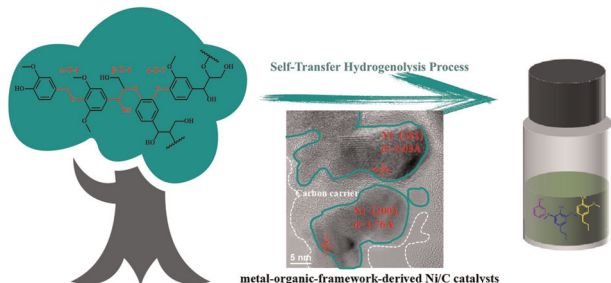
4528



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

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

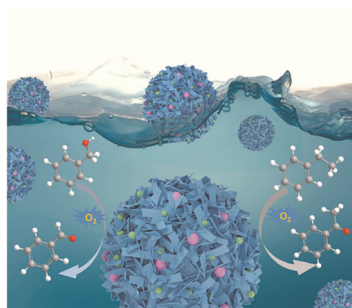
4544



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

Xuele 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 C=O bonds

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

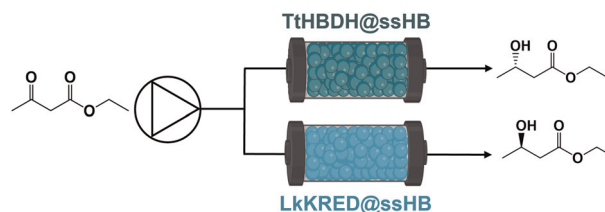


PAPERS

4563

Enantiodivergent biosynthesis of β -hydroxy esters by self-sufficient heterogeneous biocatalysts in a continuous flow

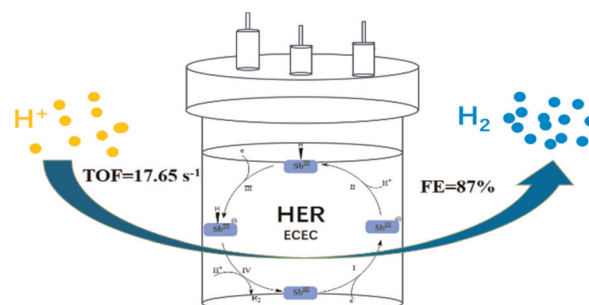
Daniel Andrés-Sanz, Ainhoa Maiz-Iginitz, Juan M. Bolivar, Alejandro H. Orrego, Haritz Sardon and Fernando López-Gallego*



4574

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

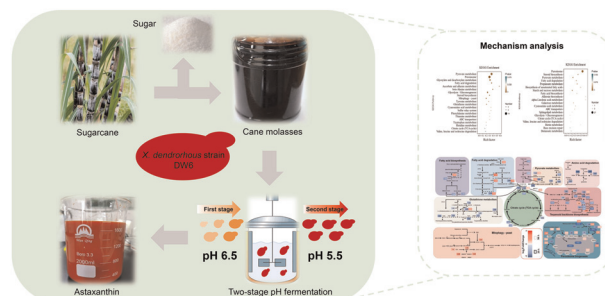
Qiao-Wei Yan, Ling-Wei Wu, Zhen-Wu Liu, Feng Chen, Chen Ling, Hai-Yang Liu,* Xin-Yan Xiao* and Li-Ping Si*



4582

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

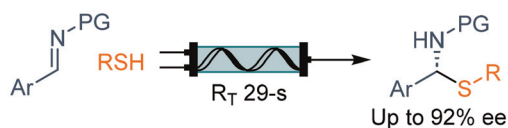
Dawei Zhou, Lixin Yang, Fang Guo, Wankui Jiang, Yujia Jiang, Wenming Zhang,* Fengxue Xin* and Min Jiang



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*

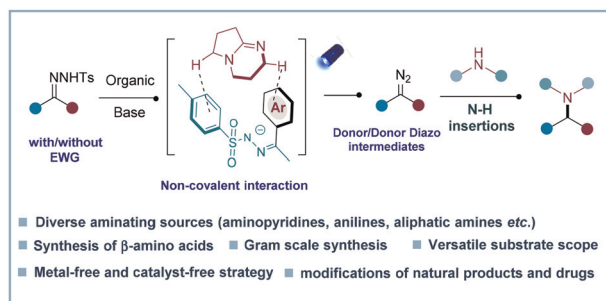


- ◆ Continuous flow
- ◆ New reactor design
- ◆ Immobilized Chiral Phosphoric Acid
- ◆ Turnover number >812
- ◆ Space time yield 1493 kg m⁻³ h⁻¹



PAPERS

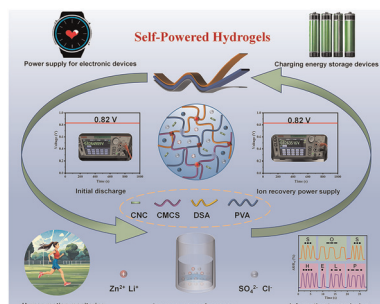
4600



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*

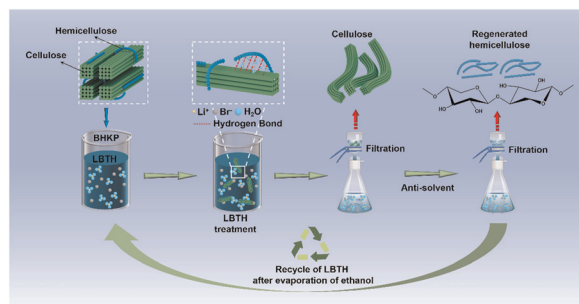
4609



Constructing robust and recyclable self-powered polysaccharide-based hydrogels by adjusting $\text{Zn}^{2+}/\text{Li}^{+}$ 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*

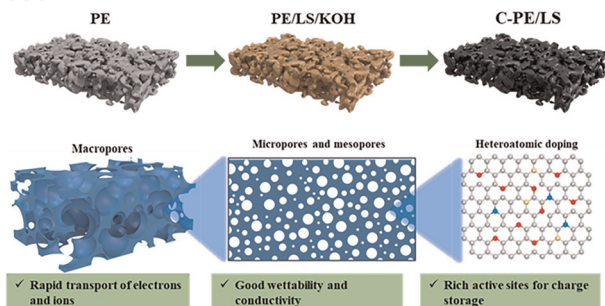
4622



Efficient fractionation of pure hemicellulose with high DP from bleached hardwood pulp using $\text{LiBr}\cdot 3\text{H}_2\text{O}$ and co-production of dissolving pulp

Runzhu Gong, Chao Liu, Meiyang 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*

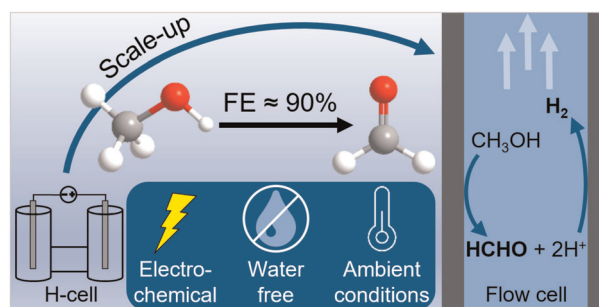


PAPERS

4645

Sustainable electrochemical synthesis of dry formaldehyde from anhydrous methanol

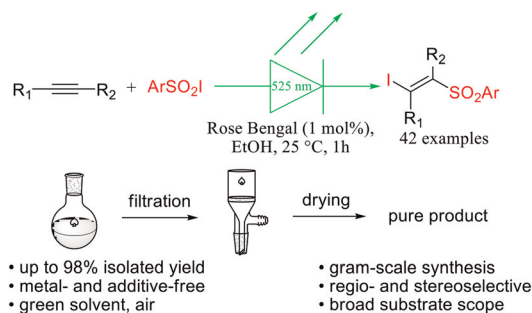
Florian Schwarz, Elizabeth Larenz and Anna K. Mechler*



4653

Photocatalytic iodosulfonation of internal alkynes under green conditions

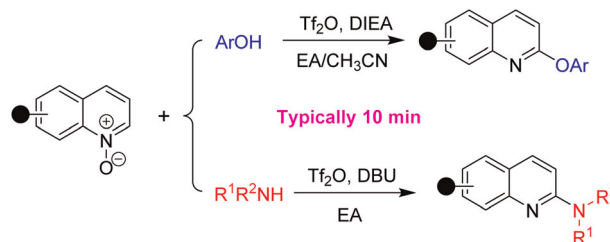
Vladimir A. Abramov, Maxim A. Topchiy, Maria A. Rasskazova, Egor A. Drokin, Ekaterina S. Tarasova, Olga V. Shurupova, Anna S. Malysheva, Sergey A. Rzhetskiy, Irina P. Beletskaya and Andrey F. Asachenko*



4659

Green and fast 2-aryloxylation/amination of quinolines

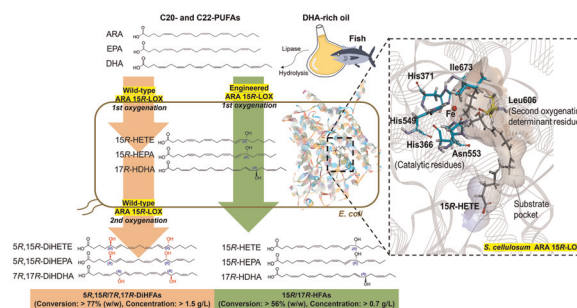
Changna Bu, Kaijuan Wang, Chengcheng Gong and Dong Wang*



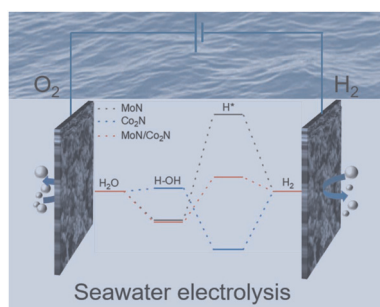
4665

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

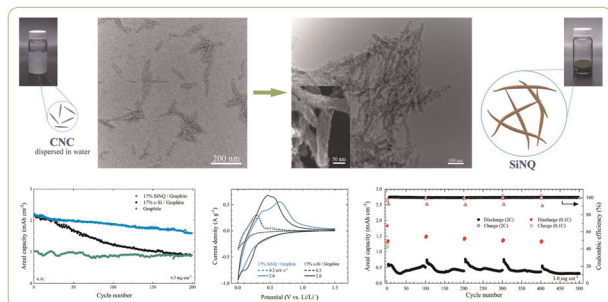


- Yield up to 75%
- Broad substrate scope
- Kind conditions
- Online electrochemical mass spectra test

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*

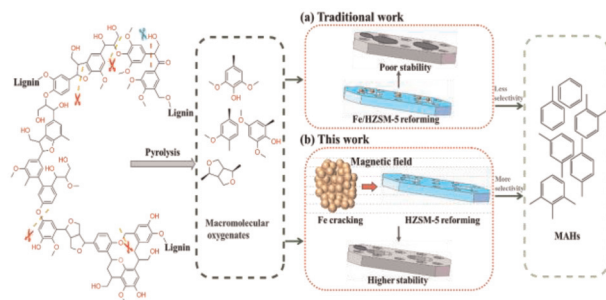
4691



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

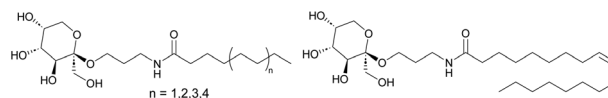


PAPERS

4715

The synthesis of fructose-based surfactants

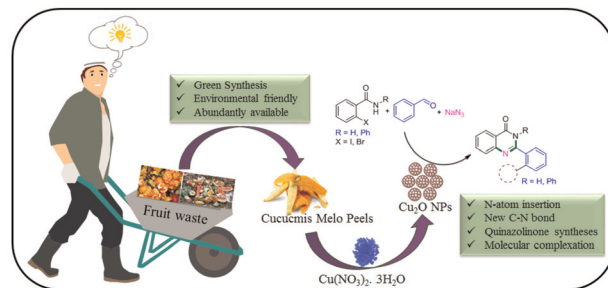
Hung-Chien Lin, Marios Kidonakis, J. P. Kaniraj, Ihor Kholomieiev, Balint Fridrich, Marc C. A. Stuart and Adriaan J. Minnaard*



4723

Biomass derived Cu₂O nanoparticles for N-atom insertion reactions: a base-free synthesis of quinazolinones with a green approach

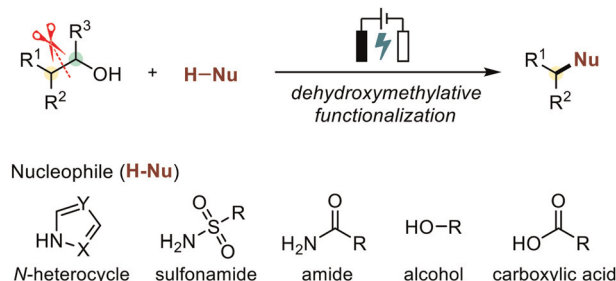
Thrilokraj R., Jan Grzegorz Matecki, Srinivasa Budagumpi, Umesh A. Kshirsagar and Ramesh B. Dateer*



4733

Electrochemical dehydroxymethylative functionalization of alkanols for forging C(sp³)-heteroatom bonds

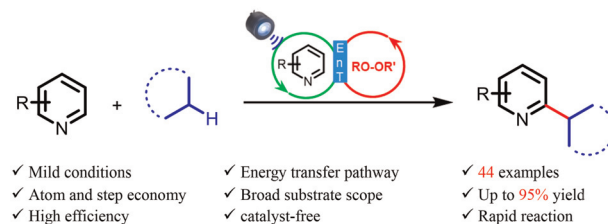
Lulu Zhao, Jian Tian, Qilin Yuan, Qiwen Zhong, Mengqi Luo, Chao Yang, Lin Guo* and Wujiong Xia*



4742

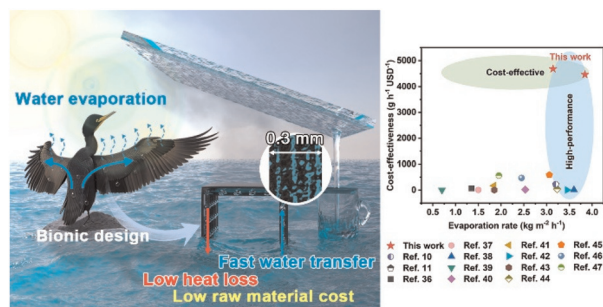
Metal- and photosensitizer-free cross-dehydrogenative coupling through photoinduced energy transfer

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



PAPERS

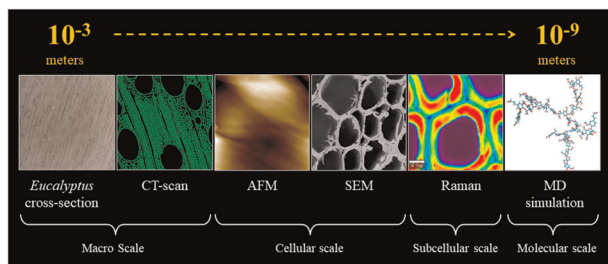
4749



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*

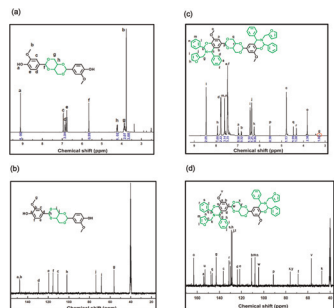
4758



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*

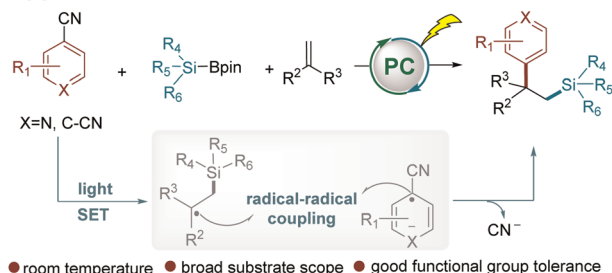
4771



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*



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

[illegible]

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

The reaction scheme shows the coupling of an aryl boronate ester (Ar¹-N₂BF₄) with an aryl hydride (H-Ar²) to form a biaryl product (Ar¹-Ar²). The reaction is catalyzed by Cu₃N₄/K-CuInS₂ in water at room temperature. A green sun icon indicates that the reaction is powered by light.

Water as green solvent
Recyclable catalyst
High product yield
Gram scale compatibility
Wide scope of substrates
Good group tolerance

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

[illegible]

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

Biobased furanics and esters
Silica-niobia catalysts

Furfural → **C8-C16 Furanics**
70-74 % yield

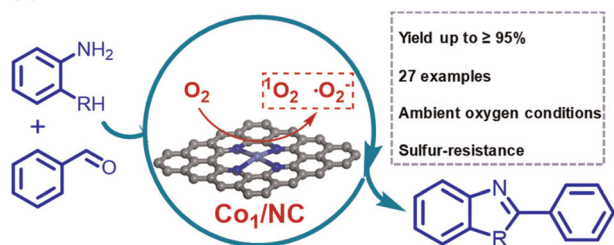
α-Angelica lactone ↔ **Levulinic acid** → **Biobased esters**
90-100 % yield

Valeric acid + $\text{HO-CH}_2\text{CH}_3$ → **Biobased esters**
91 % yield

140 °C

PAPERS

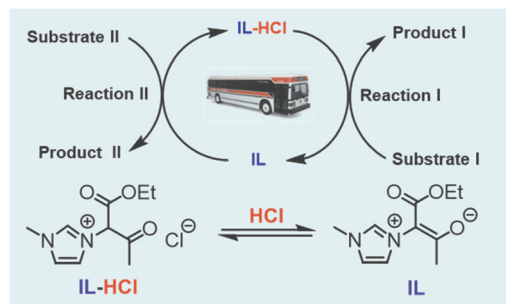
4834



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*

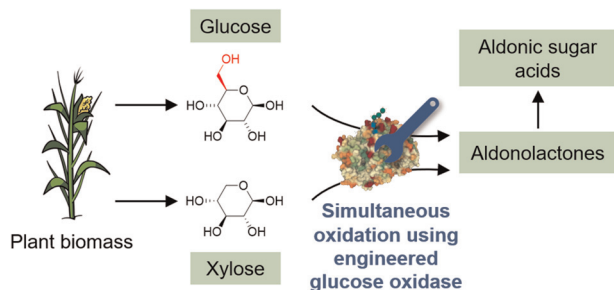
4844



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*

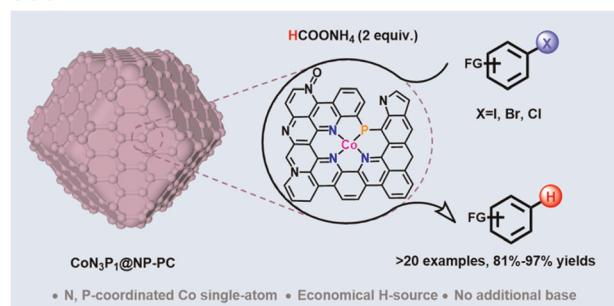
4851



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

4860



Asymmetric CoN₃P₁ 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*

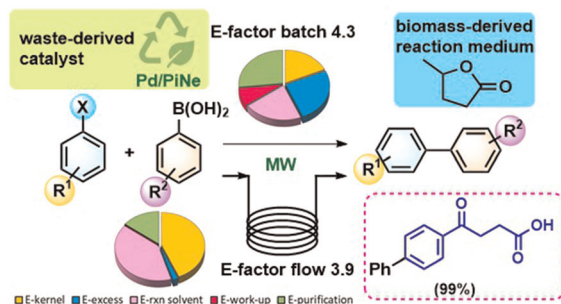


PAPERS

4871

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*



4880

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*

