

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 25(24) 10103–10696 (2023)



Cover
See Jean-Philippe Tessonnier, Luke T. Roling *et al.*, pp. 10387–10397.

Image reproduced by permission of Jean-Philippe Tessonnier and DrawImpacts from *Green Chem.*, 2023, **25**, 10387.

Cover by DrawImpacts.



Inside cover
See Yun Jeong Hwang, Jonggeol Na *et al.*, pp. 10398–10414.

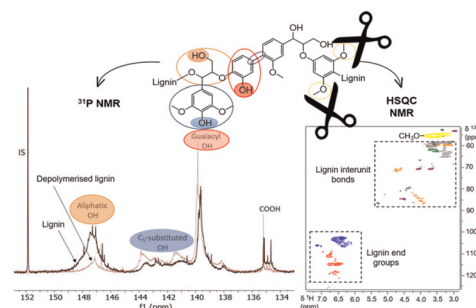
Image reproduced by permission of Jonggeol Na from *Green Chem.*, 2023, **25**, 10398.

TUTORIAL REVIEWS

10117

Selective demethylation reactions of biomass-derived aromatic ether polymers for bio-based lignin chemicals

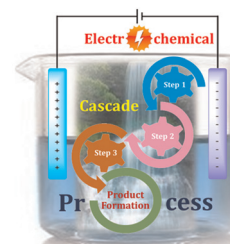
Florian M. Harth, Brigita Hočevár, Tina Ročnik Kozmelj, Edita Jasiukaitytė-Grojzdek, Jana Blüm, Michael Fiedel, Blaž Likozar* and Miha Grilc*



10144

Electrochemical cascade reactions: an account of recent developments for this modern strategic tool in the arsenal of chemical synthesis

Manoj Kumar Yadav and Sushobhan Chowdhury*



Electrochemical Cascade process
Electricity as green catalyst-oxidant-mediator!!
Integrated reaction steps!! Shorter reaction time!!
Minimal chemical waste!!



Editorial Staff

Executive Editor

Michael A. Rowan

Deputy Editor

Vikki Pritchard

Development Editors

Bee Hockin, Andrea Carolina Ojeda Porras

Editorial Production Manager

Gisela Scott

Publisher

Jeanne Andres

Senior Publishing Editor

Robin Brabham

Publishing Editors

Catherine Au, Isobel Darlington, Konoya Das, Alexandre Dumon, Amy Lucas, Kieran Nicholson, Rini Prakash, Charlotte Pugsley, Hugh Ryan

Editorial Assistant

Daphne Houston

Publishing Assistant

Robert Griffiths

For queries about submitted articles please contact Gisela Scott, Editorial Production Manager, in the first instance. E-mail green@rsc.org

For pre-submission queries please contact Michael A. Rowan, Executive Editor.

E-mail green-rsc@rsc.org

Green Chemistry electronic:

ISSN 1463-9270 is published 24 times

a year by the Royal Society of Chemistry, Thomas Graham House, Science Park, Milton Road, Cambridge, CB4 0WF, UK.

All orders, with cheques made payable to the Royal Society of Chemistry, should be sent to the Royal Society of Chemistry Order Department, Royal Society of Chemistry, Thomas Graham House, Science Park, Milton Road, Cambridge, CB4 0WF, UK
Tel +44 (0)1223 432398; E-mail orders@rsc.org

2023 Annual electronic subscription price: £2578; US\$4544. Customers in Canada will be subject to a surcharge to cover GST. Customers in the EU subscribing to the electronic version only will be charged VAT.

If you take an institutional subscription to any Royal Society of Chemistry journal you are entitled to free, site-wide web access to that journal. You can arrange access via Internet Protocol (IP) address at www.rsc.org/ip

Customers should make payments by cheque in sterling payable on a UK clearing bank or in US dollars payable on a US clearing bank.

Whilst this material has been produced with all due care, the Royal Society of Chemistry cannot be held responsible or liable for its accuracy and completeness, nor for any consequences arising from any errors or the use of the information contained in this publication. The publication of advertisements does not constitute any endorsement by the Royal Society of Chemistry or Authors of any products advertised. The views and opinions advanced by contributors do not necessarily reflect those of the Royal Society of Chemistry which shall not be liable for any resulting loss or damage arising as a result of reliance upon this material. The Royal Society of Chemistry is a charity, registered in England and Wales, Number 207890, and a company incorporated in England by Royal Charter (Registered No. RC000524), registered office: Burlington House, Piccadilly, London W1J 0BA, UK, Telephone: +44 (0) 207 4378 6556.

Advertisement sales:

Tel +44 (0) 1223 432246; Fax +44 (0) 1223 426017;

E-mail advertising@rsc.org

For marketing opportunities relating to this journal, contact marketing@rsc.org

Green Chemistry

Cutting-edge research for a greener sustainable future

rsc.li/greenchem

Green Chemistry focuses on cutting-edge research that attempts to reduce the environmental impact of the chemical enterprise by developing a technology base that is inherently non-toxic to living things and the environment.

Editorial Board

Chair

Professor Doctor Javier Pérez-Ramírez, ETH Zurich, Switzerland

Dr Keiichi Tomishige, Tohoku University, Japan

Associate Editors

Professor Aiwen Lei, College of Chemistry and Molecular Sciences, The Institute for Advanced Studies, Wuhan University, P. R. China

Dr Elsje A. Quadrelli, CNRS and CPE Lyon, France

Professor Magdalena Titirici, Imperial College London, UK

Members

Professor André Bardow, ETH Zurich, Switzerland

Dr François Jérôme, University of Poitiers, France

Professor Laurel Shafer, The University of British Columbia, Canada

Dr Serenella Sala, Joint Research Center, European Commission, Italy

Dr Helen Sneddon, University of York, UK

Dr Tao Zhang, Dalian Institute of Chemical Physics, Chinese Academy of Sciences, China

Advisory Board

Paul Anastas, Yale University, USA

Isabel Arends, TU Delft, The Netherlands

Gregg Beckham, NREL, USA

Asim Bhaumik, Indian Association for the Cultivation of Science, India

Fabrizio Cavani, University of Bologna, Italy

James Clark, University of York, UK

Avelino Corma, Universidad Politécnica de Valencia, Spain

Robert H Crabtree, Yale University, USA

Paul Dauenhauer, University of Minnesota, USA

James Dumesic, University of Wisconsin-Madison, USA

Martin Eastgate, Bristol Myers Squibb, USA

Karen Goldberg, University of Washington, USA

Buxing Han, Chinese Academy of Sciences, China

Steve Howdle, Nottingham University, UK

Andrew J. Hunt, Khon Kaen University, Thailand

Graham Hutchings, Cardiff University, UK

Philip Jessop, Queen's University, Canada

C. Oliver Kappe, University of Graz, Austria

Shu Kobayashi, University of Tokyo, Japan

Burkhard Koenig, University of Regensburg, Germany

Michael Kopach, Eli Lilly and Company, USA

Walter Leitner, RWTH Aachen University, Germany

Chao-Jun Li, McGill University, Canada

Bruce Lipshutz, University of California, USA

Doug MacFarlane, Monash University, Australia

Tomoo Mizugaki, Osaka University, Japan

Regina Palkovits, RWTH Aachen, Germany

Alvise Perosa, Università Ca Foscari, Italy

Martina Peters, Bayer AG, Germany

Martyn Poliakoff, University of Nottingham, UK

Colin Raston, Flinders University, Australia

Roberto Rinaldi, Imperial College London, UK

Robin D. Rogers, McGill University, Canada

Susannah Scott, University of California, USA

Roger Sheldon, Delft University of Technology, The Netherlands

Christian Stevens, Ghent University, Belgium

Natalia Tarasova, Mendeleev University of Chemical Technology, Russia

Rajender Varma, US Environmental Protection Agency, USA

Tom Welton, Imperial College London, UK

Kevin C. W. Wu, National Taiwan University, Taiwan

Ganapati D. Yadav, Institute of Chemical Technology, India

Hisao Yoshida, Kyoto University, Japan

Suojiang Zhang, Institute of Process Engineering, Chinese Academy of Sciences, China

Julie Zimmerman, Yale University, USA

Vânia Zuin Zeidler, Institute of Sustainable Chemistry Faculty/School of Sustainability, Leuphana University, Germany

Information for Authors

Full details on how to submit material for publication in Green Chemistry are given in the Instructions for Authors (available from <http://www.rsc.org/authors>). Submissions should be made via the journal's homepage: rsc.li/greenchem

Authors may reproduce/republish portions of their published contribution without seeking permission from the Royal Society of Chemistry, provided that any such republication is accompanied by an acknowledgement in the form: (Original Citation)–Reproduced by permission of the Royal Society of Chemistry.

This journal is © The Royal Society of Chemistry 2023.

Apart from fair dealing for the purposes of research or private study for non-commercial purposes, or criticism or review, as permitted under the Copyright, Designs and Patents Act 1988 and the Copyright and Related Rights Regulation 2003, this publication may only be reproduced, stored or transmitted, in any form or by any means, with the prior permission in writing of the Publishers or in the case of reprographic reproduction in accordance with the terms of licences issued by the Copyright Licensing Agency in the UK. US copyright law is applicable to users in the USA.

Registered charity number: 207890

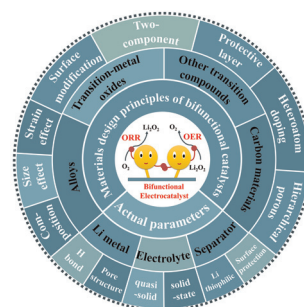


TUTORIAL REVIEWS

10182

Advanced nano-bifunctional electrocatalysts in Li–air batteries for high coulombic efficiency

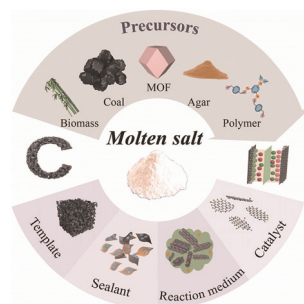
Jinyu Zhao, Rajesh Pathak,* Zhenxin Zhao, Xu Chen, Madan Bahadur Saud, Hansheng Li, Fan Wu, Quinn Qiao, Jeffrey W. Elam* and Xiaomin Wang*



10209

Molten salt technique for the synthesis of carbon-based materials for supercapacitors

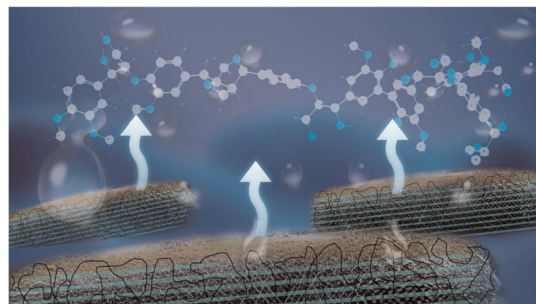
Yu Yang, Yunping Ma, Congcong Lu, Songjun Li* and Maiyong Zhu*



10235

The dawn of aqueous deep eutectic solvents for lignin extraction

Mingyang Hu, Yanyan Yu, Xiaoyan Li, Xinyu Wang and Yun Liu*



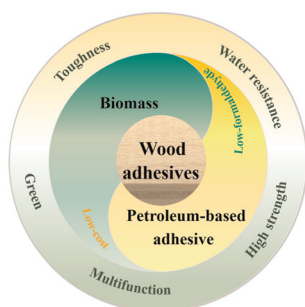
10263

Salt-assisted synthesis of advanced carbon-based materials for energy-related applications

Maiyong Zhu,* Yu Yang and Yunping Ma



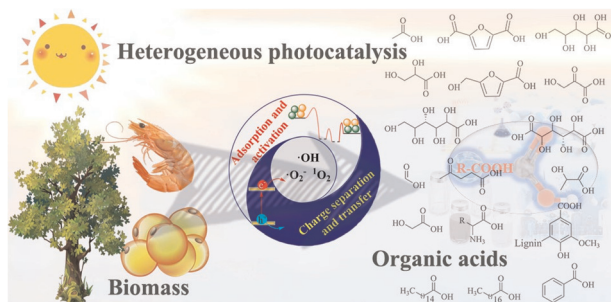
10304



Recent progress of biomass in conventional wood adhesives: a review

Wei Tian, Xiaoyi Wang, Yuhang Ye, Weijie Wu, Yuli Wang, Shaohua Jiang, Jiangbo Wang and Xiaoshuai Han*

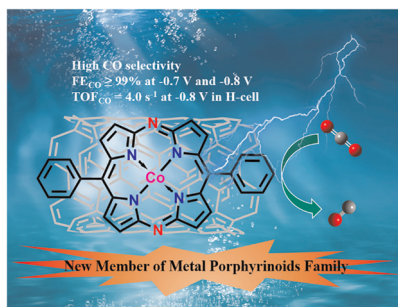
10338



Heterogeneous photocatalysis for biomass valorization to organic acids

Tengyu Liu, Jinshu Huang, Jie Li, Keping Wang, Zhenyan Guo, Hongguo Wu,* Song Yang and Hu Li*

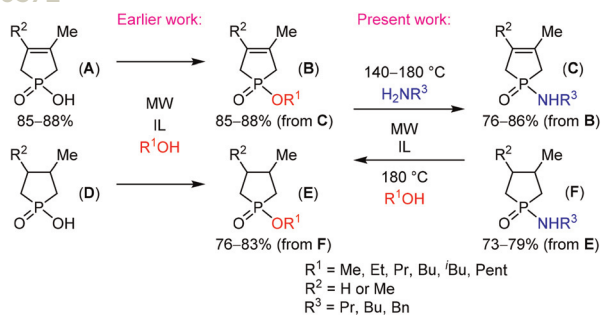
10366



Cobalt macrocyclic complex-catalyzed selective electroreduction of CO₂ to CO

Wen-Jun Xie, Jin-Mei Chen, Zhi-Wen Yang and Liang-Nian He*

10372



Microwave-assisted, ionic liquid-catalyzed aminolysis and alcoholysis of phosphinic derivatives: the interconversion of phosphinates and phosphinic amides

György Keglevich,* Nikolettta Harsági and Sarolta Szilágyi

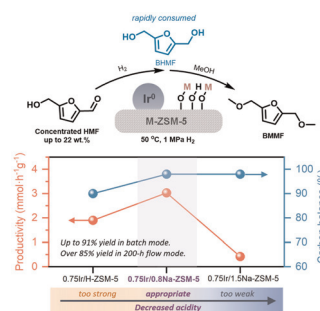


COMMUNICATIONS

10381

Towards scalable reductive etherification of 5-hydroxymethyl-furfural through iridium-zeolite-based bifunctional catalysis

Zehui Sun, Mugeng Chen, Kaizhi Wang, Chen Chen, Jiachen Fei, Wendi Guo, Conglin Zhu, Heyong He, Yongmei Liu* and Yong Cao*

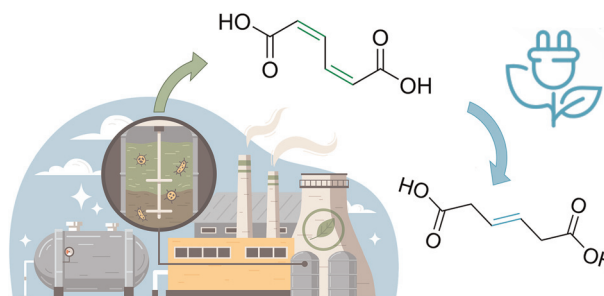


PAPERS

10387

Local reactivity descriptors to decipher the electrochemical hydrogenation of unsaturated carboxylic acids

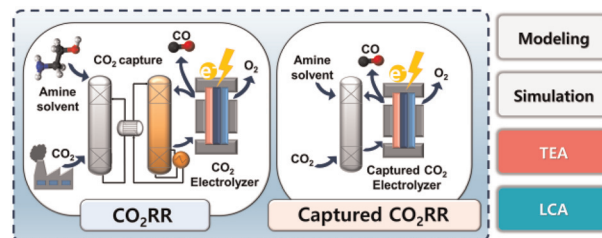
Marco Nazareno Dell'Anna, Geet Gupta, Prathamesh T. Prabhu, Ting-Hung Chu, Luke T. Roling* and Jean-Philippe Tessonnier*



10398

Techno-economic analysis and life-cycle assessment of the electrochemical conversion process with captured CO₂ in an amine-based solvent

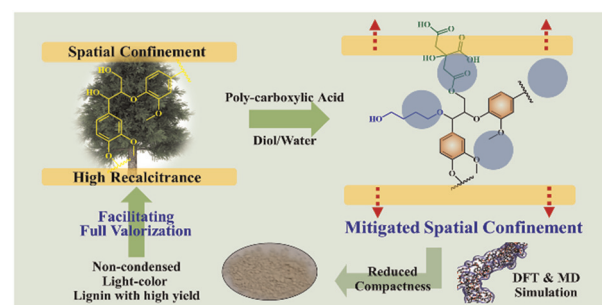
Suhyun Lee, Woong Choi, Jae Hyung Kim, Sohyeon Park, Yun Jeong Hwang* and Jonggeol Na*



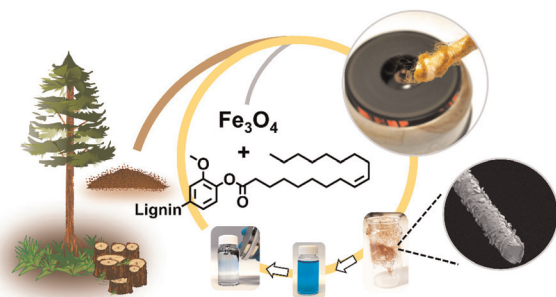
10415

Synergizing mitigated spatial confinement and chemical stabilization of lignin facilitates full utilization of lignocellulose

Jiayi Zheng, Liheng Chen,* Xueqing Qiu,* Shirong Sun and Xuliang Lin



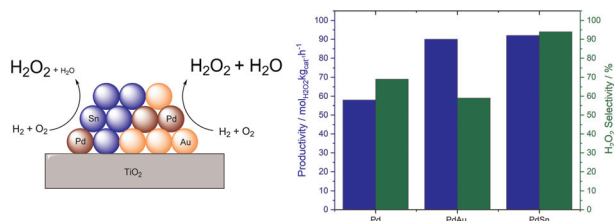
10424



Mechanically recyclable melt-spun fibers from lignin esters and iron oxide nanoparticles: towards circular lignin materials

Unnimaya Thalakkale Veetil, Adrian Moreno, Alberto J. Huertas-Alonso, Mohammad Morsali, Ievgen V. Pylypchuk, Li-Yang Liu and Mika H. Sipponen*

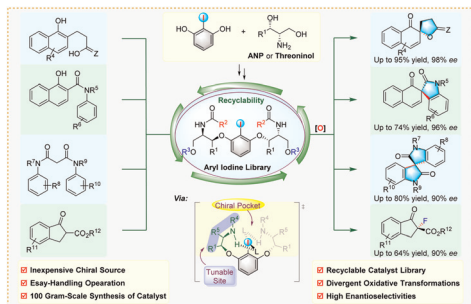
10436



A comparative study of palladium-gold and palladium-tin catalysts in the direct synthesis of H₂O₂

Dávid Kovačič, Richard J. Lewis,* Caitlin M. Crombie, David J. Morgan, Thomas E. Davies, Ángeles López-Martín, Tian Qin, Christopher S. Allen, Jennifer K. Edwards, Liwei Chen, Martin Skov Skjøth-Rasmussen, Xi Liu* and Graham J. Hutchings*

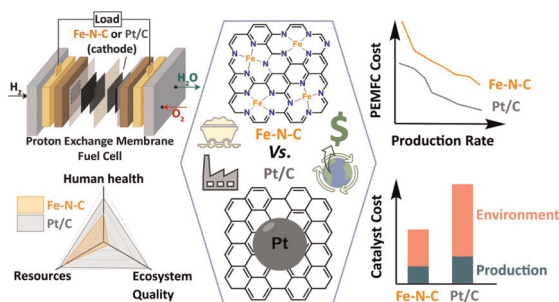
10447



New conformationally flexible and recyclable aryl iodine catalysts from an inexpensive chiral source for asymmetric oxidations

Hai-Jie Zhou, Yi-Ping Yao, Tonghui Zhang, Biao Chen, Xu Wang, Hang Zhao, Jie Zeng, Jian-Ai Chen, Xiao Xiao* and Fen-Er Chen*

10458



Comparative techno-economic and life-cycle analysis of precious versus non-precious metal electrocatalysts: the case of PEM fuel cell cathodes

Angus Pedersen, Jinil Pandya, Grazia Leonzio, Alexey Serov, Andrea Bernardi, Ifan E. L. Stephens, Maria-Magdalena Titirici, Camille Petit and Benoît Chachuat*

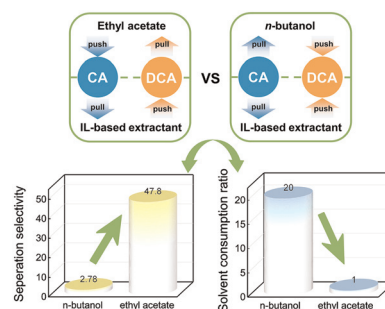


PAPERS

10472

A synergistic 'push and pull' ionic liquid biphasic system for enhanced extraction separation of cholic acid and deoxycholic acid

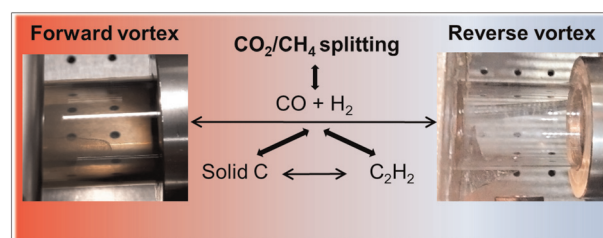
Zexiang Ding, Fanding Rong, Yifeng Cao,*
Yuanyuan Shen, Liu Yang, Lihang Chen, Qiwei Yang,
Zhiguo Zhang, Qilong Ren and Zongbi Bao*



10485

Avoiding solid carbon deposition in plasma-based dry reforming of methane

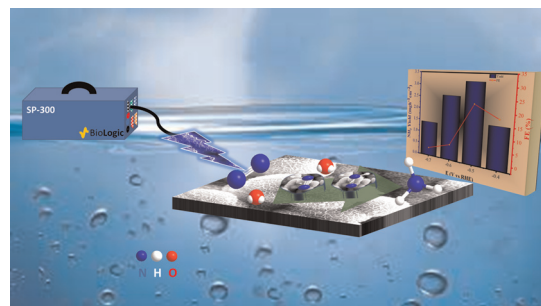
Omar Biondo,* Cas F. A. M. van Deursen,
Ashley Hughes, Alex van de Steeg, Waldo Bongers,
M. C. M. van de Sanden, Gerard van Rooij and
Annemie Bogaerts



10498

One-step synthesized Nb₂O_{5-y}-decorated spinel-type (Ni,V,Mn)₃O_{4-x} nanoflowers for boosting electrocatalytic reduction of nitrogen into ammonia

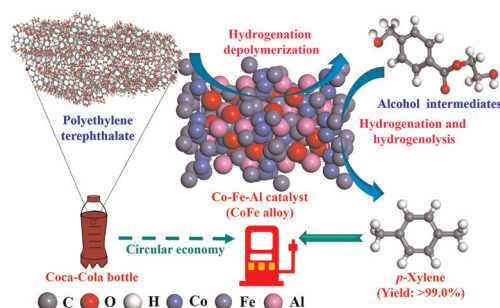
Tadele Negash Gemeda, Dong-Hau Kuo* and
Quoc-Nam Ha



10513

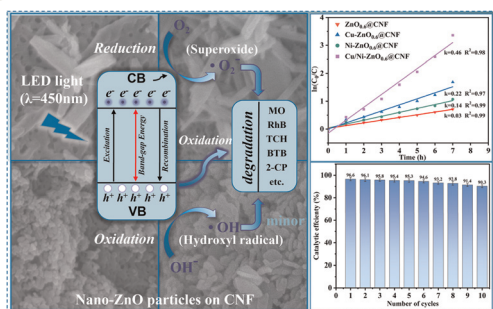
The quantitative conversion of polyethylene terephthalate (PET) and Coca-Cola bottles to p-xylene over Co-based catalysts with tailored activities for deoxygenation and hydrogenation

Yuewen Shao, Mengjiao Fan, Kai Sun, Guoming Gao,
Chao Li, Dianqiang Li, Yuchen Jiang, Lijun Zhang,
Shu Zhang and Xun Hu*



PAPERS

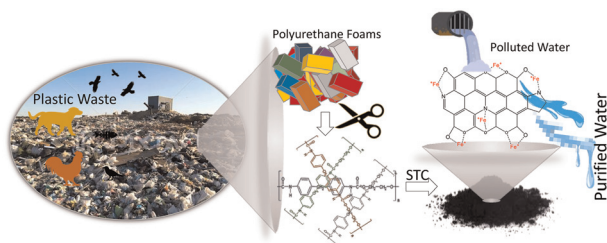
10530



Cu and Ni dual-doped ZnO nanostructures templated by cellulose nanofibrils for the boosted visible-light photocatalytic degradation of wastewater pollutants

Jiangang Yu,* Pingnian Bao, Jia Liu, Yi Jin, Jie Li and Yanwen Lv*

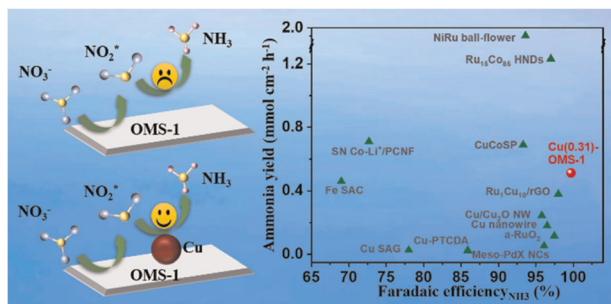
10538



A sustainable waste plastic valorisation: conversion of discarded polyurethane into an active micro-cleaner using a DES system

Ashok Shrishail Maraddi, Manohara Halanur Mruthunjayappa, Smitha V. Kamath, Glenita D'Souza, Hyeonseok Yoon* and S. K. Nataraj*

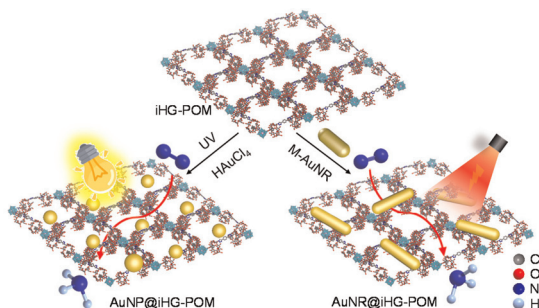
10549



Near 100% selectivity for ammonia synthesis at a high current density by promoting nitrate protonation on the copper dispersed todorokite-type manganese oxide

Shijia Li, Chuqian Xiao, Rongzhen Chen, Mengyi Wang, Yuting Ma, Kaiwen Luo, Muyao Shen, Yihua Zhu, Yuhang Li* and Chunzhong Li*

10556



Gold nanocrystal-loaded 2D supramolecular network for plasmon-enhanced nitrogen fixation

Gengxin Wang, Bingjin Li, Bao Li* and Lixin Wu*

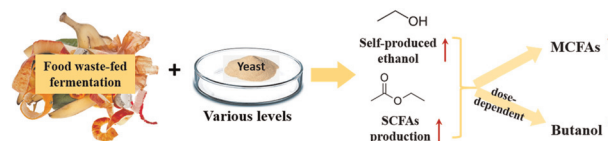


PAPERS

10567

Converting food waste into high-value medium chain fatty acids and long chain alcohols *via* chain elongation with an internally produced electron donor

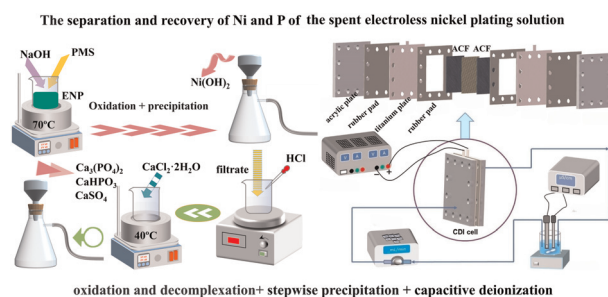
Lan Wu, Wei Wei,* Jin Qian, Xueming Chen and Bing-Jie Ni*



10576

Integrating multi-method approaches for the green separation and retrieval of nickel and phosphorus from spent electroless nickel plating solutions

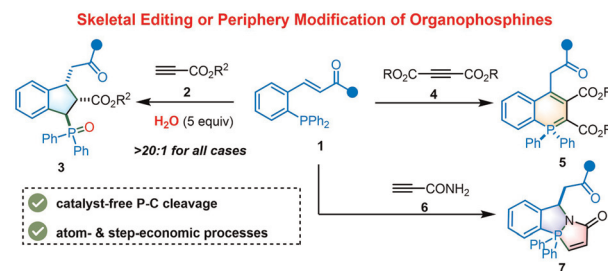
Zhontian Dong, Zhiren Zhao, Fenghe Wang, Fengyun Wang* and Mingzhu Xia*



10587

Distinct reactivities of *ortho*-chalcone-substituted organophosphines with activated alkynes: skeletal editing or periphery modification

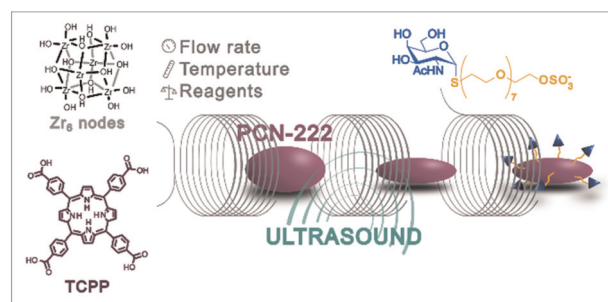
Chaoyang Li, Xinyue Niu, Wan Xu,* Zhanwei Bu, Wenjing Zhang* and Qilin Wang*



10596

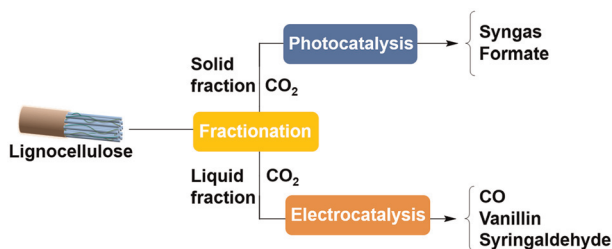
Continuous flow synthesis of PCN-222 (MOF-545) with controlled size and morphology: a sustainable approach for efficient production

Alessio Zuliani,* M. Carmen Castillejos and Nouredine Khair*



PAPERS

10611



Valorisation of lignocellulose and low concentration CO_2 using a fractionation–photocatalysis–electrolysis process

Santiago Rodríguez-Jiménez, Erwin Lam, Subhajt Bhattacharjee and Erwin Reisner*

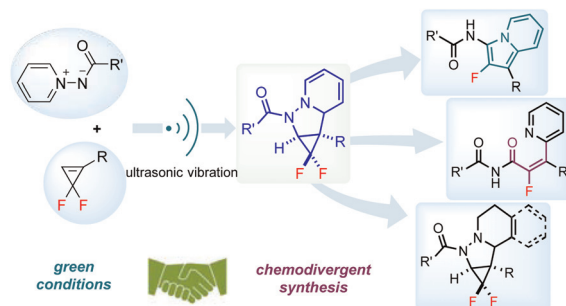
10622



Selective chemical disassembly of elastane fibres and polyurethane coatings in textiles

Martin B. Johansen, Bjarke S. Donslund, Martin L. Henriksen, Steffan K. Kristensen* and Troels Skrydstrup*

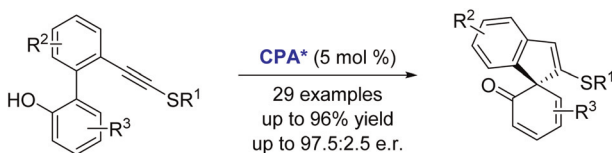
10630



Practical conversion of *gem*-difluorocyclopropenes for the chemodivergent assembly of fluorinated heterocyclic frameworks

Dongping Pan, Fu-Xiaomin Liu, Zhongyi Zeng, Junwei Ye, Ying Cai, Shengdong Wang, Zhi Zhou* and Wei Yi*

10638



Chiral Brønsted acid-catalyzed asymmetric dearomative spirocyclization of alkynyl thioethers

Xin-Yang Fan, Jia-Cheng Li, Ji-Jia Zhou,* Bo Zhou and Long-Wu Ye*

- 1st metal-free asymmetric reaction of alkynyl thioethers
- CADA reaction via direct alkyne activation
- unique S-containing products
- high enantioselectivity

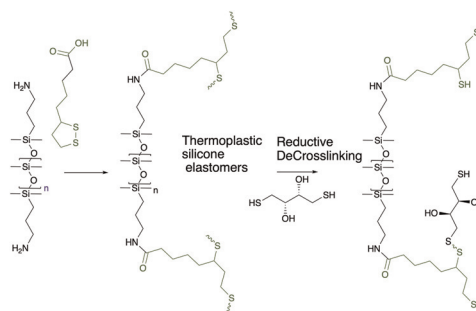


PAPERS

10644

Thermoplastic, redox recyclable silicone–lipoamide elastomers

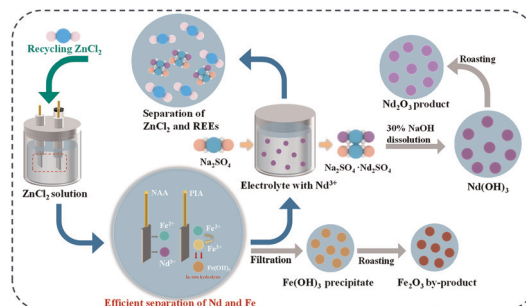
Muhammad Ebad Noman, Sijia Zheng, Haiyan Xue and Michael A. Brook*



10653

An acid-free process for selective REE recovery from spent NdFeB magnets by room-temperature electrolysis

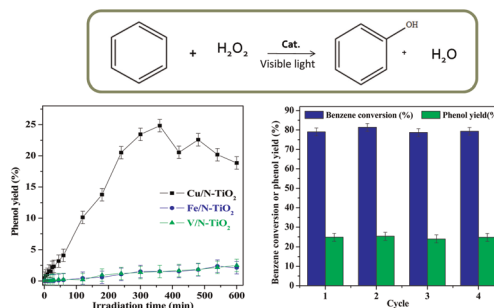
Zhang Zhihan, Wang Zhi, Wang Dong,* Min Rui, Xiao Wanhai, Lin Yong and Li Guobiao*



10664

Tuning the selectivity of visible light-driven hydroxylation of benzene to phenol by using Cu, Fe and V oxides supported on N-doped TiO₂

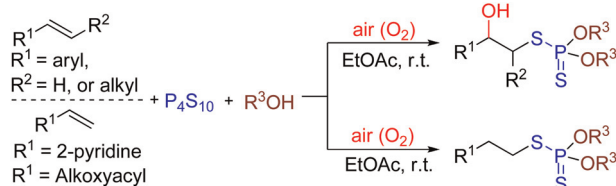
Antonietta Mancuso, Alessandro Gottuso, Francesco Parrino,* Rosaria Anna Picca, Vincenzo Venditto, Olga Sacco* and Vincenzo Vaiano



10678

Additive-free aerobic oxidative difunctionalization of alkenes with P₄S₁₀ and alcohols to access β-hydroxy phosphorodithioates

Chengming Qu, Yufen Lv, Jian Huang, Chao Ma, Huilan Yue, Wei Wei* and Dong Yi*

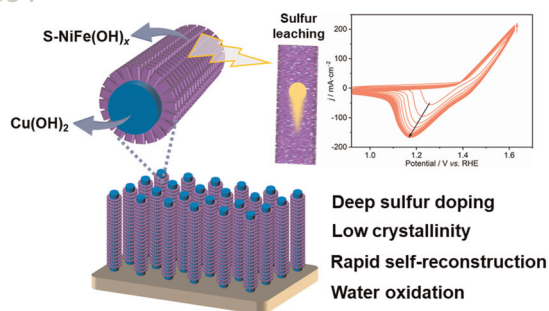


* Additive-free * Mild conditions * Simple operation
 Broad substrate scope * Good functional group tolerance



PAPERS

10684



Deep sulfur doping induces the rapid electrochemical self-reconstruction of Ni–Fe hydroxide to drive water oxidation

Xiaoge Li,* Jun Zhao, Jinhua Zhou, Qinchao Wang* and Jie Han*

CORRECTION

10693

Correction: Utilization of fluoroform for difluoromethylation in continuous flow: a concise synthesis of α -difluoromethyl-amino acids

Manuel Köckinger, Tania Ciaglia, Michael Bersier, Paul Hanselmann, Bernhard Gutmann* and C. Oliver Kappe*

