

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(19) 7397–7828 (2023)



Cover

See Zhenfeng Bian, Hexing Li, Yinghong Yue *et al.*, pp. 7518–7523.

Image reproduced by permission of Yinghong Yue from *Green Chem.*, 2023, **25**, 7518.



Inside cover

See Shū Kobayashi *et al.*, pp. 7524–7528.

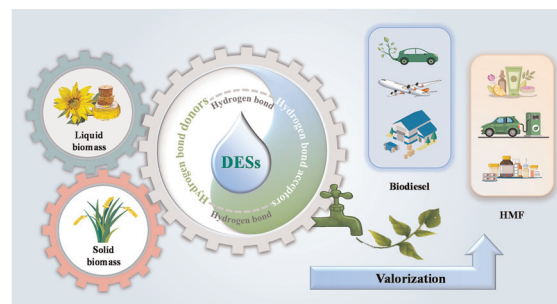
Image reproduced by permission of Shū Kobayashi from *Green Chem.*, 2023, **25**, 7524.

CRITICAL REVIEWS

7410

Deep eutectic solvents for catalytic biodiesel production from liquid biomass and upgrading of solid biomass into 5-hydroxymethylfurfural

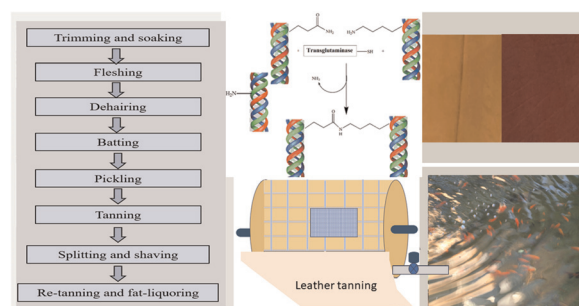
Lijuan He, Long Chen, Baohong Zheng, Heng Zhou, Hao Wang, Hu Li, Heng Zhang,* Chunbao Charles Xu* and Song Yang*



7441

A review of the green chemistry approaches to leather tanning in imparting sustainable leather manufacturing

Mohammad Mahbubul Hassan,* Jane Harris, James J. C. Busfield and Emiliano Bilotti



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

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
Dr Keiichi Tomishige, Tohoku University, Japan

Members

Professor André Bardow, ETH Zurich, Switzerland
Dr François Jérôme, University of Poitiers, France
Professor Laurel Shafer, The University of British Columbia, Canada
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 Caverni, 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

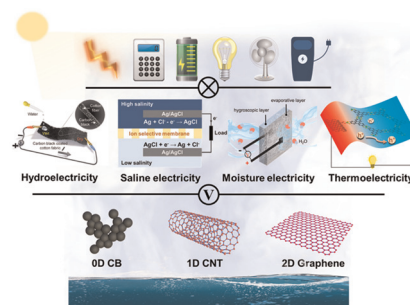


TUTORIAL REVIEWS

7470

Carbon materials for hybrid evaporation-induced electricity generation systems

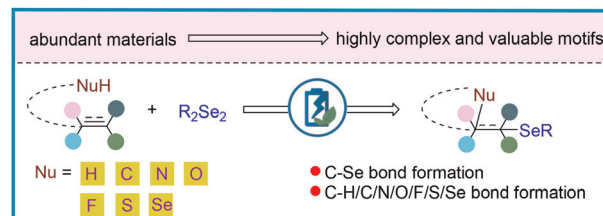
Can Ge, Duo Xu, Yan Qian, Heng Du, Chong Gao, Zhuoer Shen, Zhe Sun and Jian Fang*



7485

Recent progress in the electrochemical selenofunctionalization of alkenes and alkynes

Pei Qu, You-Qin Jiang, Yong-Hao Wang and Gong-Qing Liu*

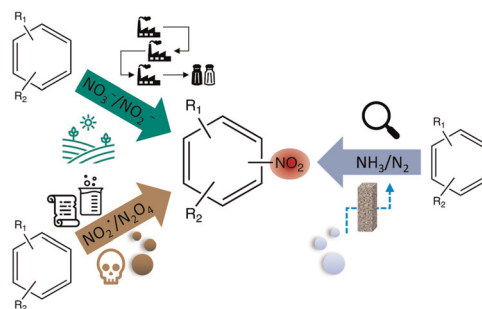


PERSPECTIVE

7508

Electrochemical nitration for organic C–N bond formation: a current view on possible N-sources, mechanisms, and technological feasibility

Nils Kurig* and Regina Palkovits

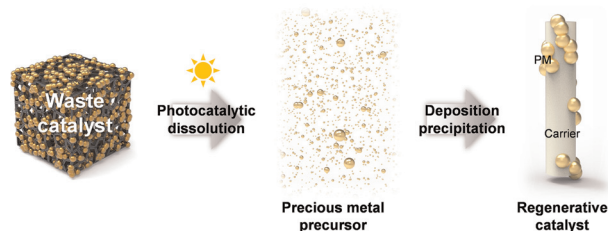


COMMUNICATIONS

7518

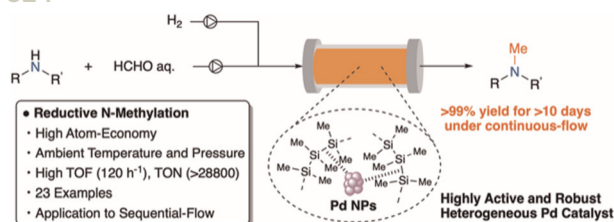
Precious metal catalyst recycling through photocatalytic dissolution

Yao Chen, Huan He, Shuyang Xu, Zhengxi Zou, Weiming Hua, Zhenfeng Bian,* Hexing Li* and Yinghong Yue*



COMMUNICATIONS

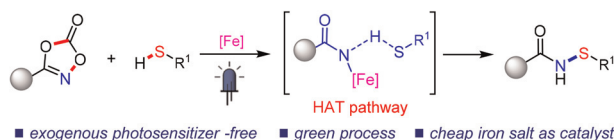
7524



Continuous-flow reductive *N*-methylation with highly active heterogeneous Pd catalysts and sequential-flow synthesis of *N*-monomethyl amines

Yuki Saito, Taisei Senzaki, Ken Nishizawa and Shū Kobayashi*

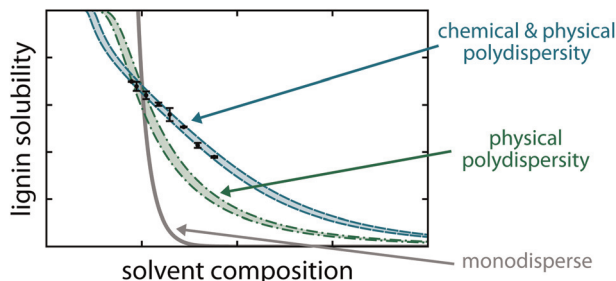
7529



Visible-light-induced iron-catalyzed S–N cross-coupling of thiols with dioxazolones

Jing-Jing Tang, Ning Yan, Yiwei Zhang, Yi Wang, Ming Bao and Xiaoqiang Yu*

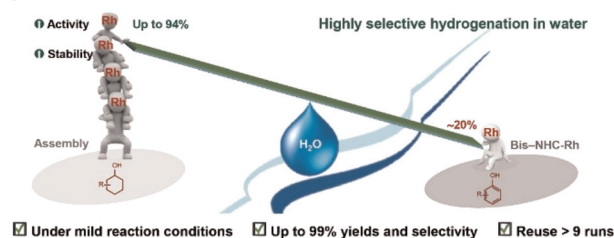
7534



Quantitative prediction of the solvent fractionation of lignin

Stijn H. M. van Leuken, Dannie J. G. P. van Osch, Panos D. Kouris, Yawen Yao, Monika A. Jedrzejczyk, Geert J. W. Cremers, Katrien V. Bernaerts, Rolf A. T. M. van Benthem, Remco Tuinier, Michael D. Boot, Emiel J. M. Hensen* and Mark Vis*

7541



Selective hydrogenation of phenols to cyclohexanols catalyzed by robust solid NHC–Rh coordination assemblies in water

Jie Chen, Jiale Ji and Tao Tu*

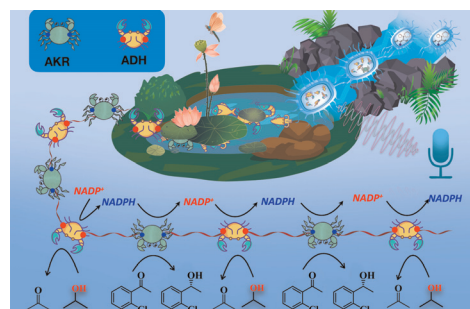


PAPERS

7547

Designing an enzyme assembly line for green cascade processes using bio-orthogonal chemistry

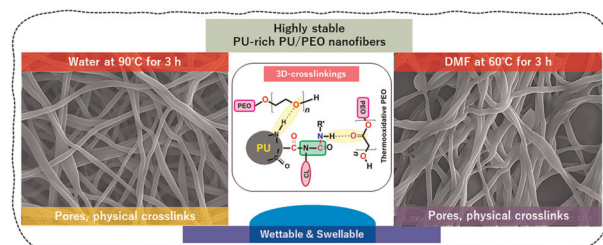
Li Qiao, Zhiyuan Luo, Ru Wang, Xiaolin Pei, Shujiao Wu, Haomin Chen, Tian Xie,* Roger A. Sheldon* and Anming Wang*



7556

Water-based eco-friendly fabrication of physicochemically crosslinked and highly wettable PU-rich electrospun PU/PEO nanofiber composites with exceptional chemical and thermal stability

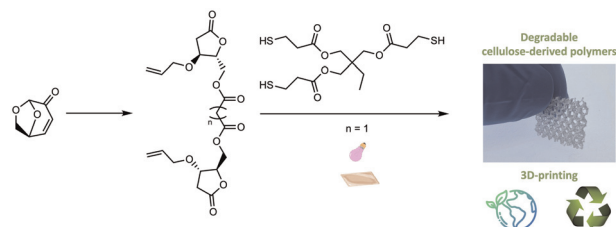
Osamu Ohsawa, Gopiraman Mayakrishnan, Yan Ge, Chunhong Zhu, Kei Watanabe* and Ick Soo Kim*



7571

Levoglucosenone to 3D-printed green materials: synthesizing sustainable and tunable monomers for eco-friendly photo-curing

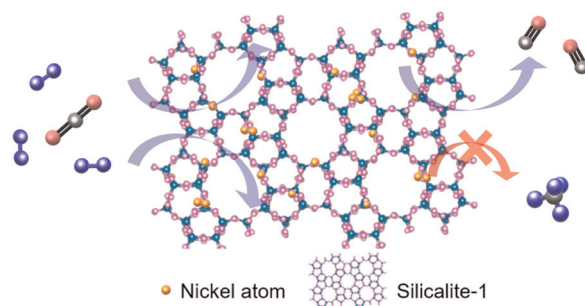
Amandine L. Flourat, Lorenzo Pezzana, Sabrina Belgacem, Abdouramane Dosso, Marco Sangermano, Sami Fadlallah* and Florent Allais*



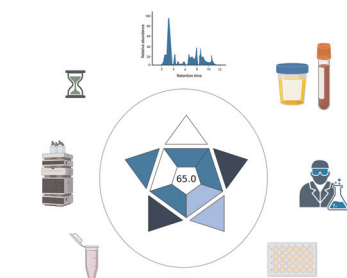
7582

Reversal of methanation-oriented to RWGS-oriented Ni/SiO₂ catalysts by the exsolution of Ni²⁺ confined in silicalite-1

Chia-Hung Chen, Hong-Kai Chen, Wei-Hsiang Huang, Chi-Liang Chen, Kittisak Choojun, Tawan Sooknoi, Hong-Kang Tian* and Yu-Chuan Lin*



7598

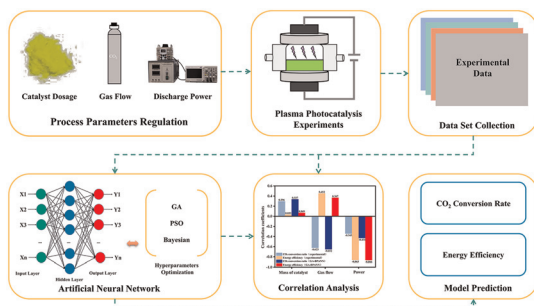


Blue Applicability Grade Index (BAGI)

Blue applicability grade index (BAGI) and software: a new tool for the evaluation of method practicality

Natalia Manousi, Wojciech Wojnowski, Justyna Płotka-Wasyłka and Victoria Samanidou*

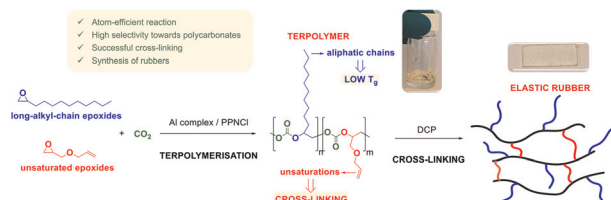
7605



Machine learning for CO₂ conversion driven by dielectric barrier discharge plasma and Cs₂TeCl₆ photocatalysts

Yangyi Shen, Chengfan Fu, Wen Luo, Zhiyu Liang, Zi-Rui Wang* and Qiang Huang*

7612



Novel elastic rubbers from CO₂-based polycarbonates

Giulia Chiarioni, Martin van Duin and Paolo P. Pescarmona*

7627



Conditions A: K₂CO₃, DMAc, with or without 18-crown-6, rt-100 °C for most of electron-deficient aryl halides (Cl, Br)

Conditions B: 1-5 mol% copper salt and oxalic diamide, *t*-BuOK, dioxane, 30-130 °C

for most of electron-rich (hetero)aryl halides (Cl, Br, I)

Assembly of (hetero)aryl thioethers via simple nucleophilic aromatic substitution and Cu-catalyzed coupling reactions with (hetero)aryl chlorides and bromides under mild conditions

Weiqi Liu, Xinghao Jin and Dawei Ma*

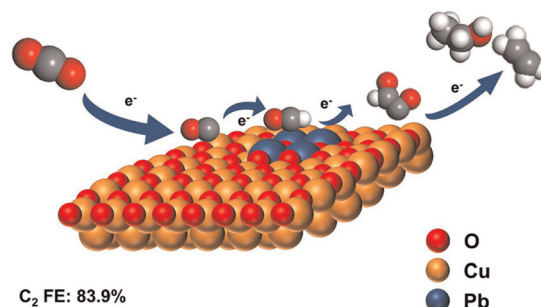


PAPERS

7635

Stabilizing Cu⁰–Cu⁺ sites by Pb-doping for highly efficient CO₂ electroreduction to C₂ products

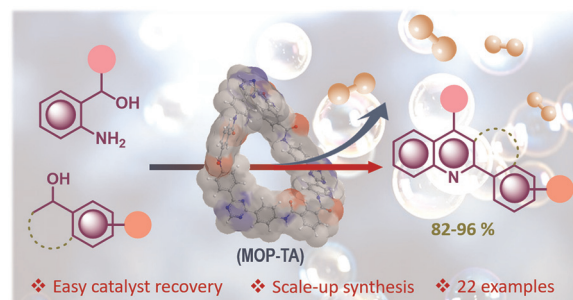
Xiaodong Ma, Xinning Song, Libing Zhang, Limin Wu, Jiaqi Feng, Shunhan Jia, Xingxing Tan, Liang Xu, Xiaofu Sun* and Buxing Han*



7642

Metal-free reusable hollow-spherical triazine microporous organic polymer supported quinolines synthesis via hydrogen evolution

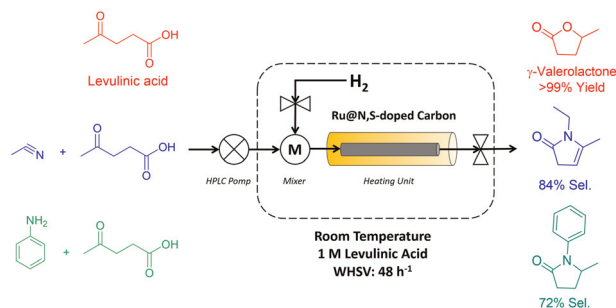
Debabrat Pathak, Bikash Kumar Kalita, Ashish Sarmah, Himanshu Sharma, Bidisha Bora, Tridib K. Goswami and Bipul Sarma*



7653

Room temperature continuous flow synthesis of γ -valerolactone and N-containing heterocycles over Ru supported bimodal N,S-doped cubic mesoporous carbon

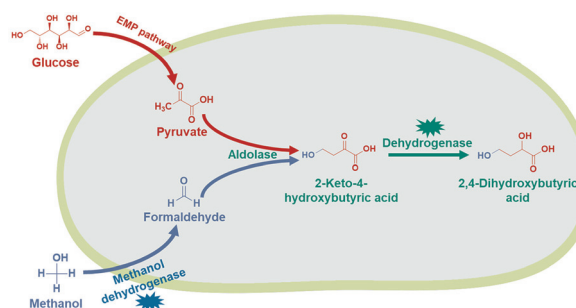
Hamzeh H. Veisi, Babak Karimi,* Mohsen Heydari and Rafael Luque*



7662

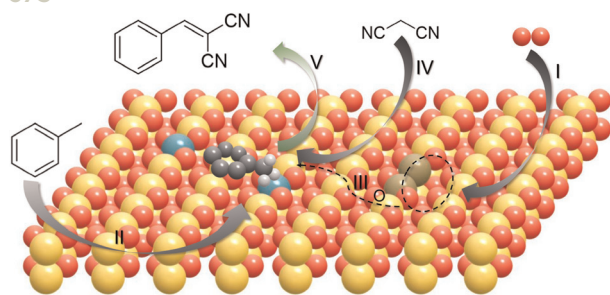
Highly efficient biosynthesis of 2,4-dihydroxybutyric acid by a methanol assimilation pathway in engineered *Escherichia coli*

Xianjuan Dong, Chao Sun, Jing Guo, Xiangyu Ma, Mo Xian* and Rubing Zhang*



PAPERS

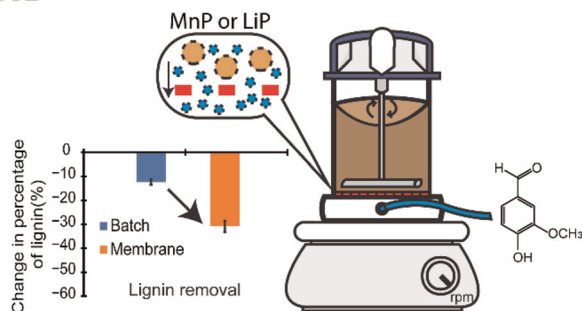
7673



Dual active-sites of Co and oxygen vacancies in Co-doped CeO₂-catalyzed toluene oxidation for the subsequent Knoevenagel condensation process

Yong Zou, Yuxuan Liu, Sai Zhang* and Yongquan Qu*

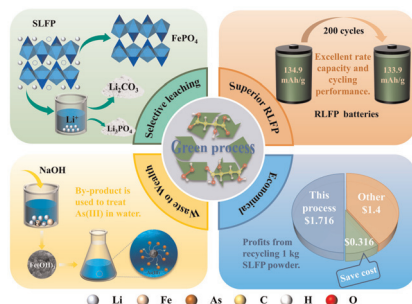
7682



Enhanced depolymerization of beech wood lignin and its removal with peroxidases through continuous separation of lignin fragments

Kenneth Sze Kai Teo, Keiko Kondo, Kaori Saito, Yu Iseki, Takashi Watanabe, Takashi Nagata* and Masato Katahira*

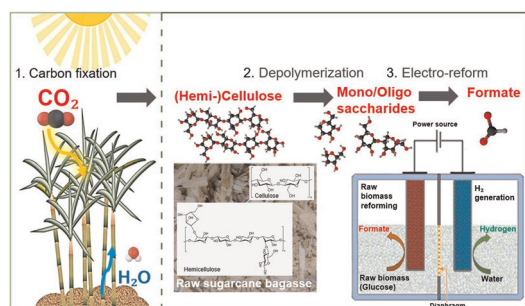
7696



Integrated recycling of valuable elements from spent LiFePO₄ batteries: a green closed-loop process

Huixiang Zhou, Yun Zhang, Liqing Li and Zhanfang Cao*

7707



Green hydrogen generation assisted by electroreforming of raw sugarcane bagasse waste

Li Quan Lee, Hu Zhao, Tian Yee Lim, Ge Junyu, Ovi Lian Ding, Wen Liu* and Hong Li*



Anthony Vivien, Laurent Veyre, Raphaël Mirgalet,
Clément Camp and Chloé Thieuleux*

7729

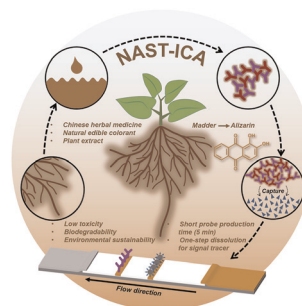
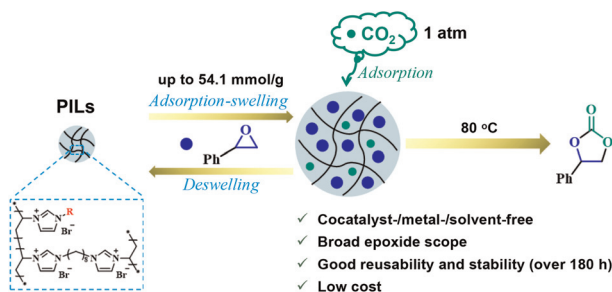
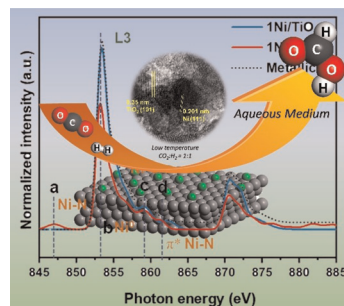
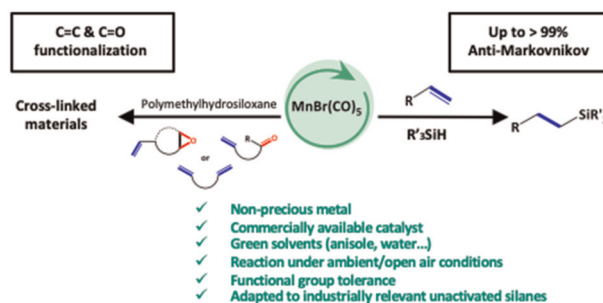
Jyotishman Kaishyop, Tuhin Suvra Khan, Satyajit Panda,
Pranay Rajendra Chandewar, Debaprasad Shee, Tulio
C. R. Rocha, Flavio C. Vicentin and Ankur Bordoloi*

7743

Bihua Chen, Shiguo Zhang* and Yan Zhang*

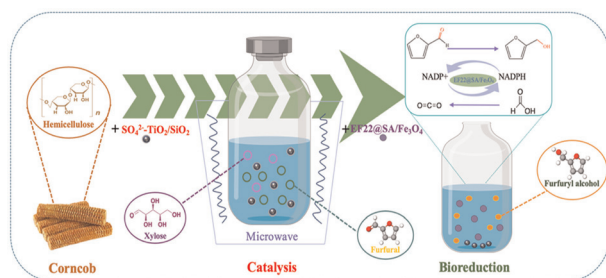
7756

Shaochi Wang, Ting Du, Junqi Huangmin, Sijie Liu,
Ying Zhu, Daohong Zhang, Jing Sun, Yanru Wang,*
Lintao Zeng* and Jianlong Wang*



PAPERS

7764

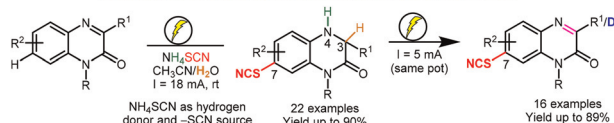


Enhanced upgrading of corncob to furfuryl alcohol with a novel silica-supported SO_4^{2-} - TiO_2 chemo-catalyst and immobilized whole-cell biocatalyst

Qi Li, Ruiying Gao, Yi Zhang, Yufei Zhang, Tieliang Liu, Yu-Cai He* and Ming-Ming Zheng*

7774

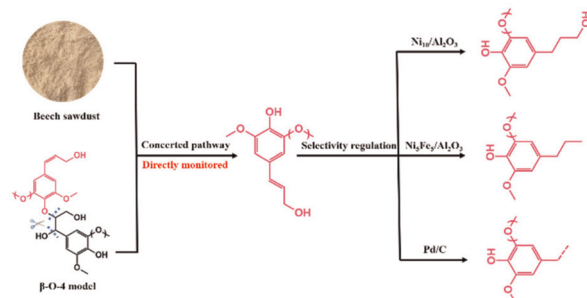
Electrochemical Cascade Sequences: Reduction, thiocyanation, and Oxidation



Electrochemical cascade sequences for remote C7–H bond thiocyanation of quinoxalin-2(1H)-ones with ammonium thiocyanate

Rajib Maity,* Abhijit Bankura and Indrajit Das*

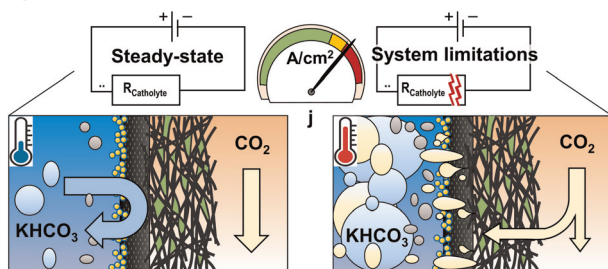
7782



$\text{Ni}_5\text{Fe}_5/\text{Al}_2\text{O}_3$ catalytic hydrogenolysis of lignin: mechanism investigation and selectivity regulation

Zhensheng Shen, Wei Wang, Lun Pan, Zhenfeng Huang, Xiangwen Zhang, Chengxiang Shi* and Ji-Jun Zou*

7794



CO_2 flow electrolysis – limiting impact of heat and gas evolution in the electrolyte gap on current density

Christina Martens,* Bernhard Schmid,* Hermann Tempel and Rüdiger-A. Eichel

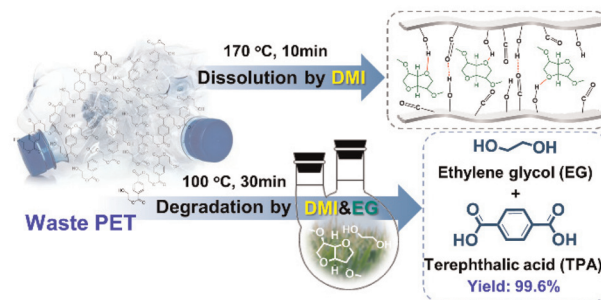


PAPERS

7807

Biobased dimethyl isosorbide as an efficient solvent for alkaline hydrolysis of waste polyethylene terephthalate to terephthalic acid

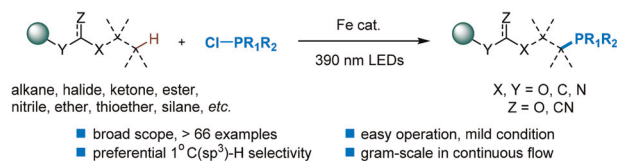
Haitao Yu, Yang Wang, Lan Chen, Chenyang Wei, Tiancheng Mu and Zhimin Xue*



7817

Photoinduced ligand-to-iron charge transfer enabled C(sp³)-H phosphorylation of hydrocarbons

Wei Shi, Ping-Fu Zhong, Xu-Kuan Qi, Chao Yang, Lin Guo* and Wujiong Xia*



CORRECTION

7825

Correction: Surprisingly fast assembly of the MOF film for synergetic antibacterial phototherapeutics

Jie Gao, Lingwan Hao, Rujian Jiang, Zhuo Liu, Limei Tian, Jie Zhao,* Weihua Ming and Luquan Ren

