

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.

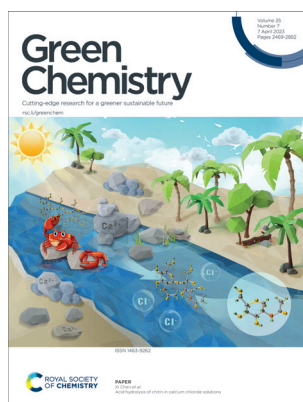
IN THIS ISSUE

ISSN 1463-9262 CODEN GRCHFJ 25(7) 2469–2882 (2023)



Cover
See Haruo Kawamoto *et al.*,
pp. 2583–2595.

Image reproduced
by permission of
Haruo Kawamoto
from *Green Chem.*,
2023, **25**, 2583.



Inside cover
See Xi Chen *et al.*,
pp. 2596–2607.

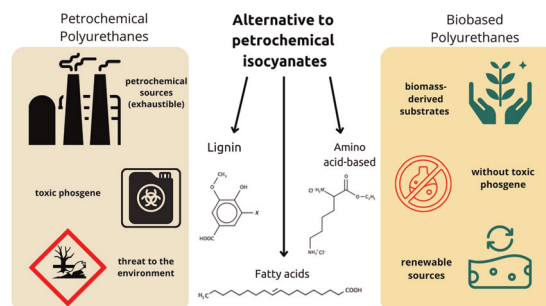
Image reproduced
by permission of
Xi Chen from *Green Chem.*,
2023, **25**, 2596.

CRITICAL REVIEWS

2482

Challenges and recent advances in bio-based isocyanate production

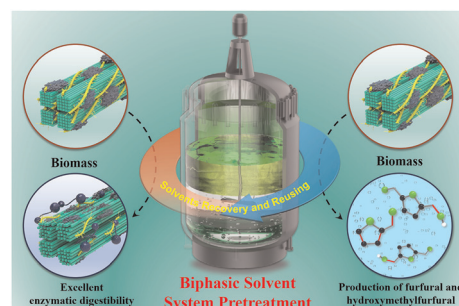
Joanna Niesiołbiedzka and Janusz Datta*



2505

Recent advances in biomass pretreatment using biphasic solvent systems

Ruolin Li, Yayue Zheng, Xiaoxue Zhao, Qiang Yong, Xianzhi Meng,* Arthur Ragauskas* and Caoxing Huang*



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, Hugh Ryan, Wing So

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 Elsie A. Quadrelli, CNRS and CPE Lyon, France

Members

Dr François Jérôme, University of Poitiers, France
Professor Laurel Shafer, The University of British Columbia, Canada
Dr Helen Sneddon, University of York, UK
Dr Keiichi Tomishige, Tohoku University, Japan
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
Asim Bhaumik, Indian Association for the Cultivation of Science, India

Fabrizio Cavani, University of Bologna, Italy
Yonas Chebude, Addis Ababa University, Ethiopia

James Clark, University of York, UK

Avelino Corma, Universidad Politécnica de Valencia, Spain

Robert H Crabtree, Yale University, USA

Pierre Digne, University of Rennes, France

James Dumesic, University of Wisconsin-Madison, USA

Peter Dunn, Pfizer, UK

Karen Goldberg, University of Washington, USA

Buxing Han, Chinese Academy of Sciences, China

Mark Harmer, SAC Technologies, USA

Milton Hearn, Monash University, Australia

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

Mihkel Koel, Tallinn University of Technology, Estonia

Burkhard Koenig, University of Regensburg, Germany

Michael Kopach, Eli Lilly and Company, USA

Dhileep Krishnamurthy, Jubilant Ingrevia Limited, India

Walter Leitner, RWTH Aachen University, Germany

Chao-Jun Li, McGill University, Canada

Rafael Luque, University of Cordoba, Spain

Doug MacFarlane, Monash University, Australia

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

Robin D. Rogers, McGill University, Canada

Gadi Rothenberg, University of Amsterdam, The Netherlands

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

Peter Wasserscheid, Friedrich-Alexander Universität Erlangen-Nürnberg, Germany

Tom Welton, Imperial College London, UK

Ganapati D. Yadav, Institute of Chemical Technology, India

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

Julie Zimmerman, Yale University, USA

Vânia Zuin, Federal University of São Carlos, Brazil

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

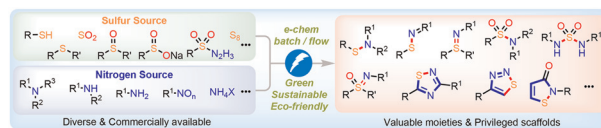


TUTORIAL REVIEWS

2524

Advances in S–N bond formation via electrochemistry: a green route utilizing diverse sulfur and nitrogen sources

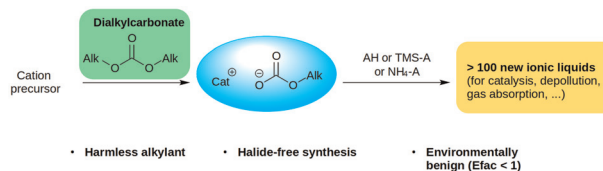
Zenghui Ye, Xi Zhang, Weiyuan Ma and Fengzhi Zhang*



2541

The dialkylcarbonate route to ionic liquids: purer, safer, greener?

Martin Tiano,* Ryan Clark, Laetitia Bourgeois and Margarida Costa Gomes*



COMMUNICATIONS

2559

Solvent-free mechanochemical chlorination of pyrazoles with trichloroisocyanuric acid

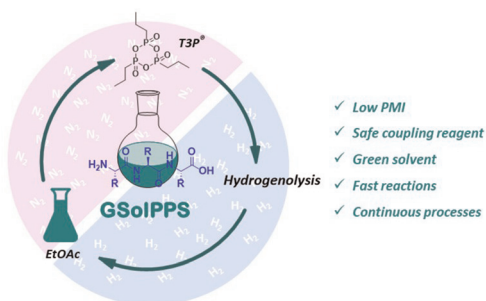
Chi-Min Chen, Jia-Xin Chen and Ching Tat To*



2563

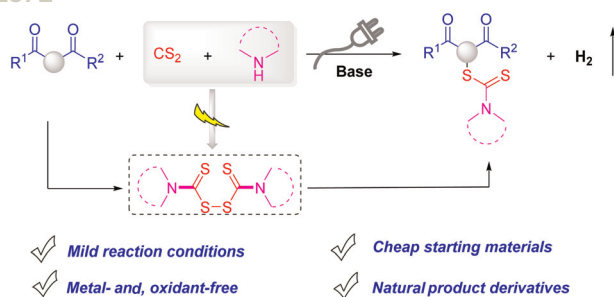
Speeding up sustainable solution-phase peptide synthesis using T3P® as a green coupling reagent: methods and challenges

Alexia Mattellone, Dario Corbisiero, Lucia Ferrazzano, Paolo Cantelmi, Giulia Martelli, Chiara Palladino, Alessandra Tolomelli* and Walter Cabri*



COMMUNICATIONS

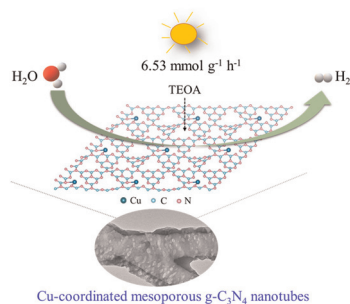
2572



Electrochemically driven α -thiocarbamylation via a dehydrocoupling strategy of β -ketoesters with amines and CS_2

Qian Wang, Xiu-Jin Meng, Hai-Tao Tang, Ying-Ming Pan,* Wen-Gui Duan* and Mu-Xue He*

2577

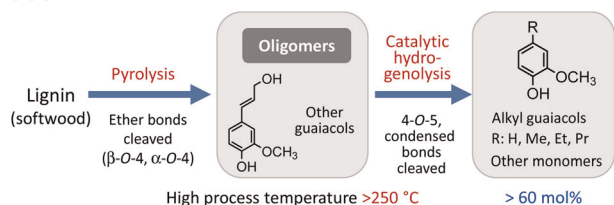


Facilitated photocatalytic H_2 production on Cu-coordinated mesoporous $\text{g-C}_3\text{N}_4$ nanotubes

Zhuizhui Su, Jianling Zhang,* Zhonghao Tan, Jingyang Hu, Fengtao Zhang, Ran Duan, Lei Yao, Buxing Han, Yingzhe Zhao and Yisen Yang

PAPERS

2583



Pyrolysis-assisted catalytic hydrogenolysis of softwood lignin at elevated temperatures for the high yield production of monomers

Jiaqi Wang, Eiji Minami and Haruo Kawamoto*

2596



Acid hydrolysis of chitin in calcium chloride solutions

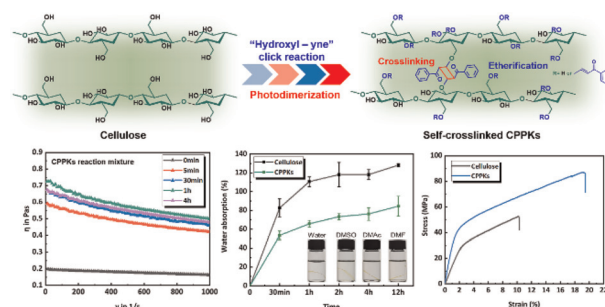
Yudi Wang, Jia Kou, Xuwei Wang and Xi Chen*



2608

One-pot cellulose etherification and self-crosslinking via a mild hydroxyl–yne click reaction in a homogeneous system

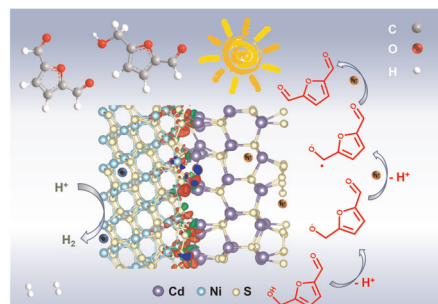
Bowen Li, Chaoqun Xu, Juan Yu,* Liang Liu, Xiaofang Zhang* and Yimin Fan*



2620

Deep eutectic solvothermal NiS₂/CdS synthesis for the visible-light-driven valorization of the biomass intermediate 5-hydroxymethylfurfural (HMF) integrated with H₂ production

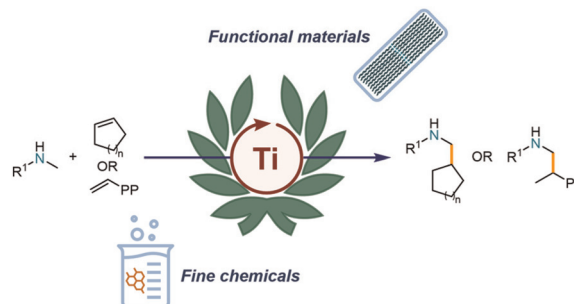
Shuzi Liu, Baolong Zhang, Zhaohui Yang, Zhimin Xue* and Tiancheng Mu*



2629

Accessing secondary amine containing fine chemicals and polymers with an earth-abundant hydroaminoalkylation catalyst

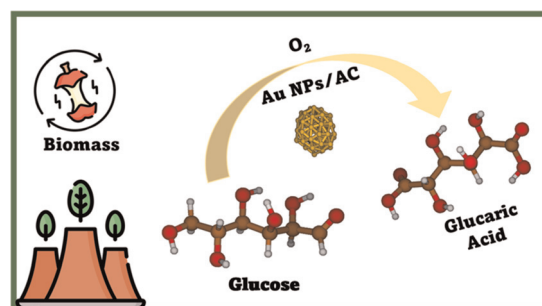
Manfred Manßen, Sabrina S. Scott, Danfeng Deng, Cameron H. M. Zheng and Laurel L. Schafer*



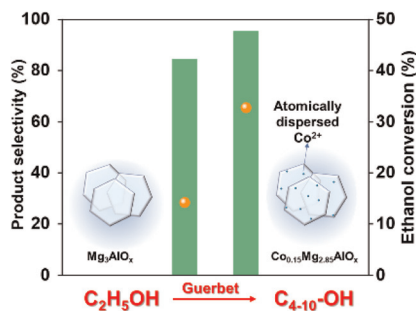
2640

Influence of stabilisers on the catalytic activity of supported Au colloidal nanoparticles for the liquid phase oxidation of glucose to glucaric acid: understanding the catalyst performance from NMR relaxation and computational studies

E. Monti, A. Ventimiglia, L. Forster, E. Rodríguez-Aguado, J. A. Cecilia, F. Ospitali, T. Tabanelli, S. Albonetti, F. Cavani, I. Rivalta,* C. D'Agostino* and N. Dimitratos*



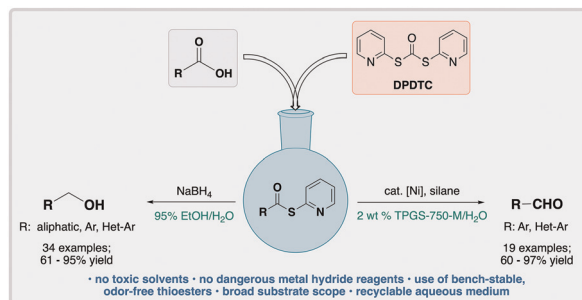
2653



Atomically dispersed Co^{2+} on MgAlO_x boosting $\text{C}_4\text{--}10$ alcohols selectivity of ethanol valorization

Wen-Lu Lv, Lei He, Wen-Cui Li, Bai-Chuan Zhou, Shao-Pei Lv and An-Hui Lu*

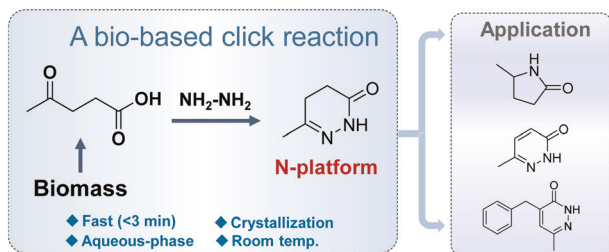
2663



Facile, green, and functional group-tolerant reductions of carboxylic acids...in, or with, water

Karthik S. Iyer, Chandler Nelson and Bruce H. Lipshutz*

2672

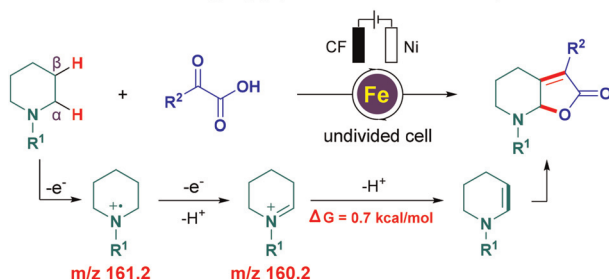


A bio-based click reaction leading to the dihydropyridazinone platform for nitrogen-containing scaffolds

Jia-Yue Chen, Yao-Bing Huang,* Bin Hu, Ke-Ming Li, Ji-Long Zhang, Xuan Zhang, Xia-Yun Yan and Qiang Lu*

2681

Electrochemical dual $\alpha,\beta\text{-C}(\text{sp}^3)\text{-H}$ functionalization of cyclic amines



Electrochemical dual $\alpha,\beta\text{-C}(\text{sp}^3)\text{-H}$ functionalization of cyclic *N*-aryl amines

Tian Feng, Zile Zhu, Dongmei Zhang, Siyi Wang, Ruopu Li, Zhaolin Zhu, Xinxing Zhang* and Youai Qiu*

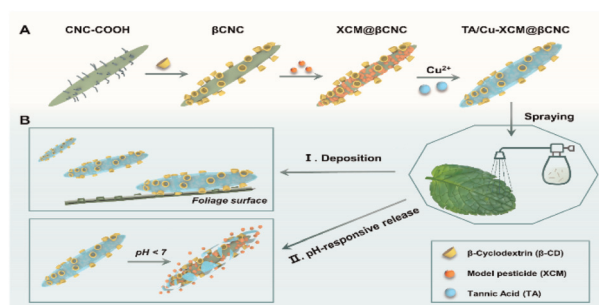


PAPERS

2690

Cellulose nanocrystals for crop protection: leaf adhesion and controlled delivery of bioactive molecules

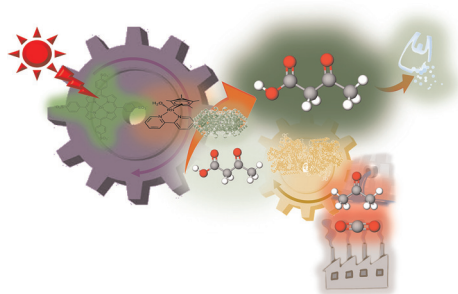
Like Ning, Chaoqun You,* Yuxin Jia, Jingqian Chen, Yu Zhang, Xun Li, Orlando J. Rojas* and Fei Wang*



2699

Visible-light-driven 3-hydroxybutyrate production from acetone and low concentrations of CO₂ with a system of hybridized photocatalytic NADH regeneration and multi-biocatalysts

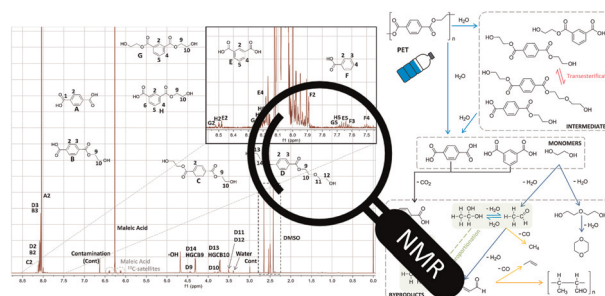
Yu Kita and Yutaka Amao*



2711

Process optimization by NMR-assisted investigation of chemical pathways during depolymerization of PET in subcritical water

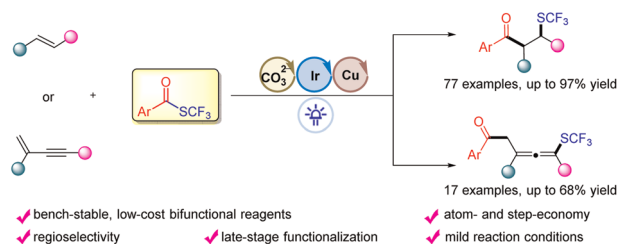
Antonio Jaime-Azuara, Thomas Helmer Pedersen* and Reinhard Wimmer*



2723

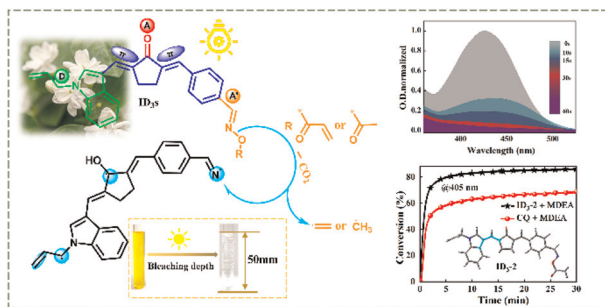
S-Trifluoromethyl thioesters as bifunctional reagents for acyl-trifluoromethylthiolation of alkenes and 1,3-enynes via photoredox/copper dual catalysis

Zhong Zhang, Yang Tian, Xiaowei Li, Zemin Wang, Ruihua Liu, Ping Chen, Xiangqian Li, Jiajia Dai and Dayong Shi*



PAPERS

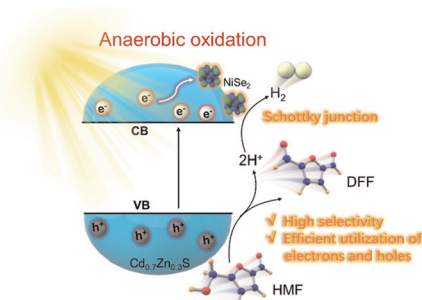
2730



Novel multifunctional unimolecular initiators built on natural indole featuring fast photobleaching and visible light/thermal double polymerization

Shang Gong, Xiang Wu, Qiuyan Liao, Shuang Deng, Jing Hou, Kuangyu Tang, Ying Xiong, Zhen Li and Hongding Tang*

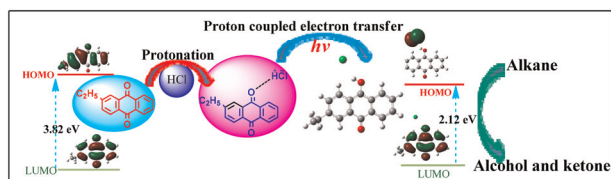
2745



Visible-light-driven anaerobic oxidative upgrading of biomass-derived HMF for co-production of DFF and H₂ over a 1D Cd_{0.7}Zn_{0.3}S/NiSe₂ Schottky junction

Tao Shan, Luteng Luo, Taoran Chen, Lixun Deng, Mengqing Li, Xuhui Yang, Lijuan Shen and Min-Quan Yang*

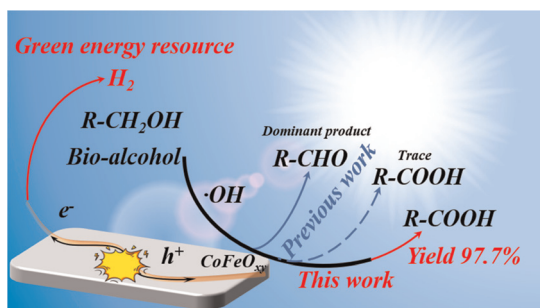
2757



Enhanced driving force and charge separation efficiency of protonated anthraquinone for C–H photooxygenation of alkanes by proton-coupled electron transfer

Hui Yin, Yingying Yuan, Yangbin Li, Jing Tang, Wenzhou Zhong* and Liqiu Mao*

2771



Non-quantum nanostructure-enabled hot carrier generation for enhanced photoelectrocatalytic oxidation of bio-alcohol in water coupled with hydrogen evolution

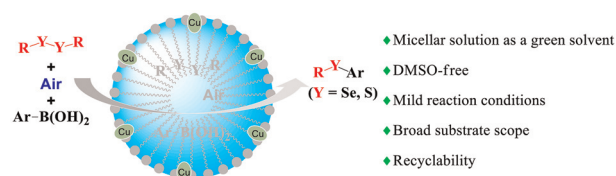
Pei-dong Wu, Lanyun Li, Keping Wang, Hu Li* and Zhen Fang*



2782

Cu-catalysed Chan–Lam synthesis of unsymmetrical aryl chalcogenides under aqueous micellar conditions

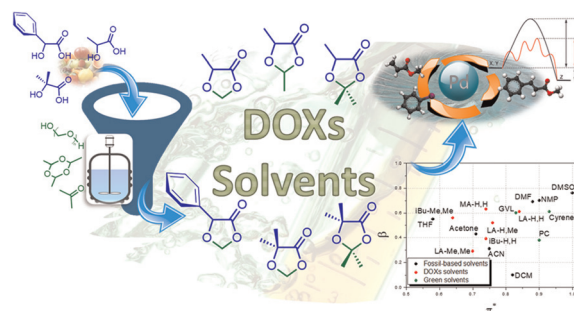
Nan Sun,* Kai Zheng, Mingqiang Zhang, Guowen Zheng, Liqun Jin, Baoxiang Hu, Zhenlu Shen and Xinquan Hu*



2790

1,3-Dioxolane compounds (DOXs) as biobased reaction media

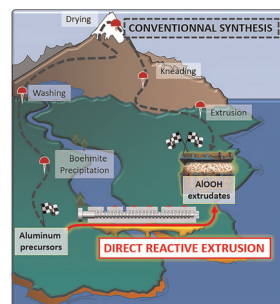
Massimo Melchiorre, Peter H. M. Budzelaar, Maria E. Cucciolito, Roberto Esposito, Emanuela Santagata and Francesco Ruffo*



2800

Coupling of solvent-free synthesis and reactive extrusion of alumina: an ecologically efficient integration for heterogenous catalyst synthesis

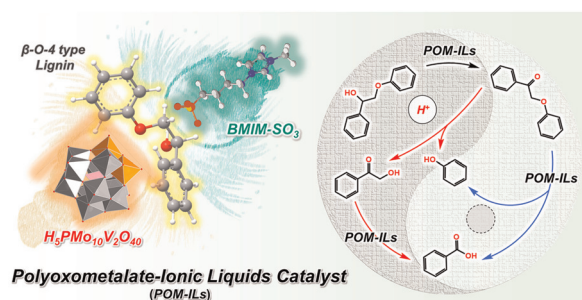
Pierre-Igor Dassie, Ryma Haddad, Maud Lenez, Alexandra Chaumonnot, Malika Boualleg, Patrick Legriel, Ales Styskalik, Bernard Haye, Mohamed Selmane, Damien P. Debecker, Clement Sanchez, Corinne Chaneac and Cedric Boissiere*



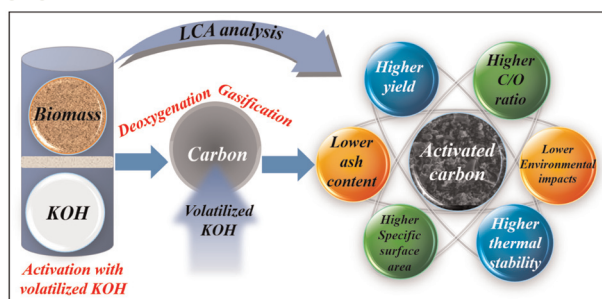
2815

A recoverable polyoxometalate-ionic liquid catalyst for selective cleavage of lignin β-O-4 models under mild conditions

Xing Xin, Zheng Li, Manzhou Chi, Mo Zhang, Yuanyuan Dong, Hongjin Lv* and Guo-Yu Yang*



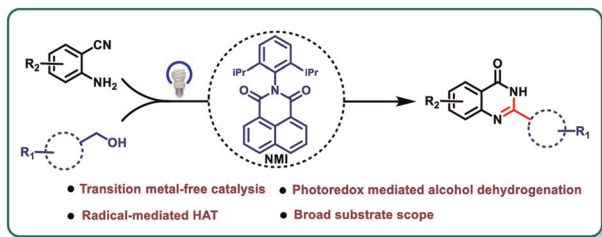
2825



Activation of biomass with volatilized KOH

Chao Li, Yuannian Li, Yuewen Shao, Lijun Zhang, Shu Zhang, Shuang Wang, Bin Li, Zhenhua Cui, Yonggui Tang and Xun Hu*

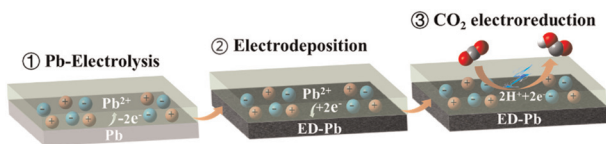
2840



Unlocking the photo-dehydrogenation ability of naphthalene monoimide towards the synthesis of quinazolinones

Supriya Halder, Sourav Mandal, Ayanangshu Biswas and Debashis Adhikari*

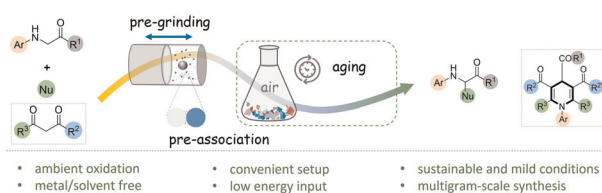
2846



Ionic liquid-based electrolysis-deposition for modulating Pb crystal facets to boost CO₂ electroreduction

Chongyang Jiang, Shaojuan Zeng,* Jiaqi Feng, Guilin Li, Zongxu Wang, Kuilin Peng, Lu Bai and Xiangping Zhang*

2853



α -C–H functionalization of glycine derivatives under mechanochemical accelerated aging en route the synthesis of 1,4-dihydropyridines and α -substituted glycine esters

Keyu Xiang, Ping Ying, Tao Ying, Weike Su and Jingbo Yu*

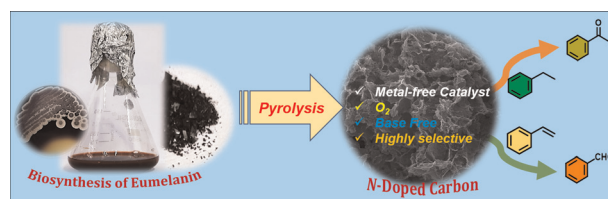


PAPERS

2863

Natural eumelanin-based porous N-doped carbon as an active bio-catalyst for base- and initiator-free aerobic oxidation of olefins and alkyl aromatic hydrocarbons

Vishal A. Ghadge, Krishnan Ravi, Dhanaji R. Naikwadi, Pramod B. Shinde* and Ankush V. Biradar*



2872

Recycling of a thermoresponsive "catalyst pill": separation of a molecular catalyst in solid ethylene carbonate in various reactions

Jeroen T. Vossen, Noah Hülken, Andreas J. Vorholt* and Walter Leitner

