

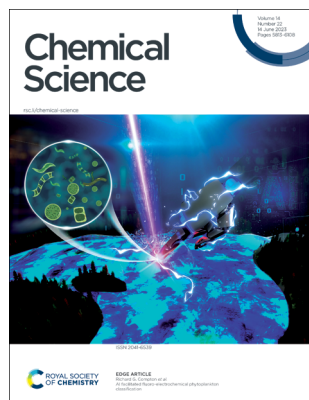
# Chemical Science

rsc.li/chemical-science

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 2041-6539 CODEN CSHCBM 14(22) 5813–6108 (2023)



**Cover**  
See Richard G. Compton *et al.*,  
pp. 5872–5879.  
Image reproduced by  
permission of Richard G.  
Compton from *Chem. Sci.*,  
2023, **14**, 5872.



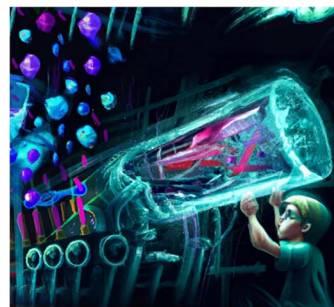
**Inside cover**  
See Manickam Bakthadoss and  
Tadiparthi Thirupathi Reddy,  
pp. 5880–5886.  
Image reproduced by  
permission of Manickam  
Bakthadoss from *Chem. Sci.*,  
2023, **14**, 5880.

## COMMENTARY

5825

### A focus on how latent “codons” are unravelled in synthetic copolymers

Christopher Barner-Kowollik\* and Bryan T. Tuten\*

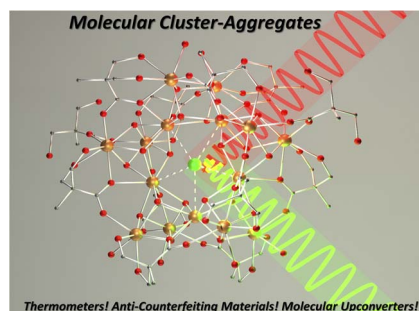


## PERSPECTIVE

5827

### Lanthanide molecular cluster-aggregates as the next generation of optical materials

Diogo Alves Gálico, Claudia Manuela Santos Calado and Muralee Murugesu\*



## Editorial Staff

### Executive Editor

May Copsy

### Deputy Editor

Samantha Apps

### Senior Editor

James Moore

### Scientific Editors

Ellis Crawford, Jingtao Huang, Esther Johnston, Sophie Orchard, Richard Thompson and Amy Welch

### Editorial Assistant

Karina Webster

### Publishing Assistant

David Bishop

For queries about submitted articles please contact James Moore, Senior Editor, in the first instance. E-mail [chemicalscience@rsc.org](mailto:chemicalscience@rsc.org)

For pre-submission queries please contact May Copsy, Executive Editor. E-mail [chemicalscience-rsc@rsc.org](mailto:chemicalscience-rsc@rsc.org)

Chemical Science (electronic: ISSN 2041-6539) is published 48 times a year by the Royal Society of Chemistry, Thomas Graham House, Science Park, Milton Road, Cambridge, CB4 0WF, UK.

Chemical Science is a Gold Open Access journal and all articles from 2015 onwards are free to read.

Please email [orders@rsc.org](mailto:orders@rsc.org) to register your interest or contact 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](mailto:orders@rsc.org)

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](mailto:advertising@rsc.org)

For marketing opportunities relating to this journal, contact [marketing@rsc.org](mailto:marketing@rsc.org)

# Chemical Science

[rsc.li/chemical-science](http://rsc.li/chemical-science)

## Editorial Board

### Editor-in-Chief

Andrew Cooper, University of Liverpool

### Associate Editors

Vincent Artero, CEA-Grenoble  
Luis M. Campos, Columbia University  
Michelle Chang, University of California, Berkeley  
Lin X. Chen, Northwestern University  
Graeme Day, University of Southampton  
Serena DeBeer, Max Planck Institute for Chemical Energy Conversion

Mircea Dincă, MIT

Vy Dong, University of California, Irvine  
François Gabbai, Texas A&M University  
Subi George, JNCASR  
Jinlong Gong, Tianjin University  
Stephen Goldup, University of Birmingham  
Zaiping Guo, University of Adelaide  
Christopher A. Hunter, University of Cambridge  
Malika Jefferies-EL, Boston University  
Ning Jiao, Peking University  
Tanja Junkers, Monash University

Hemamala Karunadasa, Stanford University  
Maja Köhn, University of Freiburg  
Yi-Tao Long, Nanjing University  
Gabriel Merino, CINVESTAV Merida  
James K. McCusker, Michigan State University  
Thomas Meade, Northwestern University  
Paolo Melchiorre, University of Bologna  
Carsten Schultz, Oregon Health & Science University  
Dmitri Talapin, The University of Chicago  
Toshiharu Teranishi, Kyoto University  
Andrei Yudin, University of Toronto

## Advisory Board

Dave Adams, University of Glasgow  
Ayyappanpillai Ajayaghosh, NIIST  
Ulf-Peter Apfel, Ruhr-University Bochum  
Polly Arnold, University of California, Berkeley  
Xinhe Bao, Dalian Institute of Chemical Physics  
Zhenan Bao, Stanford University  
Gonçalo Bernardes, University of Cambridge  
Frank Biedermann, Karlsruhe Institute of Technology  
Donna Blackmond, Scripps Research Institute  
Jeffrey Bode, ETH Zurich  
Jennifer S. Brodbelt, University of Texas at Austin, USA  
Christopher Chang, University of California, Berkeley  
Chi-Ming Che, University of Hong Kong  
Jun Chen, Nankai University  
R. Graham Cooks, Purdue University  
Christophe Copéret, ETH Zurich  
Eugenio Coronado, University of Valencia  
Leroy Cronin, University of Glasgow  
James Crowley, University of Otago  
Christopher C. Cummins, Massachusetts Institute of Technology  
Ben Davis, University of Oxford  
Jillian Dempsey, University of North Carolina at Chapel Hill  
Kazunari Domen, University of Tokyo  
James Durrant, Imperial College London  
Xinlang Feng, TU Dresden  
Ben Feringa, University of Groningen  
Makoto Fujita, University of Tokyo  
Phillip Gale, University of Technology Sydney  
Song Gao, Peking University  
Jeremiah Gassensmith, University of Texas at Dallas  
Elizabeth Gibson, Newcastle University  
Ryan Gilmour, WWU Münster  
Hubert Girault, EPFL  
Frank Glorius, WWU Münster  
Leticia González, University of Vienna  
Duncan Graham, University of Strathclyde

Vicki Grassian, University of California, San Diego  
Alexis Grimaud, Boston College  
Christian Hackenberger, FMP Berlin  
Buxing Han, Chinese Academy of Sciences  
Christy Haynes, University of Minnesota  
Patrick Holland, Yale University  
Kim Jelfs, Imperial College London  
Yousung Jung, KAIST  
Stephanie Kath-Schorr, University of Cologne  
Takashi Kato, University of Tokyo  
Christopher Kelly, Janssen Research & Development  
Jérôme Lacour, University of Geneva  
Ai-Lan Lee, Heriot-Watt University  
Daniele Leonori, RWTH Aachen University  
Chao-Jun Li, McGill University  
Yi Li, Jilin University  
R. Graham Cooks, KAIST  
Wenbin Lin, University of Chicago  
Kopin Liu, Academia Sinica  
Watson Loh, UNICAMP  
Bettina Lotsch, Max Planck Institute  
Xiong Wen (David) Lou, Nanyang Technological University  
Kazuhiko Maeda, Tokyo Institute of Technology  
Satoshi Maeda, Hokkaido University  
Swadhin Mandal, IISER Kolkata  
Ellen Matson, University of Rochester  
Scott Miller, Yale University  
Daniel Minciola, University of Pennsylvania  
Wonwoo Nam, Ewha Womans University  
Jonathan Nitschke, University of Cambridge  
Allie Obermeyer, Columbia University  
Martin Oestreich, Technical University of Berlin  
Takashi Ooi, Nagoya University  
Rachel O'Reilly, University of Birmingham  
Oleg Ozerov, Texas A&M University  
Xiulian Pan, Dalian Institute of Chemical Physics  
Nicolas Plumeré, Technical University of

Munich  
Rasmita Raval, University of Liverpool  
Erwin Reisner, University of Cambridge  
Andrea Rentmeister, WWU Münster  
Jeffrey Rinehart, University of California, San Diego  
Stuart Rowan, University of Chicago  
Richmond Sarpong, University of California, Berkeley  
Danielle Schultz, Merck  
Dwight Seferos, University of Toronto  
Oliver Seitz, Humboldt University of Berlin  
Roberta Sessoli, University of Florence  
Kay Severin, Federal Polytechnic School of Lausanne  
Mikiko Sodeoka, RIKEN  
Galo Soler-Illia, Universidad Nacional de San Martín  
David Spring, University of Cambridge  
Brian Stoltz, California Institute of Technology  
Brent Sumriner, University of Florida  
Raghavan B. Sunoj, IIT Bombay  
Yogesh Surendranath, MIT  
Mizuki Tada, Nagoya University  
Ben Zhong Tang, The Hong Kong University of Science and Technology  
Zhiyong Tang, National Center for Nanoscience and Nanotechnology  
Christine Thomas, Ohio State University  
He Tian, East China University of Science & Technology  
Zhong-Qun Tian, Xiamen University  
F. Dean Toste, University of California, Berkeley  
Takashi Uemura, University of Tokyo  
Jan van Hest, Radboud University  
Latha Venkataraman, Columbia University  
Chu Wang, Peking University  
Julia Weinstein, University of Sheffield  
Tom Welton, Imperial College London  
Charlotte Williams, University of Oxford  
Vivian Yam, University of Hong Kong  
Qi-Lin Zhou, Nankai University  
Jenny Zhang, University of Cambridge

## Information for Authors

Full details on how to submit material for publication in Chemical Science 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/chemical-science](http://rsc.li/chemical-science)

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

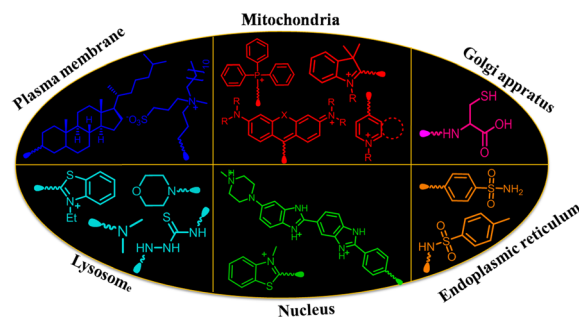


## REVIEW

5842

## Organelle-targeting ratiometric fluorescent probes: design principles, detection mechanisms, bio-applications, and challenges

Manoj Kumar Goshisht, Neetu Tripathi,\*  
Goutam Kumar Patra and Manohar Chaskar



## EDGE ARTICLES

5872

## AI facilitated fluoro-electrochemical phytoplankton classification

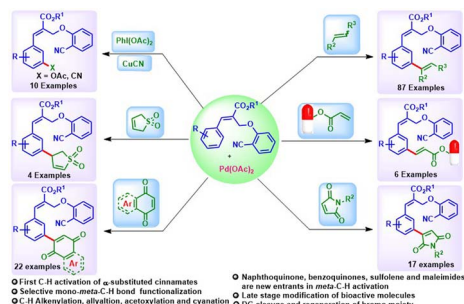
Haotian Chen, Samuel Barton, Minjun Yang,  
Rosalind E. M. Rickaby, Heather A. Bouman and  
Richard G. Compton\*



5880

## Distal meta-C–H functionalization of $\alpha$ -substituted cinnamates

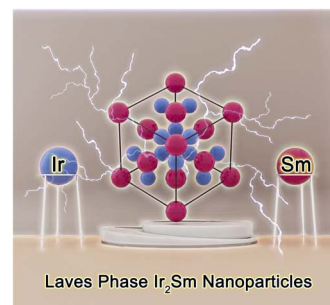
Manickam Bakthadoss\* and Tadiparthi Thirupathi Reddy



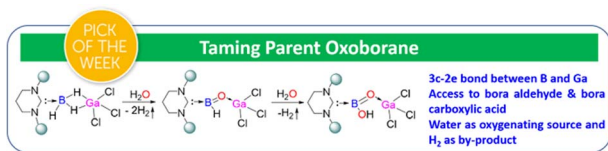
5887

## Laves phase $\text{Ir}_2\text{Sm}$ intermetallic nanoparticles as a highly active electrocatalyst for acidic oxygen evolution reaction

Shuai Zhang, Leilei Yin, Qingqing Li, Siyuan Wang,  
Weihua Wang and Yaping Du\*



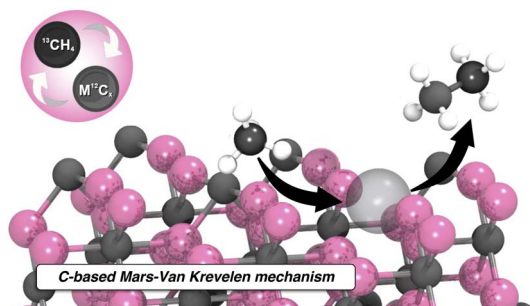
5894



### Taming the parent oxoborane

Gargi Kundu, P. R. Amrutha, K. Vipin Raj, Srinu Tothadi, Kumar Vanka and Sakya S. Sen\*

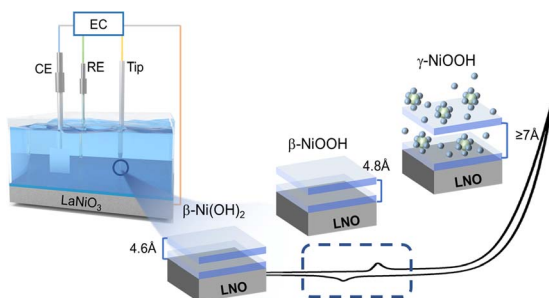
5899



### Role and dynamics of transition metal carbides in methane coupling

Seraphine B. X. Y. Zhang, Quentin Pessemesse, Lukas Lätsch, Konstantin M. Engel, Wendelin J. Stark, Alexander P. van Bavel, Andrew D. Horton, Pierre-Adrien Payard\* and Christophe Copéret\*

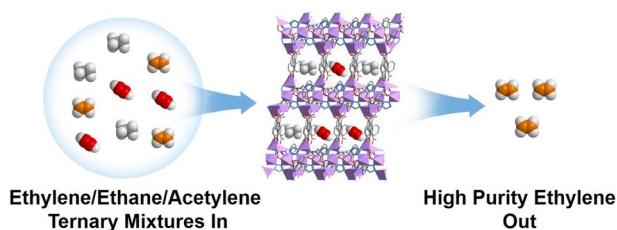
5906



### Direct observation of the dynamic reconstructed active phase of perovskite LaNiO<sub>3</sub> for the oxygen-evolution reaction

Yan Sun, Cheng-Rong Wu, Tian-Yi Ding, Jian Gu, Jia-Wei Yan,\* Jun Cheng\* and Kelvin H. L. Zhang\*

5912



### Pillar-layer Zn–triazolate–dicarboxylate frameworks with a customized pore structure for efficient ethylene purification from ethylene/ethane/acetylene ternary mixtures

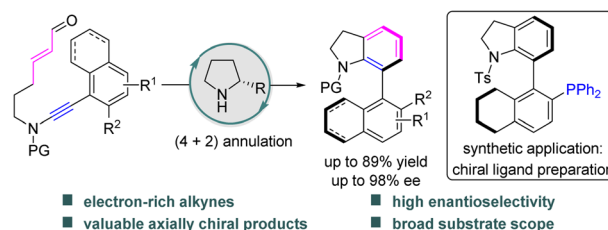
Jiaqi Liu, Hao Wang\* and Jing Li\*



5918

### Organocatalytic intramolecular (4 + 2) annulation of enals with ynamides: atroposelective synthesis of axially chiral 7-aryl indolines

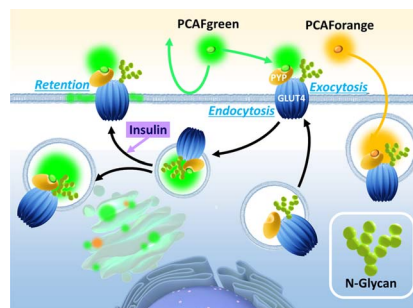
Zhi-Xin Zhang, Li-Gao Liu, Yi-Xi Liu, Jian Lin, Xin Lu,\*  
Long-Wu Ye and Bo Zhou\*



5925

### Visualization of multiple localizations of GLUT4 by fluorescent probes of PYP-tag with designed unnatural warhead

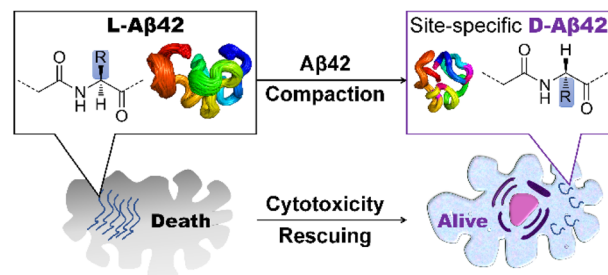
Miyako Nishiura, Yuichiro Hori,\* Maho Umeno  
and Kazuya Kikuchi\*



5936

### Site-specific chirality-conferred structural compaction differentially mediates the cytotoxicity of A $\beta$ 42

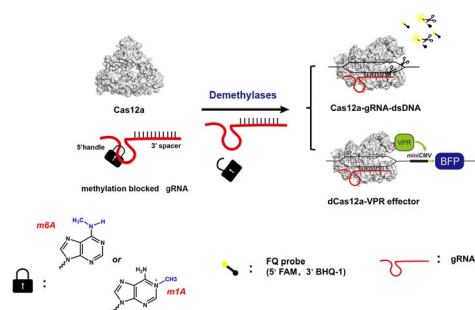
Gongyu Li,\* Chae Kyung Jeon, Min Ma, Yifei Jia,  
Zhen Zheng, Daniel G. Delafield, Gaoyuan Lu,  
Elena V. Romanova, Jonathan V. Sweedler,  
Brandon T. Ruotolo\* and Lingjun Li\*



5945

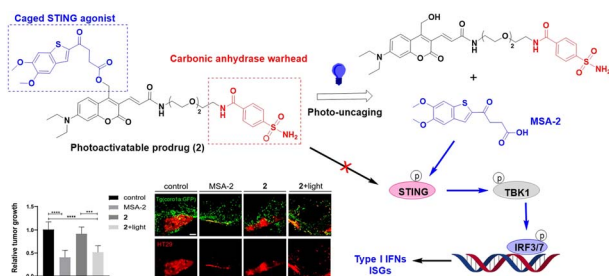
### Regulation of the CRISPR-Cas12a system by methylation and demethylation of guide RNA

Zhian Hu, Ao Sun, Jinlei Yang, Gul Naz, Gongwei Sun,  
Zhengping Li, Jun-Jie Gogo Liu,\* Sichun Zhang\*  
and Xinrong Zhang\*





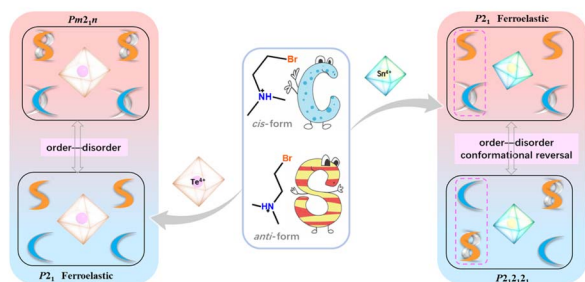
5956



### Photochemically controlled activation of STING by CAIX-targeting photocaged agonists to suppress tumor cell growth

Chunyong Ding,<sup>\*</sup> Mengyan Du, Zhi Xiong, Xue Wang, Hongji Li, Ende He, Han Li, Yijing Dang, Qing Lu, Shicong Li, Ruoxuan Xiao, Zhiai Xu, Lili Jing,<sup>\*</sup> Liufu Deng, Xiyuan Wang, Meiyu Geng, Zuoquan Xie<sup>\*</sup> and Ao Zhang<sup>\*</sup>

5965



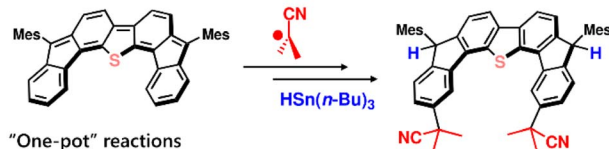
### An anomalous ferroelastic phase transition arising from an unusual *cis*-/*anti*-conformational reversal of polar organic cations

Bing-Qing Zhao, Xiao-Xian Chen, Hui Ye, Ya-Ping Gong, Jun Wang, Le Ye and Wei-Xiong Zhang<sup>\*</sup>

5974

### Site-selective radical reactions of open-shell singlet diradicaloids

Difluoreno[4,3-*b*:3',4'-*d*]thiophene  
 $\Delta E_{S-T} = -4.3$  kcal/mol

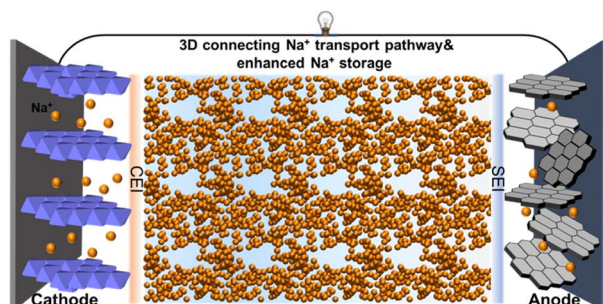


"One-pot" reactions  
(substitution & hydrogenation)

### Site-selective radical reactions of kinetically stable open-shell singlet diradicaloid difluorenoheteroles with tributyltin hydride and azo-based radical initiators

Naoki Tabata, Takumi Uchino, Chitoshi Kitamura, Kazunari Yoshizawa, Yoshihito Shiota<sup>\*</sup> and Shin-ichiro Kato<sup>\*</sup>

5983



### Three-dimensional heterogeneity in liquid electrolyte structures promotes Na ion transport and storage performance in Na-ion batteries

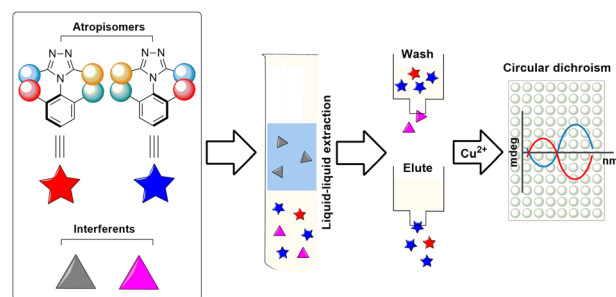
Mengying Ma, Binbin Chen and Hulin Pan<sup>\*</sup>



5992

### High-throughput determination of enantiopurity in atroposelective synthesis of aryl triazoles

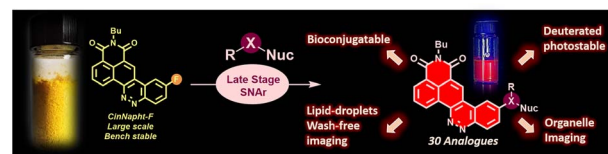
Jongdoo Lim, Melody Guo, Sooyun Choi, Scott J. Miller\* and Eric V. Anslyn\*



6000

### Unprecedented perspectives on the application of CinNaph fluorophores provided by a "late-stage" functionalization strategy

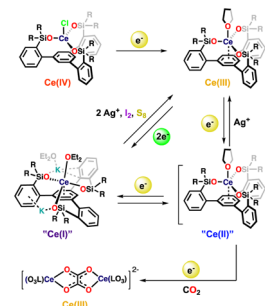
Eléonore Tacke, Minh-Duc Hoang, Kevin Tatoueix, Benoît Keromnes, Elsa Van Eslande, Philippe Durand, Gregory Pieters and Arnaud Chevalier\*



6011

### Isolation and redox reactivity of cerium complexes in four redox states

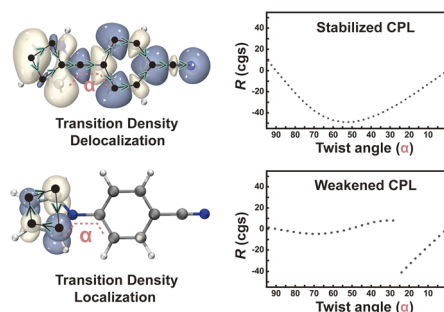
Fang-Che Hsueh, Thayalan Rajeshkumar, Laurent Maron,\* Rosario Scopelliti, Andrzej Sienkiewicz and Marinella Mazzanti\*



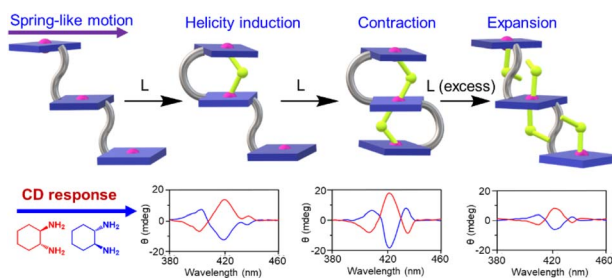
6022

### Pivotal role of transition density in circularly polarized luminescence

Zhanxiang Chen, Manli Huang, Cheng Zhong,\* Shaolong Gong, Veaceslav Coropceanu,\* Jean-Luc Brédas\* and Chuluo Yang\*



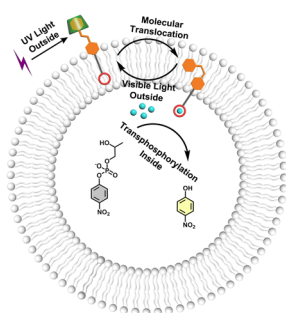
6032



### Modulation of supramolecular chirality by stepwise axial coordination in a nano-size trizinc(II)porphyrin trimer

Avinash Dhamija, Dolly Chandel and Sankar Prasad Rath\*

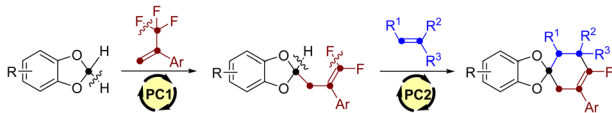
6039



### Light-controlled artificial transmembrane signal transduction for 'ON/OFF'-switchable transphosphorylation of an RNA model substrate

Jinxing Hou, Jiale Guo, Tengfei Yan, Shengda Liu, Mingsong Zang, Liang Wang, Jiayun Xu, Quan Luo, Tingting Wang\* and Junqiu Liu\*

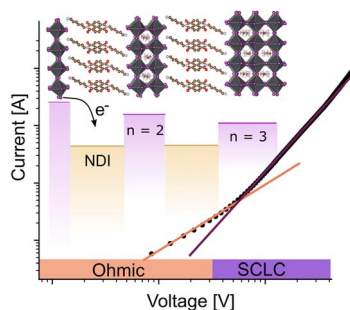
6045



### Photoredox radical/polar crossover enables C–H gem-difunctionalization of 1,3-benzodioxoles for the synthesis of monofluorocyclohexenes

Jiabao Tian and Lei Zhou\*

6052



### Photogenerated charge transfer in Dion–Jacobson type layered perovskite based on naphthalene diimide

Simon Nussbaum, Etienne Socie, George C. Fish, Nicolas J. Diercks, Hannes Hempel, Dennis Friedrich, Jacques-E. Moser, Jun-Ho Yum\* and Kevin Sivula\*

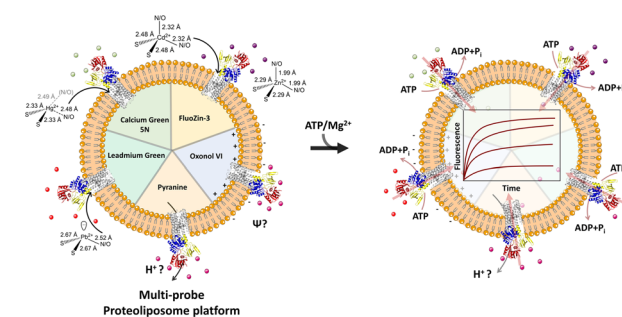




6059

## Plastic recognition and electrogenic uniport translocation of 1<sup>st</sup>-, 2<sup>nd</sup>-, and 3<sup>rd</sup>-row transition and post-transition metals by primary-active transmembrane P<sub>1B-2</sub>-type ATPase pumps

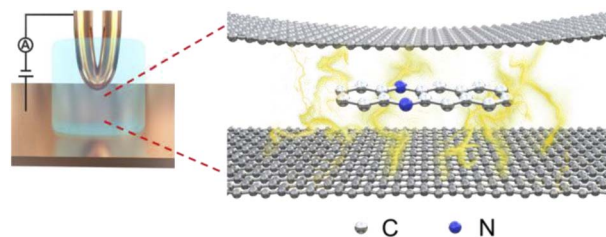
Sameera S. Abeyrathna, Nisansala S. Abeyrathna, Priyanka Basak, Gordon W. Irvine, Limei Zhang and Gabriele Meloni\*



6079

## Atomically well-defined nitrogen doping for cross-plane transport through graphene heterojunctions

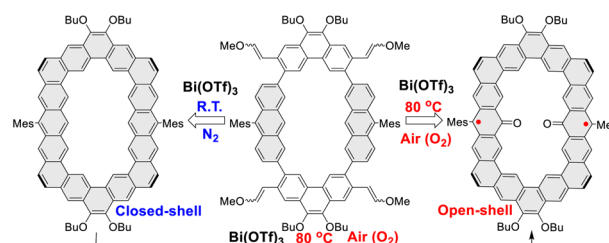
Hewei Zhang, Ping Zhou, Abdalghani Daaoub, Sara Sangtarash, Shiqiang Zhao, Zixian Yang, Yu Zhou, Yu-Ling Zou, Silvio Decurtins, Robert Häner, Yang Yang,\* Hatef Sadeghi,\* Shi-Xia Liu\* and Wenjing Hong\*



6087

## From closed-shell edge-extended kekulenes to open-shell carbonylated cycloarene diradicaloid

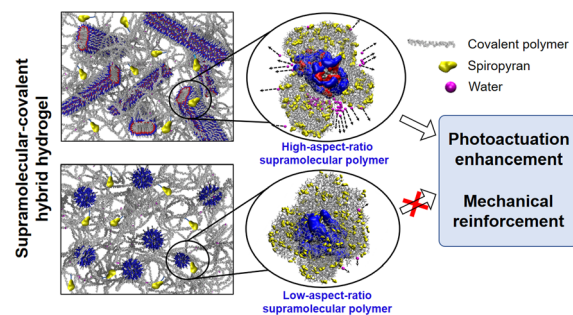
Dongdong Chang, Jiangyu Zhu, Yutao Sun, Kai Chi, Yanjun Qiao, Teng Wang, Yan Zhao, Yunqi Liu and Xuefeng Lu\*



6095

## Role of supramolecular polymers in photo-actuation of spiropyran hydrogels

Chuang Li, Qinsi Xiong, Tristan D. Clemons, Hiroaki Sai, Yang Yang, M. Hussain Sangji, Aysenur Iscen, Liam C. Palmer, George C. Schatz\* and Samuel I. Stupp\*



6105

**Correction: Molybdenum chloride double perovskites: dimensionality control of optical and magnetic properties**

Devesh Chandra Binwal, Prashurya Pritam Mudoi, Debendra Prasad Panda and Pratap Vishnoi\*

