

# Chemical Science

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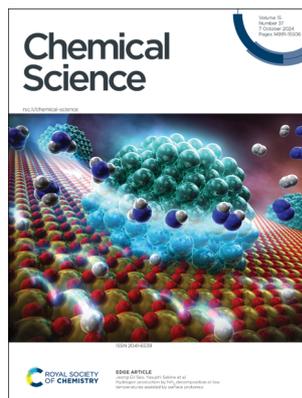
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## IN THIS ISSUE

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**Cover**  
See Mahendiran Dharmasivam, Des R. Richardson *et al.*, pp. 15109–15124. Image reproduced by permission of Des R. Richardson and Mahendiran Dharmasivam from *Chem. Sci.*, 2024, 15, 15109.



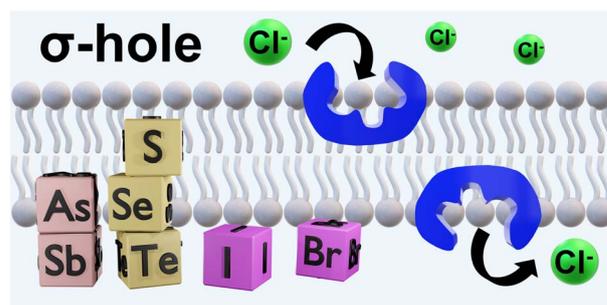
**Inside cover**  
See Jeong Gil Seo, Yasushi Sekine *et al.*, pp. 15125–15133. Image reproduced by permission of Yasushi Sekine from *Chem. Sci.*, 2024, 15, 15125.

## PERSPECTIVE

15006

### Anion transporters based on halogen, chalcogen, and pnictogen bonds: towards biological applications

Anurag Singh, Aaron Torres-Huerta, Franck Meyer and Hennie Valkenier\*

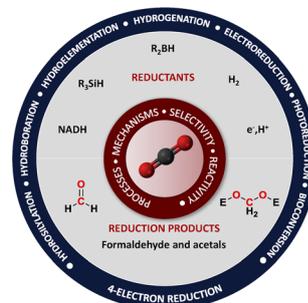


## REVIEWS

15023

### Four-electron reduction of CO<sub>2</sub>: from formaldehyde and acetal synthesis to complex transformations

Sarah Desmons, Julien Bonin,\* Marc Robert\* and Sébastien Bontemps\*



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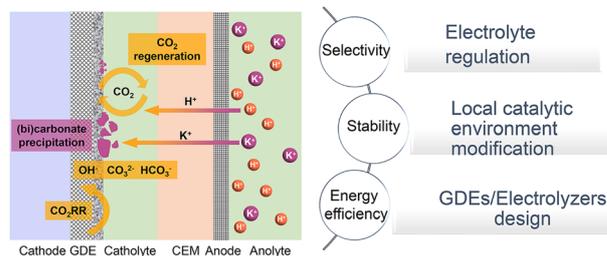
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## REVIEWS

15087

**Accelerating acidic CO<sub>2</sub> electroreduction: strategies beyond catalysts**

Bangwei Deng,\* Daming Sun, Xueyang Zhao, Lili Wang, Feiyu Ma, Yizhao Li\* and Fan Dong\*

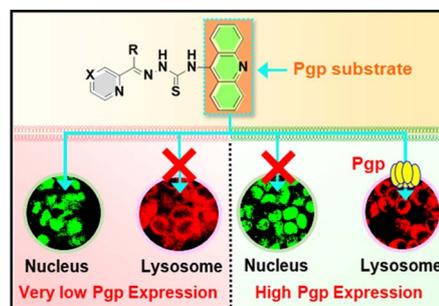


## EDGE ARTICLES

15109

**Targeting lysosomes by design: novel *N*-acridine thiosemicarbazones that enable direct detection of intracellular drug localization and overcome P-glycoprotein (Pgp)-mediated resistance**

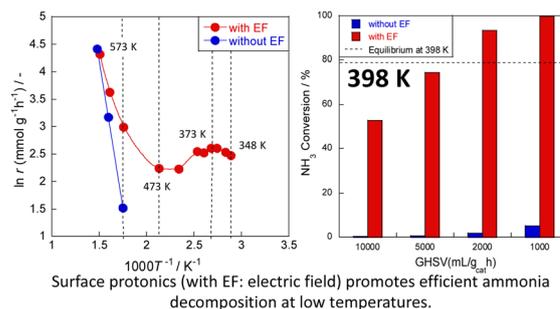
Busra Kaya, Henry Smith, Yanbing Chen, Mahan Gholam Azad, Tiffany M. Russell, Vera Richardson, Paul V. Bernhardt, Mahendiran Dharmasivam\* and Des R. Richardson\*



15125

**Hydrogen production by NH<sub>3</sub> decomposition at low temperatures assisted by surface protonics**

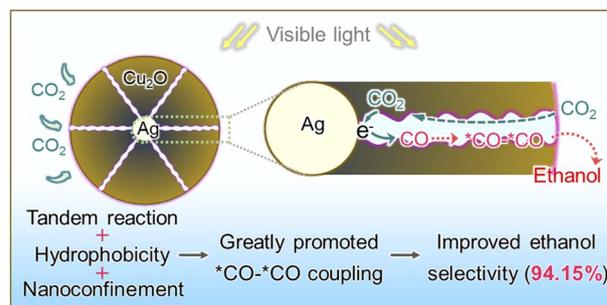
Yukino Ofuchi, Kenta Mitarai, Sae Doi, Koki Saegusa, Mio Hayashi, Hiroshi Sampei, Takuma Higo, Jeong Gil Seo\* and Yasushi Sekine\*



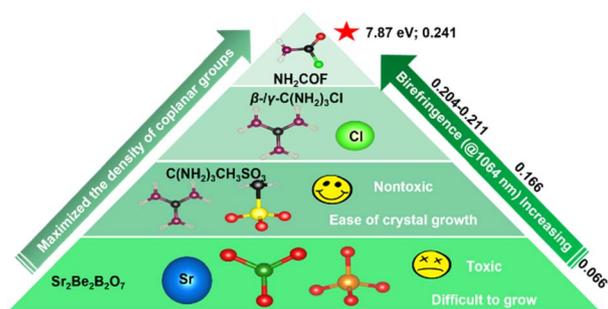
15134

**Nanoconfined tandem three-phase photocatalysis for highly selective CO<sub>2</sub> reduction to ethanol**

Hailing Huo, Ting Hu, Zhiqing Zhong, Cheng Zhan, Chengxi Huang, Qiang Ju, Liang Zhang, Fang Wu, Erjun Kan\* and Ang Li\*



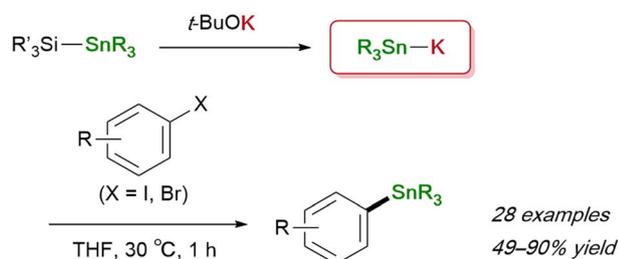
15145



### Strategically designed metal-free deep-ultraviolet birefringent crystals with superior optical properties

Yang Li, Xinglong Chen\* and Kang Min Ok\*

15152



### Surefire generation of stannylpotassium: highly reactive stannyl anions and applications

Yuta Hiraoka, Taiki Imagawa, Kazuki Nakanishi, Hinata Kawabe, Masaaki Nakamoto, Takumi Tsushima and Hiroto Yoshida\*

15160

### $\delta$ -bonding vs electron localization in divalent rare earths

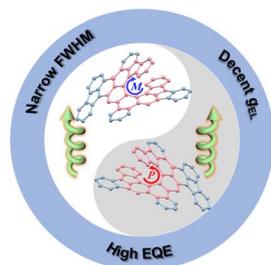


### $\delta$ -Bonding modulates the electronic structure of formally divalent $nd^1$ rare earth arene complexes

Ross E. MacKenzie, Tomáš Hajdu, John A. Seed, George F. S. Whitehead, Ralph W. Adams, Nicholas F. Chilton, David Collison, Eric J. L. McInnes and Conrad A. P. Goodwin\*

15170

### B,N-Embedded Hetero[8]helicene-Based CP-MR-TADF Enantiomers



### Efficient circularly polarized multiple resonance thermally activated delayed fluorescence from B,N-embedded hetero[8]helicene enantiomers

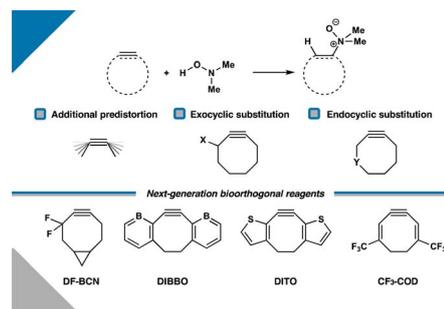
Tingting Huang, Li Yuan, Xueying Lu, Yupei Qu, Cheng Qu, Yincai Xu,\* You-Xuan Zheng\* and Yue Wang\*



15178

## Retro-Cope elimination of cyclic alkynes: reactivity trends and rational design of next-generation bioorthogonal reagents

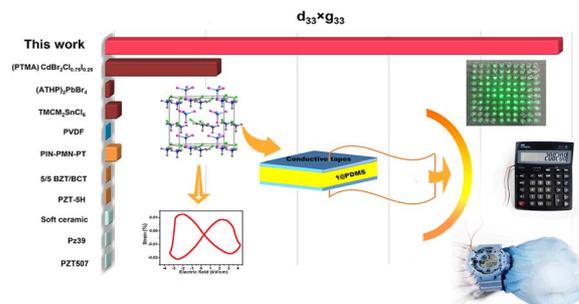
Steven E. Beutick, Song Yu, Laura Orian, F. Matthias Bickelhaupt and Trevor A. Hamlin\*



15192

## Achievement of a giant electromechanical conversion coefficient in a molecule-based ferroelectric

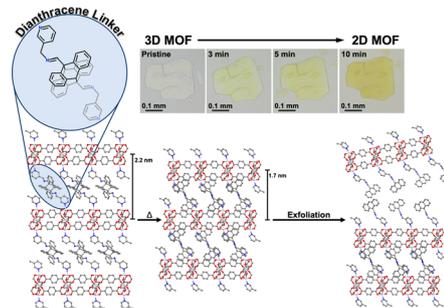
Bin Wang, Zhirui Li, Zhengxiao Tang, Haixia Zhao,\* Lasheng Long\* and Lansun Zheng



15198

## Exfoliation of a metal–organic framework enabled by post-synthetic cleavage of a dipyrindyl dianthracene ligand

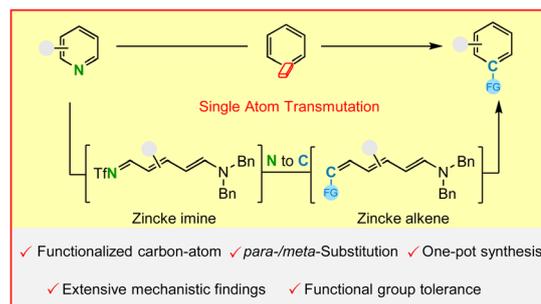
Madison E. Logelin, Eric Schreiber, Brandon Q. Mercado, Michael J. Burke, Caitlin M. Davis and Amymarie K. Bartholomew\*



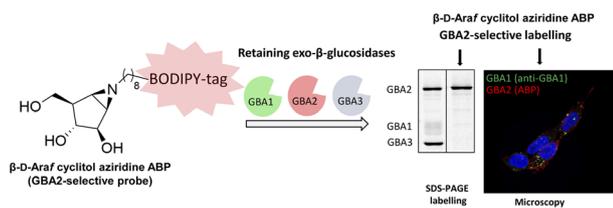
15205

## Nitrogen-to-functionalized carbon atom transmutation of pyridine

Fu-Peng Wu, Madina Lenz, Adhya Suresh, Achyut R. Gogoi, Jasper L. Tyler, Constantin G. Daniliuc, Osvaldo Gutierrez\* and Frank Glorius\*



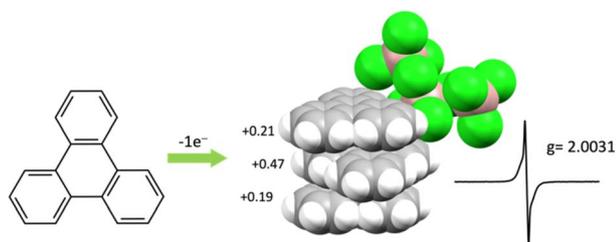
15212



### Selective labelling of GBA2 in cells with fluorescent $\beta$ -D-arabinofuranosyl cyclitol aziridines

Qin Su, Max Louwse, Rob F. Lammers, Elmer Maurits, Max Janssen, Rolf G. Boot, Valentina Borlandelli, Wendy A. Offen, Daniël Linzel, Sybrin P. Schröder, Gideon J. Davies, Herman S. Overkleeft, Marta Artola\* and Johannes M. F. G. Aerts\*

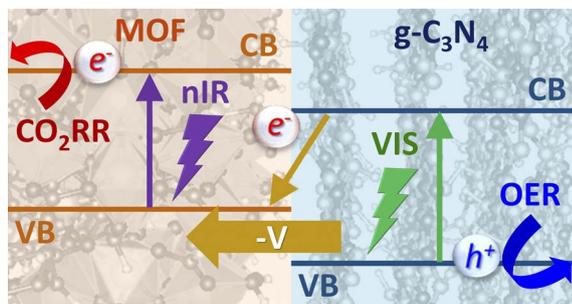
15221



### A unique trimeric triphenylene radical cation: stacking aggregation, bonding, and stability

Rameswar Bhattacharjee, Megan E. McCormack, Zheng Zhou, Zheng Wei, Marina A. Petrukhina\* and Miklos Kertesz\*

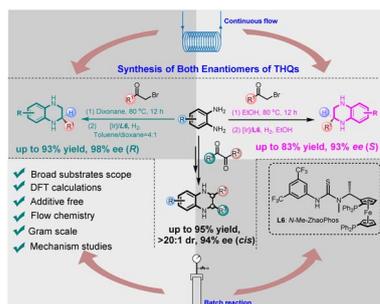
15232



### Engineering MOF/carbon nitride heterojunctions for effective dual photocatalytic CO<sub>2</sub> conversion and oxygen evolution reactions

Valentin Diez-Cabanes, Kevin Granados-Tavera, Inderdip Shere, Gloria Cárdenas-Jirón and Guillaume Maurin\*

15243



### Highly enantioselective synthesis of both enantiomers of tetrahydroquinoxaline derivatives via Ir-catalyzed asymmetric hydrogenation

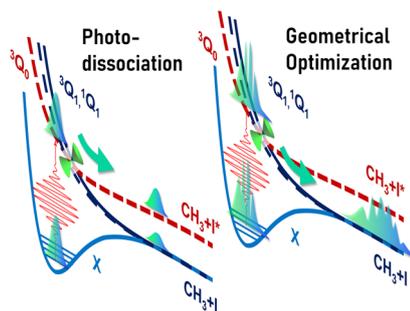
Ana Xu, Lanxing Ren, Junrong Huang, Yuxiang Zhu, Gang Wang, Chaoyi Li, Yongqiang Sun, Lijuan Song,\* Hengzhi You\* and Fen-Er Chen\*



15255

### Absolute control over the quantum yield of a photodissociation reaction mediated by nonadiabatic couplings

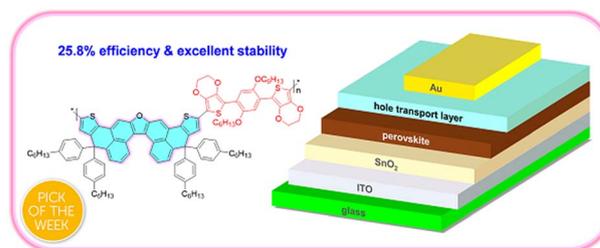
Ignacio R. Sola\* and Alberto García-Vela\*



15263

### Conjugated polymers of an oxa[5]helicene-derived polycyclic heteroaromatic: tailoring energy levels and compatibility for high-performance perovskite solar cells

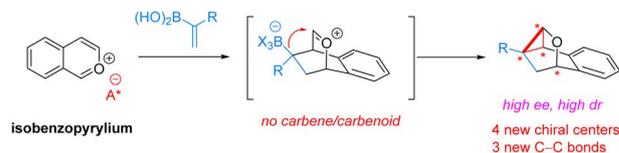
Yaohang Cai, Yuyan Zhang, Lingyi Fang, Yutong Ren, Jidong Zhang, Yi Yuan, Jing Zhang and Peng Wang\*



15274

### Organocatalytic enantio- and diastereoselective assembly of cyclopropane-incorporated polycyclic molecules via isobenzopyrylium ions

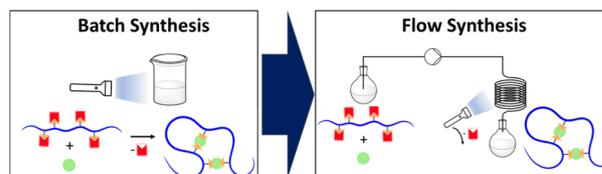
Shuxuan Liu, Chaoshen Zhang,\* Zhengyu Han, Hai Huang and Jianwei Sun\*



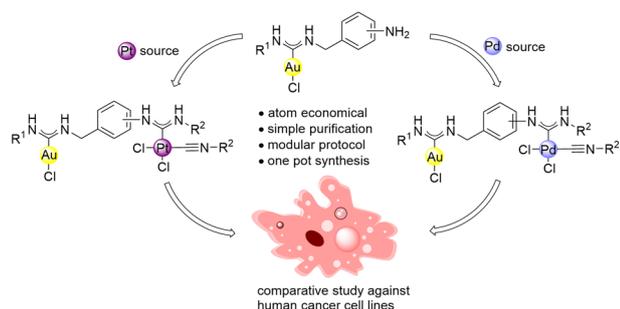
15280

### Visible light photoflow synthesis of a Cu(II) single-chain polymer nanoparticle catalyst

Sebastian Gillhuber, Joshua O. Holloway, Kai Mundsinger, Jochen A. Kammerer, Jeffrey R. Harmer, Hendrik Frisch,\* Christopher Barner-Kowollik\* and Peter W. Roesky\*



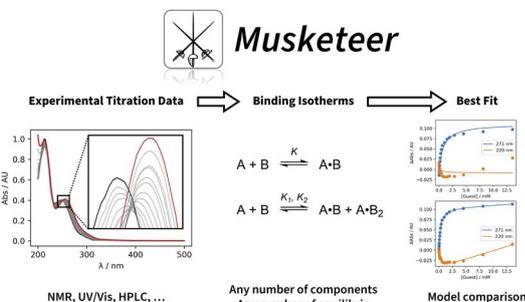
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### Comparative study of the antiproliferative activity of heterometallic carbene gold(i)–platinum(ii) and gold(i)–palladium(ii) complexes in cancer cell lines

Martin C. Dietl, Melina Maag, Sophia Ber, Frank Rominger, Matthias Rudolph, Isabella Caligiuri, Pacome K. Andele, Ibraheem A. I. Mkhalid, Flavio Rizzolio, Pablo A. Nogara, Laura Orian, Thomas Scattolin\* and A. Stephen K. Hashmi\*

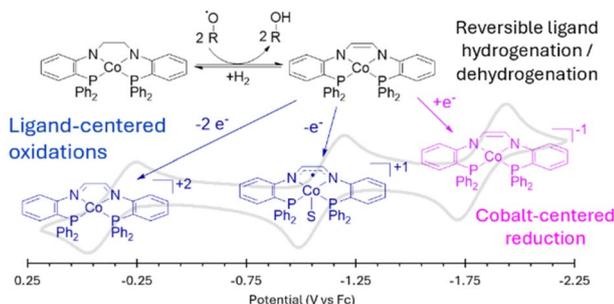
15299



### Musketeer: a software tool for the analysis of titration data

Daniil O. Soloviev and Christopher A. Hunter\*

15311



### Hydrogen atom abstraction as a synthetic route to a square planar Co<sup>II</sup> complex with a redox-active tetradentate PNNP ligand

Justin D. Miller, Mitchell M. Walsh, Kyoungsoon Lee, Curtis E. Moore and Christine M. Thomas\*

15321



### Integrated "all-in-one" strategy to construct highly efficient Pd catalyst for CO<sub>2</sub> transformation

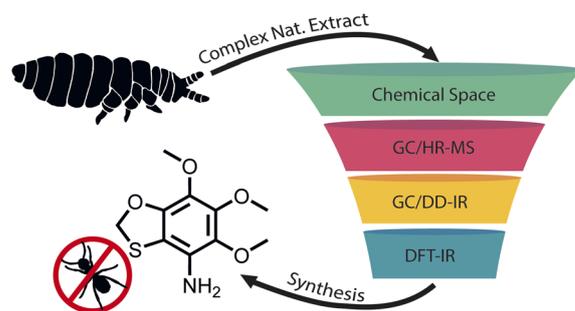
Lingfang Kong, Zekun Tao, Yunjia Li, Huiwen Gong, Yun Bai, Longbin Li, Xianjin Zhang, Zhonggao Zhou\* and Yiwang Chen\*



15332

### Identification of unique highly hetero-substituted benzenes as chemical weapons of springtails by a combination of trace analytical methods with DFT calculations and synthesis

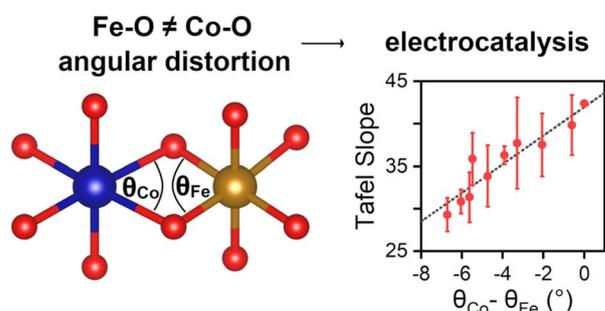
Anton Möllerke, Matthew Stell, Christian Schlawis, Ute Trauer-Kizilelma, Jennifer Herrmann, Hans Petter Leinaas, Stefan Scheu and Stefan Schulz\*



15339

### Interplay between element-specific distortions and electrocatalytic oxygen evolution for cobalt–iron hydroxides

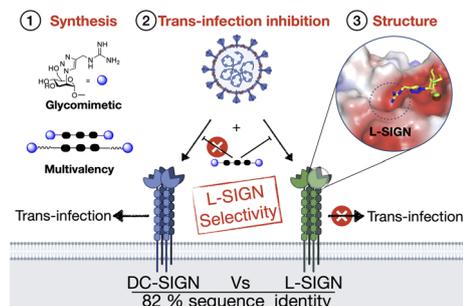
Elif Pinar Alsaç, Marlyn Boke, Justine R. Bissonnette and Rodney D. L. Smith\*



15352

### Unprecedented selectivity for homologous lectin targets: differential targeting of the viral receptors L-SIGN and DC-SIGN

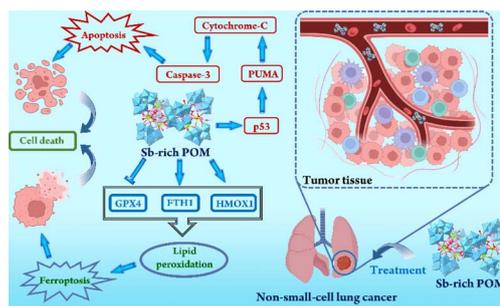
Clara Delaunay, Sara Pollastri, Michel Thépaut, Gianluca Cavazzoli, Laura Belvisi, Clémentine Bouchikri, Nuria Labiod, Fatima Lasala, Ana Gimeno, Antonio Franconetti, Jesús Jiménez-Barbero, Ana Ardá, Rafael Delgado, Anna Bernardi\* and Franck Fieschi\*



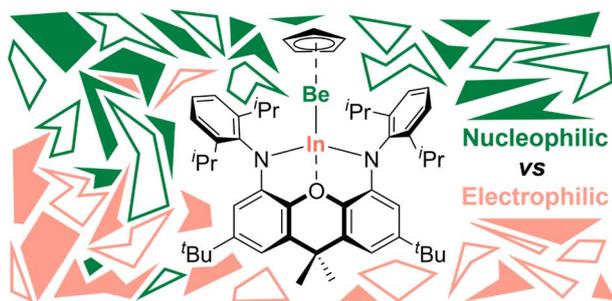
15367

### Antitumor effects of a Sb-rich polyoxometalate on non-small-cell lung cancer by inducing ferroptosis and apoptosis

Jie-Wei Lin, Yang Zhou, Hui-Ping Xiao, Lei-Lei Wu, Peng-Cheng Li, Ming-Dong Huang, Dong Xie,\* Peng Xu,\* Xin-Xiong Li\* and Zhi-Xin Li\*



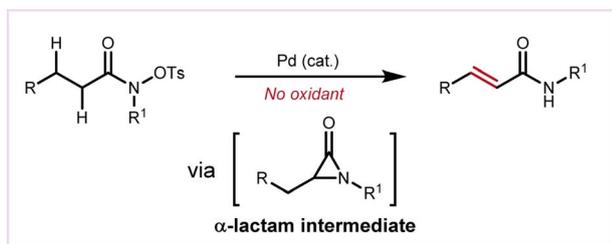
15377



### On the nature and limits of alkaline earth–triel bonding

Josef T. Boronski,<sup>\*</sup> Liam P. Griffin, Caroline Conder, Agamemnon E. Crumpton, Lewis L. Wales and Simon Aldridge<sup>\*</sup>

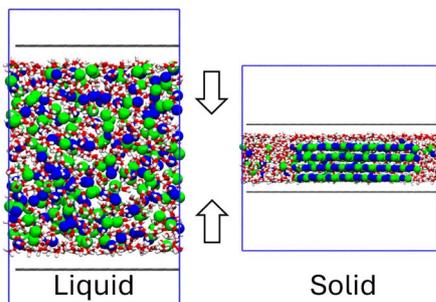
15385



### Catalytic dehydrogenative synthesis of $\alpha,\beta$ -unsaturated secondary amides without external oxidants

Shaokang An, Guoyin Lai and Wenbo H. Liu<sup>\*</sup>

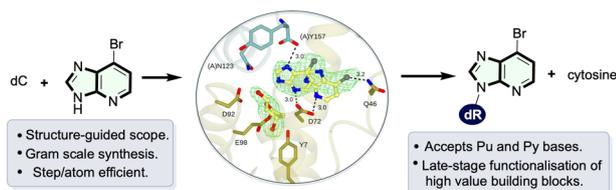
15391



### Atomic scale insights into NaCl nucleation in nanoconfined environments

Ruiyu Wang and Pratyush Tiwary<sup>\*</sup>

15399



### Gram-scale enzymatic synthesis of 2'-deoxyribonucleoside analogues using nucleoside transglycosylase-2

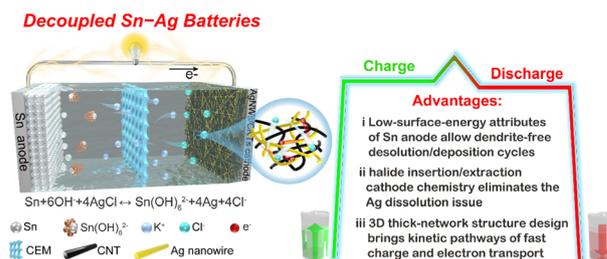
Admir Salihovic, Alex Ascham, Andrea Taladriz-Sender, Samantha Bryson, Jamie M. Withers, Iain J. W. McKean, Paul A. Hoskisson, Gideon Grogan<sup>\*</sup> and Glenn A. Burley<sup>\*</sup>



15408

### Decoupled tin–silver batteries with long cycle life and power output stability based on dendrite-free tin anode and halide insertion cathode chemistry

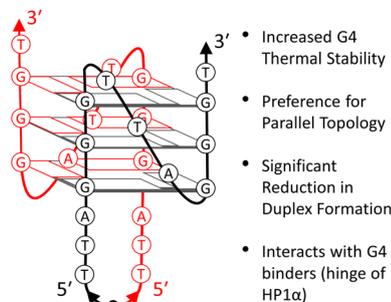
Feifei Shi, Yudong Wu, Binyan Wang, Jiawei Bai, Yihan Ren, Tao Yang, Funian Mo,\* Derek Ho and Haibo Hu\*



15417

### Inverted strand polarity yields thermodynamically stable G-quadruplexes and prevents duplex formation within extended DNA

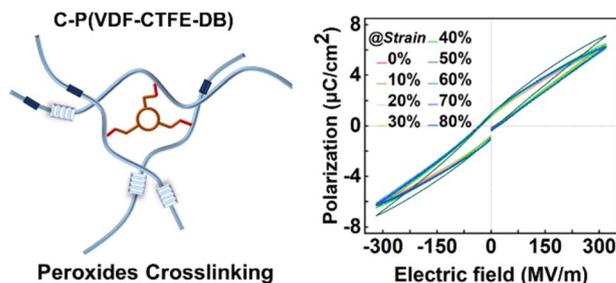
Bruce Chilton, Ruby J. Roach, Patrick J. B. Edwards, Geoffrey B. Jameson, Tracy K. Hale and Vyacheslav V. Filichev\*



15432

### Highly elastic relaxor ferroelectric *via* peroxide crosslinking

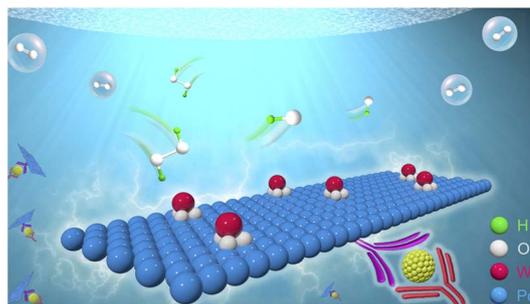
Liang Gao, Linping Wang and Ben-Lin Hu\*



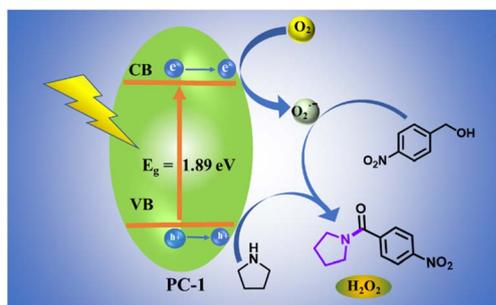
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### Oxygen-bridged W–Pd atomic pairs enable H<sub>2</sub>O<sub>2</sub> activation for sensitive immunoassays

Chengjie Chen, Dongbo Yan, Xiangkun Jia, Ruimin Li, Lijun Hu, Xiaotong Li, Lei Jiao,\* Chengzhou Zhu, Yanling Zhai\* and Xiaoquan Lu



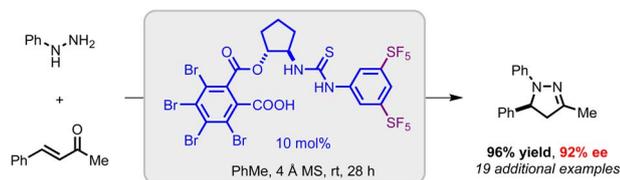
15448



### Visible light-driven molecular oxygen activation for oxidative amidation of alcohols using lead-free metal halide perovskite

Vishesh Kumar, Ved Vyas, Deepak Kumar, Ashish Kumar Kushwaha and Arindam Indra\*

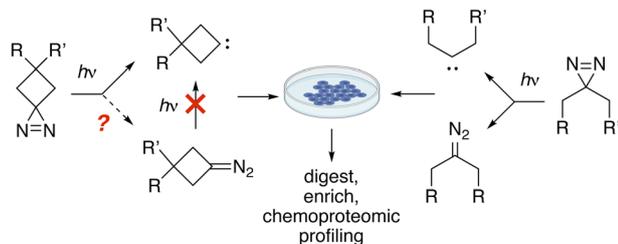
15456



### Catalytic enantioselective synthesis of 2-pyrazolines via one-pot condensation/ $6\pi$ -electrocyclization: 3,5-bis(pentafluorosulfonyl)-phenylthioureas as powerful hydrogen bond donors

Moises A. Romero Reyes, Subhradeep Dutta, Minami Odagi, Chang Min and Daniel Seidel\*

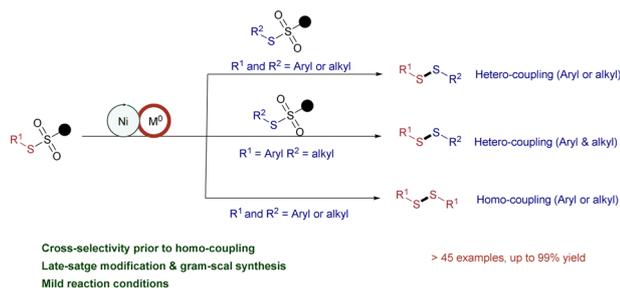
15463



### Mechanistic differences between linear vs. spirocyclic dialkyldiazirine probes for photoaffinity labeling

Jessica G. K. O'Brien, Louis P. Conway, Paramesh K. Ramaraj, Appaso M. Jadhav, Jun Jin, Jason K. Dutra, Parrish Evers, Shadi S. Masoud, Manuel Schupp, Iakovos Saridakis, Yong Chen, Nuno Maulide, John P. Pezacki, Christopher W. am Ende,\* Christopher G. Parker\* and Joseph M. Fox\*

15474



### Nickel-catalyzed selective disulfide formation by reductive cross-coupling of thiosulfonates

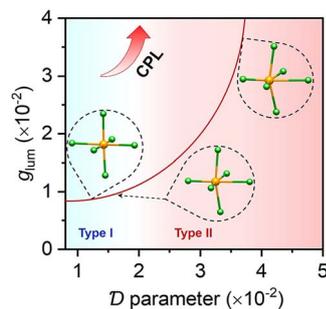
Tingting Yuan, Xiang-Yu Chen, Tengfei Ji, Huifeng Yue, Kathiravan Murugesan and Magnus Rueping\*



15480

### Boosting circularly polarized luminescence by optimizing off-centering octahedral distortion in zero-dimensional hybrid indium-antimony halides

Yulian Liu, Yi Wei, Zhishan Luo, Bin Xu, Meiyang He, Peibin Hong, Chen Li and Zewei Quan\*



15489

### Ni-catalyzed enantioselective three-component reductive alkylation of alkenes: modular access to structurally complex $\alpha$ -amino ketones

Jichao Xiao, Tingting Jia, Shuang Chen, Mengxiao Pan and Xingwei Li\*



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### Films of linear conjugated polymer as photoanodes for oxidation reactions

Shuming Chai, Shun Zhao, Jiaxin Su, Jinshui Zhang, Xiong Chen,\* Reiner Sebastian Sprick\* and Yuanxing Fang\*

