

# Energy & Environmental Science

rsc.li/ees

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 1754-5706 CODEN EESNBY 17(18) 6423-6858 (2024)



### Cover

See Wei Zhang, Chunyang Miao, Weibing Lu, ZhengMing Sun *et al.*, pp. 6507–6520. Image reproduced by permission of Wei Zhang from *Energy Environ. Sci.*, 2024, 17, 6507.



### Inside cover

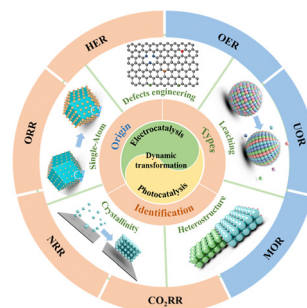
See Rodney S. Ruoff, Dong-Hwa Seo, Sunghwan Jin, Hyun-Wook Lee *et al.*, pp. 6521–6532. Image reproduced by permission of Hyun-Wook Lee from *Energy Environ. Sci.*, 2024, 17, 6521.

## REVIEWS

6435

### Dynamic transformation of active sites in energy and environmental catalysis

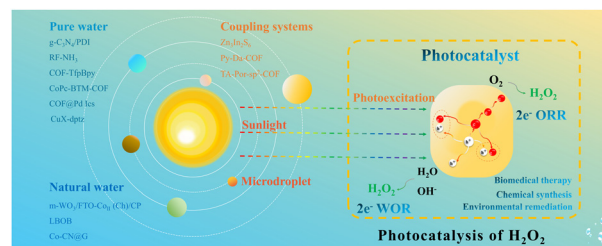
Hao Zhang,\* Lei Chen,\* Feng Dong, Zhiwen Lu, Enmin Lv, Xinglong Dong, Huanxin Li,\* Zhongyong Yuan,\* Xinwen Peng,\* Shihe Yang,\* Jieshan Qiu, Zhengxiao Guo\* and Zhenhai Wen\*



6482

### The evolution of photocatalytic H<sub>2</sub>O<sub>2</sub> generation: from pure water to natural systems and beyond

Yuyang Tang, Wuming Wang, Jiaqi Ran, Cheng Peng,\* Zuxin Xu and Wenhai Chu\*



**GOLD  
OPEN  
ACCESS**

# EES Solar

**Exceptional research on solar  
energy and photovoltaics**



Part of the EES family

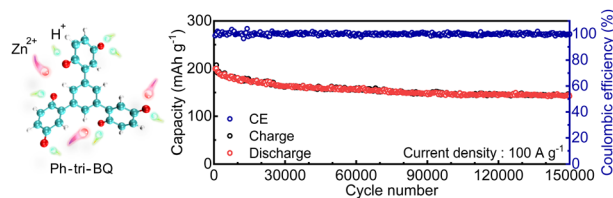
**Join  
in** | Publish with us  
[rsc.li/EESolar](https://rsc.li/EESolar)

## COMMUNICATION

6499

### Non-conjugated linkage enabling a quinone-based cathode material with long cycle life and high energy density for aqueous zinc batteries

Lu Lin, Zhiqing Xue, Tong Qiu, Jiaqi Zhu, Guoli Zhang, Hongtu Zhan, Kuo Wang and Xiaoqi Sun\*

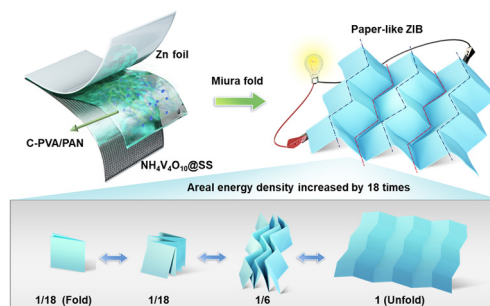


## PAPERS

6507

### Ultra-thin amphiphilic hydrogel electrolyte for flexible zinc-ion paper batteries

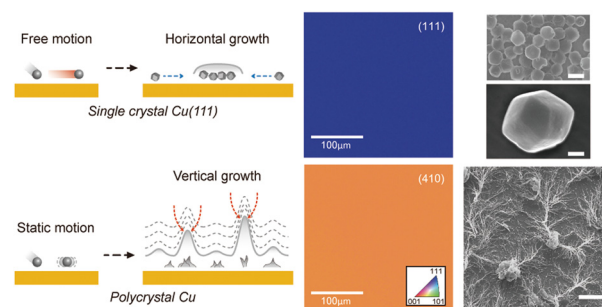
Huan Xia, Wei Zhang,\* Chunyang Miao,\* Hao Chen, Chengjie Yi, Yihan Shang, Tao Shui, Xin Cao, Jiacheng Liu, Song-Zhu Kure-Chu, Feifei Liang, Nosipho Moloto, Yipeng Xiong, Takehiko Hihara, Weibing Lu\* and ZhengMing Sun\*



6521

### Horizontal lithium growth driven by surface dynamics on single crystal Cu(111) foil

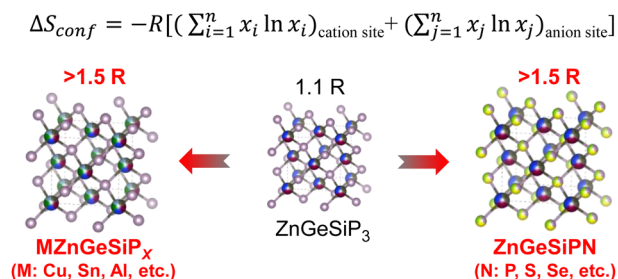
Min-Ho Kim, Dong Yeon Kim, Yunqing Li, Juyoung Kim, Min Hyeok Kim, Jeongwoo Seo, Benjamin V. Cunnning, Taewon Kim, Sang-Wook Park, Rodney S. Ruoff,\* Dong-Hwa Seo,\* Sunghwan Jin\* and Hyun-Wook Lee\*



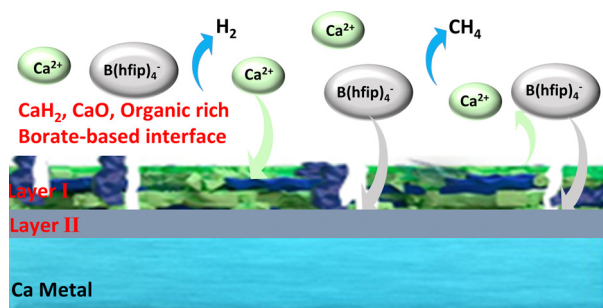
6533

### Enhancing lithium storage rate and durability in sphalerite GeP by engineering configurational entropy

Yanhong Li, Jeng-Han Wang, Tzu-Yu Liu, Xinwei Li, Zaiping Guo, Meilin Liu and Wenwu Li\*



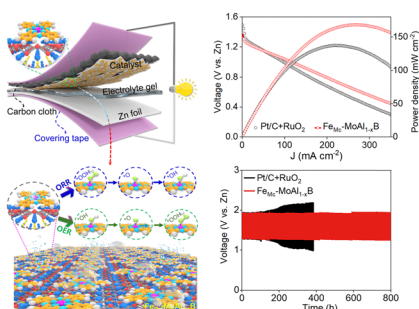
6548



### Deciphering the dynamic interfacial chemistry of calcium metal anodes

Huijun Lin, Jiayi Meng, Weihua Guo, Renjie Li, Yuyang Yi, Yiyuan Ma, Chi Fai Cheung, Doron Aurbach\* and Zheng-Long Xu\*

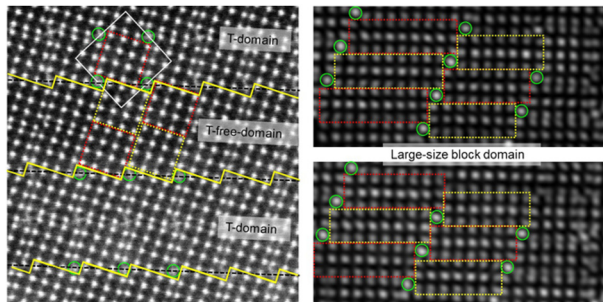
6559



### Molecularly engineered potential of d-orbital modulated iron-bridged delaminated MBene for rechargeable Zn-air batteries

Seung Woong Nam, Thanh Hai Nguyen, Duy Thanh Tran,\* Van An Dinh, Thi Thuy Nga Ta, Chung-Li Dong, Nam Hoon Kim\* and Joong Hee Lee\*

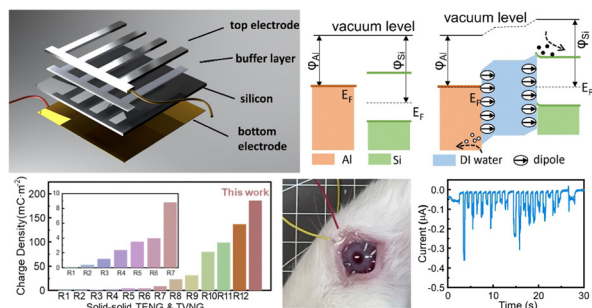
6571



### Tailoring the Wadsley-Roth crystallographic shear structures for high-power lithium-ion batteries

Panpan Jing, Mengting Liu, Hsin-Pei Ho, Yifan Ma, Weibo Hua, Haohui Li, Nan Guo, Yong Ding, Weilin Zhang, Hailong Chen, Bote Zhao,\* Jenghan Wang\* and Meilin Liu\*

6582



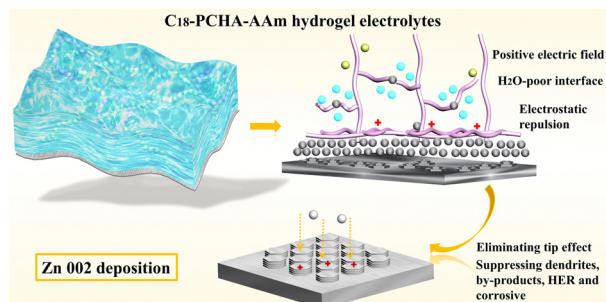
### A wiping-type semiconductor-liquid generator utilizing water-bearing solid materials and hydrated biological tissues

Zhaoqi Liu, Shiquan Lin, Peng Yang, Siyao Qin, Jun Hu and Xiangyu Chen\*





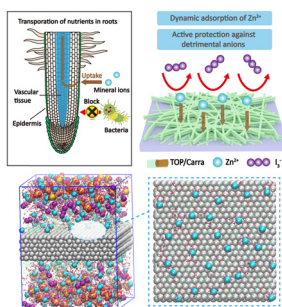
6640



### Polycation-regulated hydrogel electrolytes with nanoscale hydrophobic confinement inducing Zn(002) deposition for highly reversible zinc anodes

Xilin Wang, Bin Wang,\* Pengyang Lei, Xiaorui Wang, Lei Zhou, Junxiang Zhang, Jinyang Zhang and Jianli Cheng\*

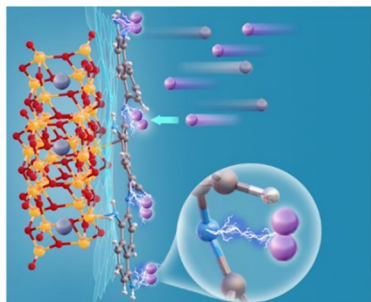
6656



### A plant root cell-inspired interphase layer for practical aqueous zinc–iodine batteries with super-high areal capacity and long lifespan

Yuting Xu, Minghao Zhang, Rong Tang, Siyang Li, Chenxi Sun, Zeheng Lv, Wenhao Yang, Zhipeng Wen, Cheng Chao Li,\* Xue Li\* and Yang Yang\*

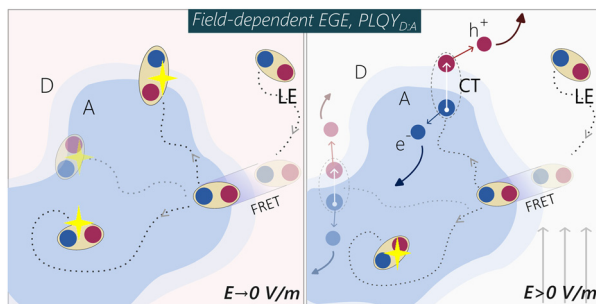
6666



### Dual mechanism with graded energy storage in long-term aqueous zinc-ion batteries achieved using a polymer/vanadium dioxide cathode

Zhihang Song, Yi Zhao, Huirong Wang, Anbin Zhou, Xiaoyu Jin, Yongxin Huang,\* Li Li, Feng Wu and Renjie Chen\*

6676



### On the critical competition between singlet exciton decay and free charge generation in non-fullerene based organic solar cells with low energetic offsets

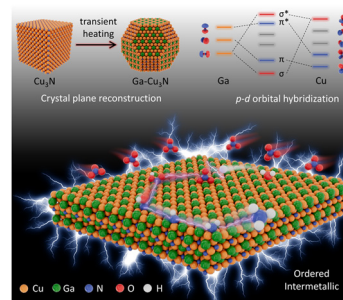
Manasi Pranav, Atul Shukla, David Moser, Julia Rumenev, Wenlan Liu, Rong Wang, Bowen Sun, Sander Smeets, Nurlan Tokmoldin, Yonglin Cao, Guorui He, Thorben Beitz, Frank Jaiser, Thomas Hultzsich, Safa Shoaee, Wouter Maes, Larry Lüer, Christoph Brabec, Koen Vandewal, Denis Andrienko, Sabine Ludwigs and Dieter Neher\*



6698

### Transient heating synthesis of a highly ordered Ga–Cu intermetallic antiperovskite for efficient ammonia electrosynthesis and ultrastable zinc–nitrate fuel cells

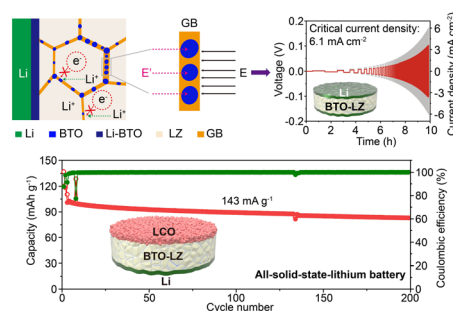
Peifang Wang,\* Chongchong Liu, Lei Rao, Weixiang Tao, Rong Huang, Peilin Huang and Gang Zhou\*



6707

### Field-responsive grain boundary against dendrite penetration for all-solid-state batteries

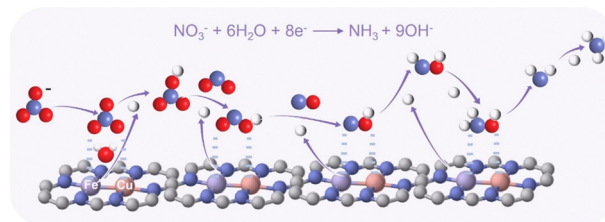
Bing-Qing Xiong, Xiaoye Liu, Qingshun Nian, Zihong Wang, Yuhong Zhu, Xuan Luo, Jinyu Jiang, Digen Ruan, Jun Ma, Junhao Jiang, Yi-Feng Cheng, Changhao Li and Xiaodi Ren\*



6717

### Regulating intermediate adsorption and H<sub>2</sub>O dissociation on a diatomic catalyst to promote electrocatalytic nitrate reduction to ammonia

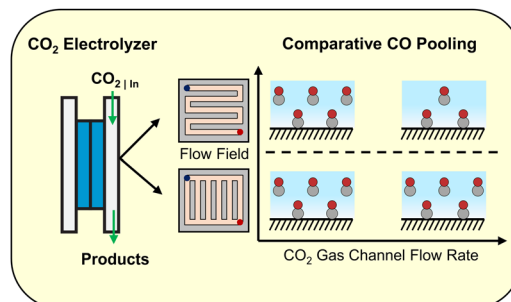
Xiaoxue Zhang, Xiaokang Liu, Zhen-Feng Huang,\* Li Gan, Shishi Zhang, Ru Jia, Muhammad Ajmal, Lun Pan, Chengxiang Shi, Xiangwen Zhang, Guidong Yang and Ji-Jun Zou\*



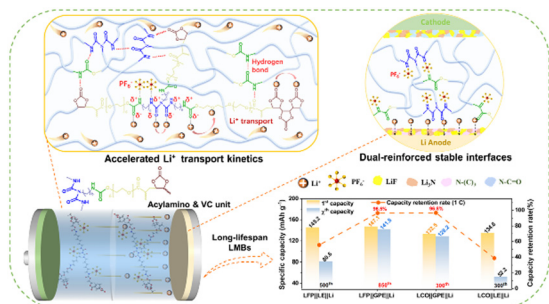
6728

### CO residence time modulates multi-carbon formation rates in a zero-gap Cu based CO<sub>2</sub> electrolyzer

Siddhartha Subramanian,\* Jesse Kok, Pratik Gholkar, Asvin Sajeer Kumar, Hugo-Pieter Iglesias van Montfort, Ruud Kortlever, Atsushi Urakawa, Bernard Dam and Thomas Burdyny\*



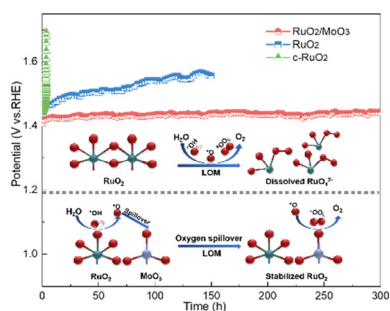
6739



### Leveraging polymer architecture design with acylamino functionalization for electrolytes to enable highly durable lithium metal batteries

Jiayu Zheng, Lingyan Duan,\* Hang Ma, Qi An, Qing Liu, Yongjiang Sun, Genfu Zhao, Hanlin Tang, Yang Li, Shimin Wang, Qijun Xu, Lilian Wang and Hong Guo\*

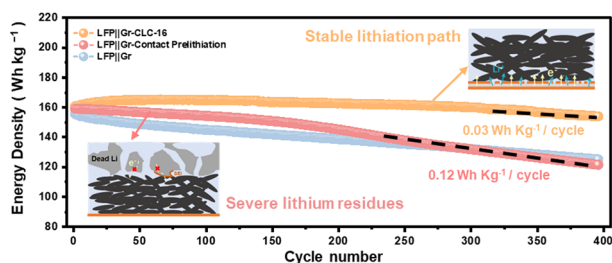
6755



### Oxygen spillover from RuO<sub>2</sub> to MoO<sub>3</sub> enhances the activity and durability of RuO<sub>2</sub> for acidic oxygen evolution

Wangyan Gou, Shishi Zhang, Yichen Wang, Xiaohe Tan, Linqing Liao, Zening Qi, Min Xie, Yuanyuan Ma,\* Yaqiong Su\* and Yongquan Qu\*

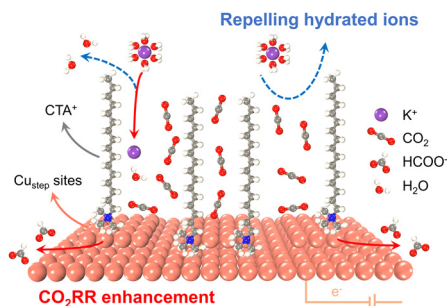
6766



### Air-stable lithium-sandwiched current collector for non-destructive, thermally safe, and sustained supplementary lithiation

Can Zhang, Xinlong Chen, Wang Wan, Ganxiong Liu, Quan Nie, Fangzhou Yang, Xueyang Li, Sa Li, Yunhui Huang and Chao Wang\*

6779



### Stepped copper sites coupling voltage-induced surfactant assembly to achieve efficient CO<sub>2</sub> electroreduction to formate

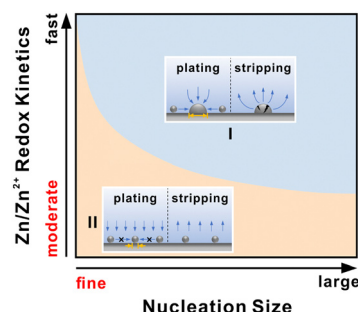
Sicong Qiao, Guikai Zhang, Dong Tian,\* Wenjie Xu, Wei Jiang, Yuyang Cao, Jun Qian, Jing Zhang, Qun He\* and Li Song\*



6787

### A homogeneous plating/stripping mode with fine grains for highly reversible Zn anodes

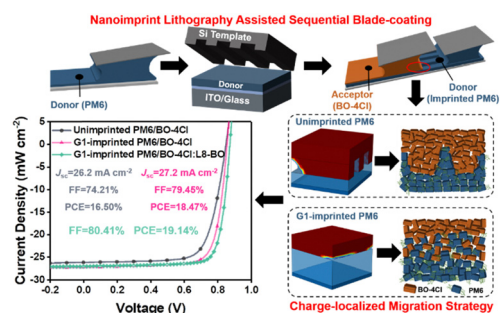
Zhen Luo, Yufan Xia, Shuang Chen, Xingxing Wu, Esther Akinlabi, Ben Bin Xu,\* Hongge Pan, Mi Yan and Yinzhu Jiang\*



6799

### Modulation of charge migration and ink flow dynamics exceeding 19% efficiency for blade-coating pseudo-planar heterojunction organic solar cells

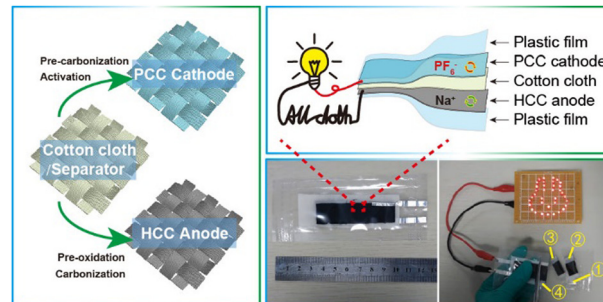
Houdong Mao, Jiahua Zhang, Xin Cen, Jiayou Zhang, Lin Wen, Jingwei Xue, Dou Luo, Lifu Zhang,\* Zhao Qin, Wei Ma, Licheng Tan\* and Yiwang Chen\*



6811

### Targeted design strategies for a highly activated carbon cloth cathode/anode to construct flexible and cuttable sodium ion capacitors with an all-woven-structure

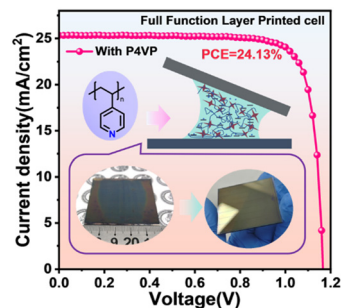
Ying-Ying Wang, Zhong-Yuan Wang, Yu-Juan Xu, Wei-Hua Chen,\* Guo-Sheng Shao\* and Bao-Hua Hou\*



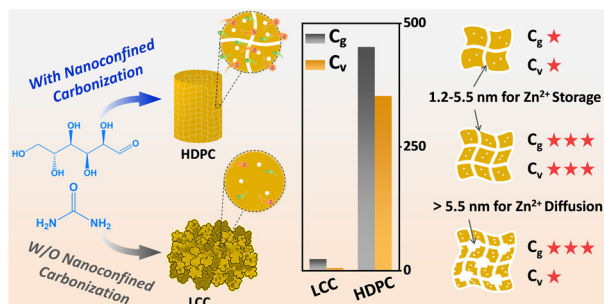
6821

### Polymer modulated ink rheology and compatibility enables homogenized printing of a Spiro-OMeTAD transport layer for scalable and stable perovskite solar modules

Jin Li, Baojing Fan, Xukai Liu, Yuxin Liu, Zhi Xing, Chenxiang Gong, Zhaoyang Chu, Linfeng Li, Xiangchuan Meng, Rui Guo,\* Fuyi Wang, Xiaotian Hu\* and Yiwang Chen\*



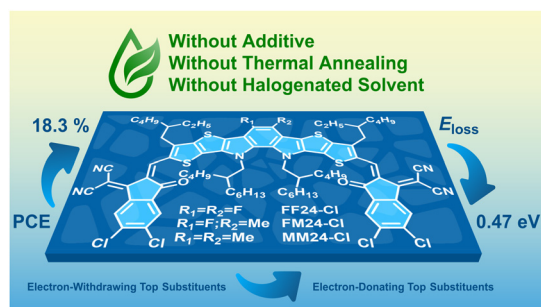
6833



### Nanoconfined carbonization enabling high-density porous carbon for jointly superior gravimetric and volumetric zinc-ion storage

Jiacong Lu, Xinyue Zhong, Xiaomin Lin, Jiuqing Gui, Mingtao Zheng, Yingliang Liu and Yeru Liang\*

6844



### C-shaped *ortho*-benzodipyrrole-based acceptors with different electronic effects of top substituents for as-cast green-solvent processed high-performance organic solar cells

Yufei Gong, Tianwei Zou, Xiaojun Li,\* Shucheng Qin, Guangpei Sun, Tongling Liang, Ruimin Zhou, Jianqi Zhang, Jinyuan Zhang, Lei Meng, Zhixiang Wei and Yongfang Li\*

