VIDEO ARTICLE

Vid. Proc. Adv. Mater., Volume 2, Article ID 210180 **(2021)**

Composition Engineered Electrocatalysts for Water Splitting and Metal-ion batteries

Kun Xu, Yao Zhou, Zhe Wang, Hong Jin Fan*

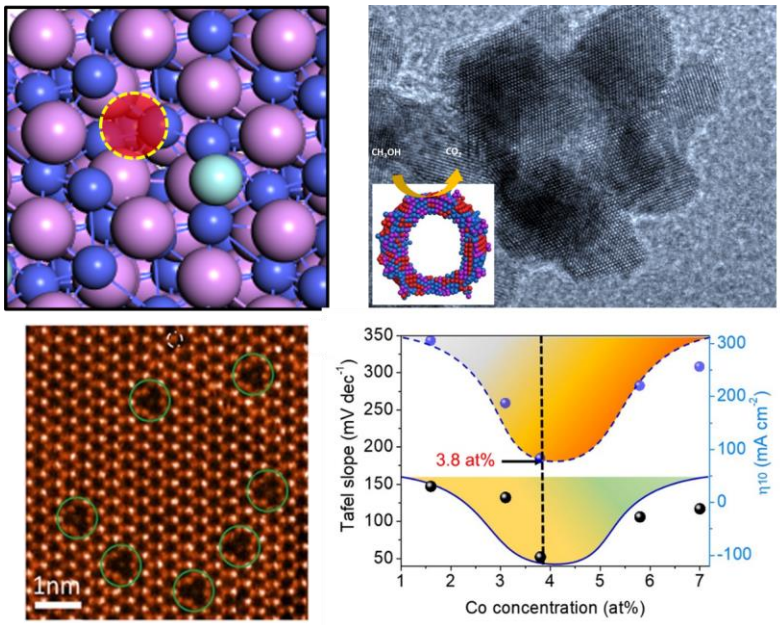
School of Physical and Mathematical Sciences, Nanyang Technological University, 637371, Singapore

*Corresponding and Presenting Author. E-mail: fanhj@ntu.edu.sg

DOI: 10.5185/vpoam.2021.0180

Graphical Abstract

Doping and composition engineering is effective to tailoring the electronic structure and enhancement in electrocatalytic performance for water splitting and metal ion batteries.



Abstract

Water electrolysis, fuel cells, and metal-air batteries all require efficient and cheap electrocatalysts that can significantly lower the reaction overpotentials. Defects due to doping or alloy are pivotal to tailoring the electrocatalytic activities of the electrode materials. In this talk, I will discuss about effect of composition engineering and doping of electrocatalysts in their performance in water splitting and meal-ion batteries. First, we show dual anion doping, or metal-anion co-doping in alloy compounds can simultaneously modulate key parameters in water dissociation and hydrogen adsorption energies, leading to evident enhancement in both hydrogen and oxygen evolution reactions activities. Second, local configurations in the basal plane of MoS_2 due to atomic doping has triggered the intrinsic HER activity. Finally, some applications in high-power and durable zinc air batteries will also be presented.

Keywords: Water splitting, hydrogen generation reaction, electrocatalysts, metal-ion batteries, defect chemistry.

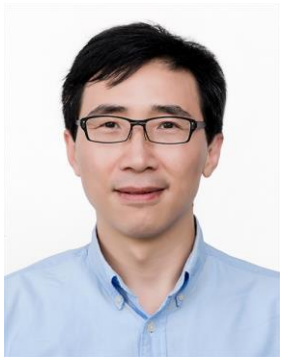
Acknowledgements

This work is supported by Singapore MOE (MOE2017-T2-1-073) and A*STAR (AMEIRG18-0006).

References

1. Kun Xu, Yiqiang Sun, Xiuling Li, Zihan Zhao, Yongqi Zhang, Cuncheng Li, and Hong Jin Fan*, *ACS Materials Lett.*, **2020**, *2*, 736-743.
2. Yao Zhou, Jing Zhang, Erhong Song, Junhao Lin, Jiadong Zhou, Kazu Suenaga, Wu Zhou, Zheng Liu, Jianjun Liu*, Jun Lou*, and Hong Jin Fan*, *Nature Commun.*, **2020**, *11*, 2253.
3. Caiwu Liang, Peichao Zou, Adeela Nairan, Yongqi Zhang, Jiaxing Liu, Kangwei Liu, Shengyu Hu, Feiyu Kang, Hong Jin Fan*, Cheng Yang*, Exceptional Performance of Hierarchical Ni-Fe Oxyhydroxide@NiFe Alloy Nanowire Array Electrocatalysts for Large Current Density Water Splitting, *Energy Enviorn. Sci.*, **2020**, *13*, 86-95.
4. Kun Xu, Yiqiang Sun, Yuanmiao Sun, Yongqi Zhang, Guichong Jia, Qinghua Zhang, Lin Gu, Shuzhou Li, Yue Li*, and Hong Jin Fan*, Yin-Yang Harmony: Metal and Non-metal Dual-Doping Boosts Electrocatalytic Activity for Alkaline Hydrogen Evolution, *ACS Energy Lett.*, **2018**, *3*, 2750-2756.
5. Yongqi Zhang, Bo Ouyang, Jing Xu, Guichong Jia, Shi Chen, Rajdeep Singh Rawat, and Hong Jin Fan*, Rapid synthesis of CoN nanowires: highly efficient and low-cost catalyst for oxygen evolution, *Angew. Chem. Int. Ed.*, ***2016***, *55*, 8670-8674.

Biography of Presenting Author



Hong Jin Fan joined in NTU as Nanyang Assistant Professor in 2008, promoted to Associate Professor with tenure in 2014, and full professor in 2019. He received PhD in Physics from National University of Singapore in 2003, followed by postdoc at Max-Planck-Institute of Microstructure Physics, Germany and University of Cambridge. His research interests include energy materials and technologies, including photo- and electrocatalysis water splitting for hydrogen generation, and new batteries. He has authored and co-authored more than 2300 journal papers with nearly 25000 citations. He is selected as Fellow of Royal Society of Chemistry (FRSC) and has been consecutively recognized as *Highly Cited Researchers* since 2016 (Clarivate Analytics). He is currently Associate Editor of the journal *Materials Today Energy*, and editorial board member of other Elsevier and Wiley journals. He has committed significant professional service by organizing conferences and symposia over the years, including MRS in US and ICMAT in Singapore.

Citation of Video Article

Vid. Proc. Adv. Mater., Volume 2, Article ID 210180 **(2021)**

Full Video Article www.proceedings.iaamonline.org/article/vpoam-2021-0180