Precise Surface Control of Electrode Materials for Improved Battery Performance

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Abstract: The control of surface property of cathode materials is known to be critical in improving the stability of high energy cathode materials considering the essential role played by the cathode-electrolyte interface. My talk mainly focuses on two aspects: First is about the synthetic protocols developed in our group to achieve precise surface control of electrode materials through solution-based routes. I'll show that the control in growth kinetics is able to produce uniform surface nanoshells with thickness achieving one nanometer accuracy. I will introduce different synthetic protocols successful for constructing those widely used coating species such as metal oxides, metal phosphates, and carbon [1]. Second, I'll introduce the different protection effect and stabilization mechanism of the surface species on high energy cathode materials. I'll mainly discuss a newly-develop protocol known as surface-localized doping[2], which is able to achieve an optimized effect in not only ensuring a much stable surface by strengthen its crystalline framework with well-selected metal cations, but also showing no detrimental effect on its reversible capacity since the doping is localized to only the nanometer depth on the surface. Finally, we will envision the future challenges and possible research directions related to the stability control of next generation high energy cathode materials.

References:

[1] De-Shan Bin, Yan-Song Xu, Si-Jie Guo, Yong-Gang Sun, An-Min Cao,* and Li-Jun Wan*, Acc. Chem. Res., **2021**, 54(1), 221–231

[2] Jun-Yu Piao, Lin Gu, Zengxi Wei, Jianmin Ma, Jinpeng Wu, Wanli Yang, Yue Gong, Yong-Gang Sun, Shu-Yi Duan, Xian-Sen Tao, De-Shan Bin, An-Min Cao*, and Li-Jun Wan J. Am. Chem. Soc., **2019**, 141, 4900-4907

Biography:

An-Min Cao earned his PhD from the Institute of Chemistry, Chinese Academy of Sciences (ICCAS) in 2006. Thereafter he did postdoctoral research in Prof. Götz Veser's group on functional nanomaterials for heterogeneous catalytic reactions. From May 2010 he transferred to the University of Texas at Austin to work on clean energy related materials with Prof. A. Manthiram. He served as a full professor at ICCAS since 2012. Dr. Cao's current research centers on the surface/interface control of high energy electrode materials for secondary batteries.