Crystalline-controllable combustion synthesis of ferrite-based anode materials for sodium ion batteries

Xue Li[a], Peng Dong[a], Cheng Liu[a], Xiaohua Yu[a], Jinbao Zhao[b], Ling Huang[b], Shigang Sun[b], Jiaming Liu[a], Yingjie Zhang[b, *]

[a] *National and Local Joint Engineering Laboratory for Lithium-ion Batteries and Materials Preparation Technology, Faculty of Metallurgical and Energy Engineering, Kunming University of Science and Technology, Kunming 650093, PR China*
[b] *State Key Laboratory of Physical Chemistry of Solid Surfaces, Collaborative Innovation Center of Chemistry for Energy Materials, College of Chemistry and Chemical Engineering, Xiamen University, Xiamen, 361005, China*

E-mail: 438616074@qq.com

Transition metal oxides especially Fe-based oxides with conversion reaction have been considered as one of the promising materials for SIBs anode materials.

In this study, we report a facile and scalable technique for the crystalline-controllable preparation of $CuFe_2O_4$ nanoparticles by solution combustion synthesis as a high capacity anode material of sodium ion batteries. Innovatly, we have studied the effect of temperature on the crystal structure and morphology. The internal relevance of the crystal structure and morphology on the electrochemical performance is also studied in detail by theoretical calculation andelectrochemical tests. When being used as the anode materals for SIBs, the $CuFe_2O_4$ obtained at 150 ℃ exhibits superior electrochemical performance in the electrochemical tests. After 80 cycles, the discharge capacity remains 331.0 mAh g^{-1}, showing a high capacity retention of 79.8%. The excellent electrochemical performance is mainly due to the cubic structure and nanoscale size which can stabilize material structure and offer large activity area, facilitate Na ion diffusion ability and ease the volume expansion.

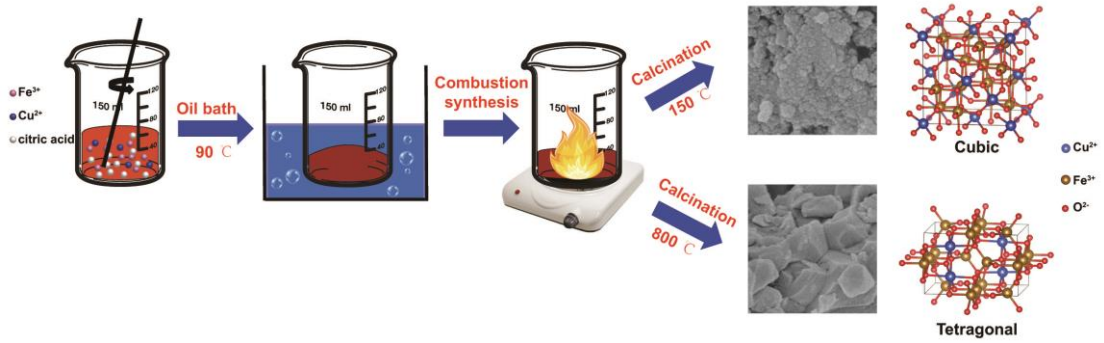

Fig. 1. Schematic illustration of the preparation process for $CuFe_2O_4$.

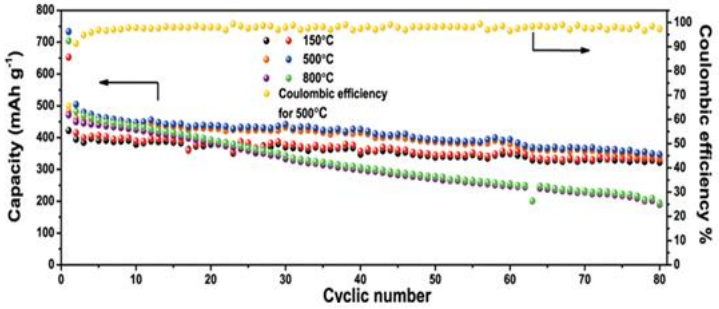

Fig. 2. The cycling performance of CuFe-150, CuFe-500 and CuFe-800 at the current density of 50 mA g-1 (0.01~3.0 V).