Na⁺ and Fe³⁺ Co Doped cathode materials with high electrochemical performances

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In the present work, nanoscale spherical MnO₂ was prepared by hydrothermal method and used as precursor. Then spherical LiMn₂O₄, LiFe_{0.06}Mn_{1.94}O₄ and LiNa_{0.06}Mn_{1.94}Fe_{0.06}O₄ were synthesized by 2-step sintering method. Physical chemical characterization and electrochemical performance tests were carried out with various methods such as X-ray diffraction(XRD), scanning electron microscopy(SEM), Electrochemical Impedance Spectroscopy(EIS), Cyclic Voltammetry(CV) and charge-discharge cycling test. The results indicated that LiNa_{0.06}Mn_{1.94}Fe_{0.06}O₄ has better rate cycling performance than LiMn₂O₄. Because it has stable crystal structure and the particles are smaller (about 160 nm). After 100 cycles at 0.5 C rate, the discharge capacity of LiNa_{0.06}Mn_{1.94}Fe_{0.06}O₄ was 108.0mAh/g, while that of LiMn₂O₄ was only 92.2mAh/g. Their retaining capacities were 90.91% and 74.12%, respectively. At 10 C rate, the former has better discharge (34.3mAh/g) than that of the latter. This paper also shows that the composite doping of Na⁺ and Fe³⁺ has a positive effect on the Li⁺ diffusion coefficient and charge transfer resistance.

Keywords: Hydrothermal; LiMn₂O₄; Composite doping; Electrochemical performances

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