LiNi$_{0.5}$Mn$_{1.45}$Zn$_{0.05}$O$_4$ with Excellent Electrochemical Performance for Lithium Ion Batteries

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Pure LiNi$_{0.5}$Mn$_{1.45}$Zn$_{0.05}$O$_4$ with a mixture of ordered and disordered phase has been successfully synthesized by a low temperature solution combustion synthesis method at 700°C. The phase structure and micro morphologies are investigated by X-ray powder diffraction (XRD), infrared spectroscopy (FT-IR) and scanning electron microscopy (SEM). The electrochemical properties are studied by cyclic voltammetry (CV), electrochemical impedance spectroscopy (EIS) and galvanostatic charge-discharge testing. The results indicate that the substitution of Zn on Mn site in the LiNi$_{0.5}$Mn$_{1.5}$O$_4$ can improve the cycling stability both at room temperature and even at elevated temperature 55°C and the rate capability significantly. The initial specific capacity at 1C rate of LiNi$_{0.5}$Mn$_{1.45}$Zn$_{0.05}$O$_4$ is 140.4mAh/g, and can remain 95% after 400 cycles at room temperature and 92.9% after 100 cycles at 55°C. The specific capacity of LiNi$_{0.5}$Mn$_{1.45}$Zn$_{0.05}$O$_4$ is high to 125.3mAh/g at 10C, and the capacity retention is still 95.4% after 100 cycles at 10C compared with the first cycle at 10C. The excellent performance of LiNi$_{0.5}$Mn$_{1.45}$Zn$_{0.05}$O$_4$ is ascribed to its better crystallinity, higher conductivity and higher lithium diffusion coefficient ($D_{Li}$).

**Keywords:** Lithium-ion batteries, LiNi$_{0.5}$Mn$_{1.5}$O$_4$ spinels, Zn doping, rate capability

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