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$LiNi_{0.5}Mn_{1.45}Zn_{0.05}O_4$ 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℃. 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℃ 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℃. 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

FULL TEXT