Preparation and Electrochemical Performance of Nano- $\text{LiNi}_{0.05}\text{Mn}_{1.95}\text{O}_4$ Cathode Materials by a Low-Temperature Molten-Salt Combustion Method

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Nano- $\text{LiNi}_{0.05}\text{Mn}_{1.95}\text{O}_4$ cathode materials with nano-sized particles were successfully synthesized by a low temperature molten-salt combustion method at 400 °C for 1 h and then two-stage calcination at 600 °C for 3 h. The crystal structures and morphologies of nano- $\text{LiNi}_{0.05}\text{Mn}_{1.95}\text{O}_4$ were characterized by X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), scanning electron microscopy (SEM) and transmission electron microscopy (TEM). All obtained samples with good crystallinity were identified as the cubic spinel structure of LiMn_2O_4 . The lattice parameters and the particle size of samples decreased as the Ni doped. The effects of Ni^{2+} ion doping on the electrochemical properties of nano- $\text{LiNi}_{0.05}\text{Mn}_{1.95}\text{O}_4$ were investigated by a galvanostatic charge-discharge test, cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS). The results showed that the nano- $\text{LiNi}_{0.05}\text{Mn}_{1.95}\text{O}_4$ sample exhibited the initial discharge capacity of 112.4 mAh g⁻¹ with capacity retention of 80.7% after 1000 cycles at 1.0 C (1 C = 148.0 mAh g⁻¹). In addition, the nano- $\text{LiNi}_{0.05}\text{Mn}_{1.95}\text{O}_4$ sample exhibited good rate capabilities at different current densities from 0.5 C to 5.0 C. These improvements are attributed to the synergistic effects of the nano-structure and nickel doping of the $\text{LiNi}_{0.05}\text{Mn}_{1.95}\text{O}_4$ sample.

Keywords: Lithium-ion battery; Cathode material; Nano- $\text{LiNi}_{0.05}\text{Mn}_{1.95}\text{O}_4$; Molten-salt combustion method

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