Effect of Calcining Temperatures on the Electrochemical Performances of $\text{LiNi}_{0.5}\text{Co}_{0.2}\text{Mn}_{0.3}\text{O}_2$ Cathode Material for Lithium Ion Batteries

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In this paper, the effects of calcination temperatures on the electrochemical properties of $\text{LiNi}_{0.5}\text{Co}_{0.2}\text{Mn}_{0.3}\text{O}_2$ cathode materials for lithium ion batteries were studied. The $\text{LiNi}_{0.5}\text{Co}_{0.2}\text{Mn}_{0.3}\text{O}_2$ materials were prepared by a sol-gel method at 750 °C, 800 °C, 850 °C and 900 °C, respectively. In order to study the effects of calcination temperatures on the material, X-ray diffraction, scanning electron microscope, charge/discharge cycle test, cyclic voltammetry test and impedance test were used to characterize and test the materials. The results show that with the increase of calcination temperature, the particles of $\text{LiNi}_{0.5}\text{Co}_{0.2}\text{Mn}_{0.3}\text{O}_2$ materials change from spherical to regular polyhedron. The $\text{LiNi}_{0.5}\text{Co}_{0.2}\text{Mn}_{0.3}\text{O}_2$ material prepared at higher calcination temperature has better electrochemical properties, but too high calcination temperature will also have adverse effects on the properties of the materials. When the calcination temperature is 850 °C, the particle size of $\text{LiNi}_{0.5}\text{Co}_{0.2}\text{Mn}_{0.3}\text{O}_2$ material is uniform with good dispersion, high crystallinity and good layered structure. And also it has the best electrochemical performance. The first discharge specific capacity of the material prepared at this calcination temperature is 168.3mAh g⁻¹ with a retention rate is 90.4% after 50 cycles.

Keywords: Li-ion battery, calcining temperature, $\text{LiNi}_{0.5}\text{Co}_{0.2}\text{Mn}_{0.3}\text{O}_2$, sol-gel method, electrochemical performance

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