Improving Electrochemical Performance of Fe doped $\text{Li}_{1.2}\text{Ni}_{0.13}\text{Co}_{0.13}\text{Mn}_{0.54}\text{O}_2$ Cathode Material for Lithium-Ion Battery

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$\text{Li}_{1.2}\text{Ni}_{0.13}\text{Co}_{0.13}\text{Mn}_{0.54}\text{O}_2$ cathode material was prepared via a high temperature solid-state method. Using X-ray diffraction, scanning electron microscopy, electron diffraction spectroscopy, infrared absorption spectrum, electrochemical impedance spectroscopy (EIS), and galvanostatic charge-discharge measurements. The $\text{Li}_{1.2}\text{Ni}_{0.13}\text{Co}_{0.13}\text{Mn}_{0.54}\text{O}_2$ electrode appears a high reversible discharge capacity of 300 mAhg⁻¹ at 0.1C-rate with a high capacity retention rate of 90.9% after 50 cycles within a potential range of 2.0-4.8 V at room temperature. The Fe-doped cathode materials indicate a better improvement in cycling performance and rate character, which EIS datas indicated a number of variation in surface film resistance (R_s) and lithium intercalation/de-intercalation resistance (R_{ct}) as a function of applied voltage. The datas indicate well-crystallized surface of the particles and stability of layered structure of $\text{Li}_{1.2}\text{Ni}_{0.13}\text{Co}_{0.13}\text{Fe}_{0.02}\text{Mn}_{0.52}\text{O}_2$ electrode with amorphous surface area and spinel nanodomain distribution for $\text{Li}_{1.2}\text{Ni}_{0.13}\text{Co}_{0.13}\text{Mn}_{0.54}\text{O}_2$ electrode at cycling, which explain the excellent electrochemical performance of Fe doped $\text{Li}_{1.2}\text{Ni}_{0.13}\text{Co}_{0.13}\text{Mn}_{0.54}\text{O}_2$ cathode material.

Keywords: Cathode material; Fe doping; electrochemical performance

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