The Electrochemical Performance of Mg-F Co-doped Spinel $\text{LiNi}_{0.5}\text{Mn}_{1.5}\text{O}_4$ Cathode Materials for Lithium-Ion Battery

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The Mg doped and Mg-F co-doped spinel $\text{LiNi}_{0.5}\text{Mn}_{1.5}\text{O}_4$ nanoparticles have been synthesized using a rheological method and investigated as high voltage cathode materials for rechargeable lithium-ion batteries. The results demonstrate that the Mg-F co-doped $\text{LiNi}_{0.5}\text{Mg}_{0.2}\text{Mn}_{1.3}\text{O}_{3.8}\text{F}_{0.4}$ cathodes present an improved electrochemical performance over the pristine and Mg doped samples. After cycling at different current densities at 55 °C, the discharge capacities are 101.4 mAh g⁻¹ for the $\text{LiNi}_{0.5}\text{Mg}_{0.2}\text{Mn}_{1.3}\text{O}_{3.8}\text{F}_{0.4}$ cathode (90 % of the capacity retention), 73.3 mAh g⁻¹ for the $\text{LiNi}_{0.5}\text{Mg}_{0.2}\text{Mn}_{1.3}\text{O}_4$ sample (71 % of the capacity retention), and 43.1 mAh g⁻¹ for the pristine $\text{LiNi}_{0.5}\text{Mn}_{1.5}\text{O}_4$ material (49 % of the capacity retention). The remarkable performances may be attributed to the doping of Mg ions which in turn suppress the John-Teller effect by increasing the average oxidation state of Mn ions. Furthermore, the doping of F ions provide a more stable crystal structures and smaller charge transfer resistance.

Keywords: Lithium-ion battery, Cathode material, Co-doping, Rate capability, High temperature

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