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Effect of varying the chelating and precipitating agents volumes on LiNi0.8Mn0.1Co0.1O2 (NMC811)

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The LiNi0.8Mn0.1Co0.1O2 (NMC811) cathode material was synthesized by a two-step process, co-precipitation and solid-state methods. The effect of varying the volumes of the chelating (NH4OH) and precipitating (NaOH) agents on the structure, morphology, thermal stability and cycling performance of the prepared NMC811 nanopowders was investigated. The thermogravimetric analysis showed that the NMC811 was stable when annealed with temperatures around 900 ℃. The X-ray diffraction patterns showed that the NMC811 material consists of the hexagon α-NaFeO2 structure. The crystallite sizes ranging from 77 to 101 nm increased with an increase in volumes of the chelating and precipitating agents, respectively. Scanning electron microscopy revealed quasi-spherical shaped secondary particles for the prepared NMC811 nanoparticles. The pyramid-shaped particles changed and appeared to melt together, and irregular polyhedron-like particles crumbled into smaller particles with an increase in the volume of chelating and precipitating agents, respectively. The surface composition of the cathode materials was studied by X-ray photoelectron spectroscopy. The galvanostatic charge/discharge results showed high Coulombic efficiency above 95% after 80 cycles for all samples, and the 20 ml NH4OH sample had the highest discharge capacity of 142 mAh g-1. The EIS results revealed that the chelating agent less affects the resistance at the electrode-electrolyte interface than the precipitating agent. Thus, leading to improved efficiency and performance in applications where rapid charge and discharge cycles are required.

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