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Study of the structural, morphological, and electrochemical properties of LiNi0.8Mn0.1Co0.1O2 (NMC811) doped with copper for applications in energy storage material

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A two-step method was used to synthesize the LiNi0.8Mn0.1Co0.1O2 (NMC811) and copper (Cu)-doped NMC811 (Cu-NMC811) cathode materials, the co-precipitation and solid-state synthesis. The effect of Cu doping on the structure, morphology and electrochemical performance of NMC811 nanopowders was investigated. The thermogravimetric analysis confirmed that the annealing temperatures around 850 ℃ are required to form NMC811 nanopowders. The X-ray diffraction patterns of both NMC811 and Cu-NMC811 corresponded to hexagonal α-NaFeO2 structure with R-3¯m space group. X-ray photoelectron spectroscopy showed oxidation states on the surface of the nanopowders. The Scanning electron microscopy shows the morphology of polyhedron-like NMC811 particles changes to uniformly distributed rock-like particles under Cu doping. Fourier-transform infrared spectroscopy displayed vibration bands belonging to NMC811 unaltered by doping Cu. The electrochemical performance of Cu doped into NMC811 improved the initial discharge capacity to 287 mAhg-1 at 0.1 C and the structural stability. The results further showed better capacity retention of 56.09% after 100 cycles for Cu-NMC811.

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