Effect of synthesis conditions and calcination temperature on the structural and electrochemical properties of $LiNi_{0.8}Co_{0.1}Mn_{0.1}O_2$ as a positive electrode for Lithium-ion batteries

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Nickel-rich layered metal oxide materials are prospective cathode materials for lithium ion batteries due to the relatively higher capacity and lower cost than $LiCoO_2$. In this work, spherical $Ni_{0.8}Co_{0.1}Mn_{0.1}(OH)_2$ precursors are successfully synthesized by co-precipitation method. The homogeneous and spherical $Ni_{0.8}Co_{0.1}Mn_{0.1}(OH)_2$ precursors had a high tap-density of 1.91 g/cm^3. $LiNi_{0.8}Co_{0.1}Mn_{0.1}O_2$ was then prepared as a cathode material for lithium-ion battery from this precursor by reaction with 5% excess LiOH.H2O at 800oC in air. The cathode material had well-ordered layer-structure and tap-density of 2.35 g/cm^3. The crystal structure, morphology and electrochemical properties of the $Ni_{0.8}$ $Co_{0.1}$ $Mn_{0.1}$ $(OH)_2$ precursors and $LiNi_{0.8}Co_{0.1}Mn_{0.1}O_2$ were investigated by using X-ray diffraction, scanning electron microscopy, charge-discharge test and cyclic voltammetry method. In the voltage ranges of 3.0 – 4.3V, the initial discharge capacity of $LiNi_{0.8}Co_{0.1}Mn_{0.1}O_2$ at 0.1 C rate was 193 mAh g^{-1}. The cell delivers a capacity of 170.373 mAh g^{-1} at 1st cycle and 153.71 mAh g^{-1} at 100th cycle with 90.41 % of capacity retention at 1C discharge.