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Effect of calcination and sintering temperature on the properties of layered $LiNi_{1/3}Co_{1/3}Mn_{1/3}O_2$ cathode material for lithium-ion batteries

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Abstract : The layered cathode material for Li-ion batteries was synthesized by solid state reaction method with three step calcination temperatures 500 °C for 5h, 800 °C for 10h, 900 °C for 18h and sintered at 900 °C for 20h. In order to investigate the possible reactions occurring in the synthesis of $LiNi_{1/3}Co_{1/3}Mn_{1/3}O_2$, thermo gravimetric analysis is conducted on the precursor in N_2 atmosphere. The phase composition, micro-morphology, elemental composition and cation distribution of the products are characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), energy dispersive spectra (EDS) and Fourier transform infrared (FTIR) respectively. The results of XRD pattern possessed the α-$NaFeO_2$ structure of the hexagonal system (space group $R\bar{3}m$). The morphological features of the powders are branded by Scanning electron microscopy (SEM). The FT-IR spectroscopic data reveals that the structure of the oxide lattice constituted by LiO_6, NiO_6, CoO_6 and MnO_6 octahedra. The variation of the ac conductivity, dielectric constant and electric modulus as function of frequency at room temperature (303k) was determined to study the electrical properties of the synthesized samples. From this study, we conclude that the layered $LiNi_{1/3}Co_{1/3}Mn_{1/3}O_2$ material is prepared by solid-state reaction method at different temperature the optimum calcination and sintering temperature is 900^0C for 18h and 900^0C for 20h respectively.

Keywords : Layered structure, XRD, SEM, Impedance, Dielectric constant.

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