DEVELOPMENT OF Li $(Ni_{1/3}Mn_{1/3}Co_{1/3X}Ba_X)O_2$ CATHODE MATERIALS FOR RECHARGEABLE LI-ION BATTERIES

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Abstract

This study was based on Ba doped Li ($Ni_{1/3}Mn_{1/3}Co_{1/3X}Ba_X$) O_2 were synthesized by a glycine nitrate combustion method which involves mixture of oxidizing reagents such as nitrates of metals and a fuel such as glycine which acts as a reducing reagent, and it is used as cathode active material for lithium ion rechargeable batteries. To replace the costly $LiCoO_2$ cathode material system, characterization of Li ($Ni_{1/3}Mn_{1/3}Co_{1/3X}Ba_X$) O_2 was used. Therefore, cationic substitutions to Li ($Ni_{1/3}Mn_{1/3}Co_{1/3}$) O_2 are widely adapted to overcome the problem of cation mixing (Amine *et al.*, 2005). This study focused to synthesize Li ($Ni_{1/3}Co_{1/3-x}Mn_{1/3}Ba_x$) O_2, x = 0 - 1/3, via glycine nitrate process. Performances of lithiated oxides as cathode materials in lithium ion batteries and substitutive effect on electrochemical properties have been investigated by D.C four probe technique. The highest room temperature electrical conductivity of $Li(Ni_{1/3}Mn_{1/3}Co_{1/3X}Ba_X)O_2$ is about $1x10^{-3}$ Scm^{-1}, which is relevant to Ba composition is similar to 0.11 value. More interestingly, the cathode material prepared substituting Co by Ba show a higher conductivity value than Li ($Ni_{1/3}Mn_{1/3}Co_{1/3}$)O_2 system. The Vander Pauw method is one of the standard and most widely used methods for the measurement of resistivity of semiconductors in this research. The manufacture of materials selected electrodes carried out through tape casting and the electrical conductivity measured for tapes. It showed considerable resistivity value of material. The good capacity retention of Li ($Ni_{1/3}Mn_{1/3}Co_{1/3X}Ba_X$)$O_2$ electrodes is attributed to stabilization of the electrode structure by Ba doping of Co sites. Ba substituted cathode material display better cycle performance in terms of cycle life compared with Li ($Ni_{1/3}Mn_{1/3}Co_{1/3}$)O_2 system. In this study, glycine nitrate method provide an attractive option for the preparation of Li ($Ni_{1/3}Mn_{1/3}Co_{1/3X}Ba_X$)$O_2$ cathode material.