SOL-GEL SYNTHESIS OF $LiCoO_2$ AND $LiCo_{0.4}Ni_{0.6}O_2$, THEIR ELECTROCHEMICAL PERFORMANCES AND APPLICATIONS IN Li-ION BATTERIES AS CATHODE MATERIALS

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Lithium cobalt oxide ($LiCoO_2$) is extensively used as a cathode material in commercially available Li-ion batteries due its high energy density and good cycle-life performances. However, the high cost of this material and toxicity of cobalt are some drawbacks. Recently, the cathodes of the type $LiM_xNi_yO_2$ where M is one of the transition or alkaline earth metals are being extensively used as less-costly cathodic material in Li-ion batteries.

The aims of the present work are to study the structural and electrochemical properties of $LiCoO_2$ and lithiated nickel cobalt oxide, $LiCo_{0.4}Ni_{0.6}O_2$, and to assess their applications in Li-ion batteries. $LiCoO_2$ and $LiCo_{0.4}Ni_{0.6}O_2$ were synthesized by using the sol-gel technique.

The properties of the compounds were studied using XRD, FTIR and DSC. The oxides $LiCoO_2$ and $LiCo_{0.4}Ni_{0.6}O_2$ were used as cathode materials for rechargeable lithium-batteries and their electrochemical performances were studied. The potentiostat and galvanostat techniques were used to determine the electrochemical characteristics. The discharge capacities of the $LiCoO_2$ were 155 and 145 mA h g^{-1}, of the $LiCo_{0.4}Ni_{0.6}O_2$ were 19 and 15 mA h g^{-1} for the 1st and 15th cycles, respectively. The overall electrochemical capacity of $LiCo_{0.4}Ni_{0.6}O_2$ oxide has been drastically reduced due to the *s*-block or *p*-block metal substitution and impurity remained during the synthesis and showed very poor cycleability. However, more stable charge-discharge cycling performances have been observed for $LiCoO_2$ oxide at different current rates. Differences and similarities between these two cathode materials are also discussed. Using the synthesized $LiCoO_2$ as the cathode and natural untreated vein graphite of Sri Lanka as anode with 1 M $LiPF_6$ in EC/DMC as liquid electrolyte Li-ion batteries were assembled and tested.

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