Facile Hydrothermal Synthesis of Few Layered Ce – MnO_2 Coated $LiCoO_2$ Cathode Material for Lithium-Ion Batteries

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Lithium-ion batteries gradually become a potential candidate for replacement of nickel-cadmium batteries due to its high intrinsic energy density with easy portability. The cathode materials serve as an important component and significantly change the properties and performance of the lithium-ion batteries. $LiCoO_2$ is the widely used cathode materials in LIBs and it has been extensively studied due to its superior structure and electrochemical properties. Even the theoretical capacity of $LiCoO_2$ is 274 mAh g^{-1}, the increased electrostatic repulsion between the oxygen layers followed by anisotropic volume change during the charge-discharge process leading to a large capacity fade. Recent research showed that the few layered MnO_2 exhibits high lithium ion storage capacity and the cerium also significantly improve the performance of the $LiCoO_2$ cathode material. In this work, we have synthesized the few layered Ce – MnO_2 coated $LiCoO_2$ cathode material with a facile one-step hydrothermal method for a lithium-ion battery application. First, the $LiCoO_2$ cathode material was ground into fine powders by ball milling method and sintered at 900℃ for 10 in the air. This pretreated $LiCoO_2$ material used for further synthesis process and few-layered – MnO_2 was coated simple hydrothermal method at 100℃. As synthesized few layered Ce – MnO_2 coated $LiCoO_2$ cathode material was characterized by various physicochemical techniques. Powder X-ray diffraction technique was used to study the crystalline nature and phase structure of the material. Few layered Ce – MnO_2 and its encapsulation over $LiCoO_2$ were confirmed by field emission electron microscope (FESEM) technique and the elemental analysis were carried out using analysis. The thermal stability of the synthesized Ce – MnO_2 coated $LiCoO_2$ was studied by thermogravimetric analysis. A 2032 type coin cell was assembled by using Ce – MnO_2 coated $LiCoO_2$ as a cathode material and we have studied the electrochemical performance by, cyclic voltammetry, charge-discharge, cycle stability, C-rate performances and electrochemical impedance spectroscopy technique. Our experimental results confirmed that the Ce – MnO_2 coated $LiCoO_2$ cathode material shows better performance than pure $LiCoO_2$ cathode material.

Reference:

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