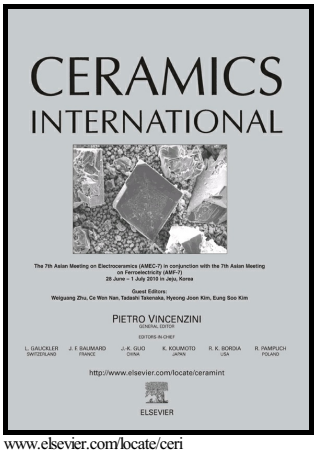

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Improving electrochemical properties of $LiCoO_2$ by enhancing thermal decomposition of Cobalt and Lithium carbonates to synthesize ultrafine powders

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Abstract

Ultrafine $LiCoO_2$ powders were directly synthesized by enhancing thermal decomposition of Cobalt and Lithium carbonates through a mechanochemical activation treatment to intensify the solid state diffusion reaction. Effects of activation treatment time on particle size and structure of the $LiCoO_2$ compound were investigated. In the present study, the optimum mechano-chemical activation time was found to be 10 h. In this study, the ultrafine $LiCoO_2$ powders (particle size in the range from 200 nm to 400 nm) show good structural stability and higher structural integrity. X-ray photoelectron spectroscopy (XPS) results indicate that most of Co cations exist as Co^{3+}, which contributes to the improvement of the electrochemical performance. Cyclic voltammetry (CV) curves of different cycles display almost a complete overlap, which can be regarded as another evidence of the excellent cycle performance. The $LiCoO_2$ powders exhibit a high initial discharge specific capacity of 175.2 mAh/g at 0.1 C (274 mA/g at 1 C) and a remarkable cycle stability from 167.5 mAh/g to 146.2 mAh/g at 0.5 C and from 147.5 mAh/g to 115.2 mAh/g at 3 C after 100 cycles in the range of 3.3~4.3 V. The apparent activation energy and the frequency factor of the decomposition of $CoCO_3$ are 69.83 kJ/mol and 1.369×10^6, respectively, indicating that the

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