UNIVERSITI TEKNOLOGI MARA

PHYSICAL CHARACTERISTICS AND ELECTROCHEMICAL PERFORMANCE OF NANOSTRUCTURED $LiMn_{2-x}Ti_xO_4$ CATHODE MATERIAL

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

Spinel compounds are being investigated extensively due to their promising properties in replacing the commercially used layered cathode material. This is due to its abundance, less toxic nature and low-cost production. However, spinel compound, $LiMn_2O_4$ is unstable and suffer from severe capacity fading. Partial substitution of titanium, Ti, with manganese might overcome this problem. In this work, spinel $LiMn_{2-x}Ti_xO_4$ (x = 0.05, 0.1, 0.2) via a novel self-propagating combustion synthesis and its electrochemical properties are investigated. Simultaneous Thermogravimetric Analysis (STA), X-Ray Diffraction (XRD) and Field Emission Scanning Electron Microscopy (FESEM were used to characterize all the materials. The characterization of all samples show pure and single-phase spinel cubic structured materials obtained at 700 ˚C and 850 ˚C for 24 h and 48 h annealing duration with a polyhedral like morphology. The EDX results which give the atomic percent for each sample were found to be agreeable to the calculated synthesized values. The effect of the physical characteristics of the cathode material on the electrochemical performances of the battery were elaborated in this study. The material $LiMn_{1.9}Ti_{0.1}O_4$ annealed at 850 ˚C for 24 h and 48 h has the best specific capacity of 112 $mAhg^{-1}$ in the first cycle, showing potential as good cathode material.

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