UNIVERSITI TEKNOLOGI MARA

DEVELOPMENT OF CARBON NANOTUBES DERIVED FROM PALM OIL AS ELECTRODE MATERIALS FOR LITHIUM ION BATTERY

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Candidate'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 result 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 other degree or qualification.

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ABSTRACT

The emergence of nanoscience and nanotechnology has been reckoned as the driving force to the development of alternative materials fof energy storage application. The constant demand for high energy density, lighter, thinner lithium-ion battery has motivated research into new battery materials. Carbon nanotubes are arrangements of carbon atoms in the form of thin, hollow tubes. Their physical and chemical properties have attracted much interest in recent years. In this present study, the main focus has been devoted to synthesizing carbon nanotubes (CNTs) via spray pyrolysis method. Natural palm oils has been used as carbon feedstock for this study. Several types of transition metals catalyst namely nickel (Ni), cobalt (Co), iron (Fe) has been used for synthesized of CNTs. Combination of bimetallic Ni/Co, Ni/Fe and Ni/Fe/Mn also has been studied as catalyst sources. The synthesis temperature has been optimized between 700 °C and 900 °C. FE-SEM and HR-TEM study has been carried out to verify the properties of as-obtained black powder from the synthesis process at different parameters. The images showed that the powder obtained were multi-walled carbon nanotubes. The diameter of as-prepared multi-walled carbon nanotubes ranging from 10 nm to 50 nm. XRD study also has been carried out to determine the phase presence in the materials. Results reveal that the crystalline nature of carbon nanotubes greatly affected by the different catalyst used and temperature control as well. In the second part of this study, systematic investigation of carbon nanotubes as anode materials for lithium batteries has been performed. Electrochemical charge-discharge studies of these MWCNTs electrodes had a reversible lithium storage capacity of 100 - 400 mAh/g. It has been observed that the crystallinity of MWCNTs have a direct influence on the specific capacity of these MWCNTs electrodes. The kinetics of Li-ion insertion in carbon nanotube electrodes also were characterized by cyclic voltametry measurements. Cyclic voltammetry measurement of MWCNTs electrodes synthesized from palm oils showed that this material exhibits reversible properties demonstrated by the presence of a pair of redox peaks, corresponding to lithium insertion and extraction in the MWCNTs structure.

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