

UNIVERSITI TEKNOLOGI MARA

**PERFORMANCE OF NORMAL AND NANO-
MATERIAL $\text{Li}_{(1+x)}\text{Mn}_2\text{O}_4$ FOR BATTERY
APPLICATIONS**

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Candidate's Declaration

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ABSTRACT

Stoichiometric of LiMn_2O_4 and non-stoichiometric of $\text{Li}_{(1+x)}\text{Mn}_2\text{O}_4$ where ($x= 0.1, 0.2, 0.3, 0.4$ and 0.5) were prepared using the sol-gel method. Thermogravimetric Analysis (TGA) were done on the samples to study the thermal properties and decomposition of the precursors. The precursors were later heated for 72 hours at $850\text{ }^\circ\text{C}$. The annealed samples were characterized using X-ray Diffraction (XRD), Field Emission Scanning Electron Microscope (FE-SEM) and Particle Size Analyzer. Fabrication of the cathodes and assembling of the batteries followed. The batteries were tested for their electrochemical characteristics. Cyclic voltammetries were carried out using a three probe electrochemical cell. Materials with the best electrochemical characteristics was chosen to prepared the nano material. The nano materials was prepared using high energy ball milling method using the Retsch PM 200. The nano samples were characterized using Field Emission Scanning Electron Microscope (FE-SEM), Transmission Electron Microscopy (TEM) and particle size analysis. Fabrication of the cathodes nano materials and assembling of the batteries were then carried out.

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CHAPTER 1

INTRODUCTION

1.1 Battery Overview

A battery is a device that converts chemical energy contained in its active materials directly into electric energy by means of an electrochemical oxidation-reduction (redox) reaction [1]. Batteries can be divided into primary (non-rechargeable) and secondary (rechargeable) batteries according to the capability of electrical regeneration after chemical energy has been converted fully to electrical energy during discharge. Primary batteries cannot be recharged, i.e. the electrochemical reaction cannot be reversed. Hence, they are discharged once and discarded or recycled chemically.

The primary battery is a convenient source of power for portable electric and electronic device, lighting, photographic equipment, computers and communication equipment, watches and calculators. Other than that it has also become a convenient source for memory backup. The general advantages of primary batteries are good shelf life, high energy density at low to moderate discharge rates, little, if any maintenance and ease of use. Although large high-capacity primary batteries are used in military applications, signaling, standby power, and so on, the vast majority of primary batteries are the familiar cylindrical and flat cells.