UNIVERSITI TEKNOLOGI MARA

MECHANOCHEMICAL SYNTHESISED SOLID ELECTROLYTE BASED ON Li_2O: ELECTRICAL AND STRUCTURAL PROPERTIES

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Thesis submitted in fullfillment
of the requirements for the degree of
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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the reguloations of Universiti Teknologi MARA. It was original and is the result of my own work, unless otherwise indicated or acknowledge as reference work. This thesis has not been submitted to any other academic instituition 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

This study involved the fabrication of lithium ion solid electrolyte in the Li_2O-TiO_2-P_2O_5 (LTP) system. All samples were prepared using mechanical milling (MM) method. The precursor TiO_2-P_2O_5 (TP) system were first fabricated and characterized by Electrochemical Impedance Spectroscopy (EIS), X-Ray Diffractometer (XRD), Field Emission Scanning Electrone Microscope (FESEM) and laser particle sizer. The highest room temperature conductivity was obtained for 60 wt.% of TiO_2-40 wt.% of P_2O_5 (TP 40) and TP 40 sintered at 900 °C (TP 900) with values of 3.18×10^{-7} Scm^{-1} and 8.13×10^{-7} Scm^{-1} respectively. XRD studies showed presence of TiP_2O_7 peaks in the diffraction pattern of TP 40 as well as TP 900. FESEM micrographs showed agglomeration of the samples as the sintering temperature changed indicating availability of big and small grains. Small grains increased as sintering temperature increased. The size of the particle of the TP samples were estimated to range from 0.70 μm to 3.01 μm for sintered and unsintered samples. In the LTP system, the highest conductivity obtained for the unsintered sample, LTP 15 and sintered LTP 15 (LTP 900) is 6.89×10^{-6} Scm^{-1} and 3.03×10^{-5} Scm^{-1} respectively. The diffraction pattern indicate the presence of $LiTi_2(PO_4)_3$ peaks which is the conducting phase. Small grains were observed in all sintered samples with increase in as sintering temperature increases. The sizes of particle of LTP samples were decreased to as low as 200 nm. Temperature dependance studied showed that the conductivity obeys Arrhenius rule indicating that the conductivity is thermally activated.

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