UNIVERSITI TEKNOLOGI MARA

CHARACTERISTIC OF DOPED MG49 GEL POLYMER ELECTROLYTE

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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 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

This dissertation focuses on solid and gel polymer electrolytes based on 49% poly (methyl methacrylate)-grafted natural rubber (MG49) as polymer host, lithium trifluoromethansulfonate ($LiCF_3SO_3$) as ionic dopant salt, and ethylene carbonate (EC) as plasticizer. The electrical and physical characteristic of these electrolytes were investigated for possible application in energy storage devices. The ionic conductivity (σ) values of these electrolytes were calculated by using a bulk resistance value obtained from the complex impedance spectra plot in the frequency range of 100 Hz to 1 MHz. It was found that, the conductivity of solid polymer electrolyte (SPE) increase up to the maximum value at 35 wt. % $LiCF_3SO_3$ salt then decrease at higher salt loading. The increase and decrease in conductivity of SPE is associated with the ion dissociation and association of lithium salt in polymer matrix. Upon the addition of plasticizer, the conductivity found was further increase as plasticizer increases. The increase of conductivity is explained in terms of the free volume theory. The plasticized SPE also known as gel polymer electrolyte (GPE). The polymer-salt complexes were studied by the Fourier Transform Infrared (FTIR) spectra analysis. It was found that, the polymer-salt complexes occur at C=O (1728 cm^{-1}) and C-O-C (1265 cm^{-1}) of the MG49. XRD analysis confirmed the polymer-salt complexes take place. The temperature dependence conductivity studies show the ionic transport mechanism for SPE and GPE were governed by Arrhenius and Vogel-Tamman-Fulcher (VTF) behaviour respectively. The glass transition temperature (T_g) of SPE was reduced with addition of EC plasticizer and this value seen to correlate with the ionic conductivity. The energy band gap analysis study shows that the presence of plasticizer disturbed the energy band gap of the polymer-salt complexes which results in increase of the conductivity. The window stability was observed around 2.39 V for SPE and 3.65 V for the GPE sample.

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