UNIVERSITI TEKNOLOGI MARA

PROTON CONDUCTING POLYMER ELECTROLYTES BASED ON POLY-ETHYL METHACRYLATE: PREPARATION, CHARACTERIZATION AND APPLICATION

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Thesis submitted in fulfillment
of the requirements for the degree of
Master of Science

Faculty of Applied Science

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AUTHOR'S DECLARATION

I declare that the work in this dissertation 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 topic 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

The objective of this study is to investigate the characteristics of PEMA based proton conducting polymer electrolytes as a free standing film and its performance in electrochemical cell application. A new material of proton conducting polymer electrolyte was introduced using PEMA, $NH_4CF_3SO_3$ and BMATFSI ionic liquid as the host polymer, doping salt and additive, respectively. In this study, all electrolyte films obtained by solution casting technique were transparent and sticky. Structural, morphological, thermal and electrical properties of all films were investigated by DSC, SEM, and IS respectively. Structural properties of the polymer electrolytes were further investigated by XRD. Interactions of the salt and ionic liquid with the host polymer were investigated by FTIR spectroscopy. Conductivity of the polymer electrolytes increased with salt content. This could be attributed to enhancement in number of carrier ions and enhancement of ion transport as a result of enhancement of amorphous region as shown by XRD study. The highest conductivity achieved is in the order of 10^{-4} S cm^{-1} for the film added with 35 wt % BMATFSI. The film had high amorphicity and low glass transition temperature of 2 °C which is the factor of improvement in segmental motion of the host polymer. The temperature dependence of the ionic conductivity of the polymer electrolyte system obeyed the VTF relation. The t_{ion} number in the polymer film is 0.82, showed that the conductivity in the film was predominantly due to ions. The film is electrochemically stable up to 1.8 V. The discharge performance of the batteries showed that the film has potential for application in protonic electrochemical cells.

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