UNIVERSITI TEKNOLOGI MARA

THERMAL AND CONDUCTIVITY STUDIES OF COMPOSITE POLYMER BLEND ELECTROLYTES BASED ON POLY(ETHYLENE OXIDE) AND EPOXIDIZED NATURAL RUBBER

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Thesis submitted in fulfillment
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 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 thesis 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

In this study, immiscible blends of poly(ethylene oxide) (PEO) and epoxidized natural rubber with 50 mol% epoxide content (ENR-50) added with lithium perchlorate ($LiClO_4$) and nano-sized titanium dioxide (TiO_2) were studied. To have a systematic comparison, a series of systems of PEO/$LiClO_4$, PEO/TiO_2, PEO/$LiClO_4$/TiO_2, ENR-50/$LiClO_4$, ENR-50/TiO_2, ENR-50/$LiClO_4$/TiO_2, PEO/ENR-50, PEO/ENR-50/$LiClO_4$ and PEO/ENR-50/$LiClO_4$/TiO_2 were prepared via solution casting method. The thermal properties, conductivity, intermolecular interaction, morphologies, crystalline structures and rheological behavior were studied accordingly with greater emphasis on the relationship between thermal properties and conductivity behaviour. From impedance spectroscopy analysis, the ionic conductivity at room temperature was found in the order of PEO/$LiClO_4$ > PEO/ENR-50/$LiClO_4$/TiO_2 ≈ PEO/ENR-50/$LiClO_4$ > PEO/$LiClO_4$/TiO_2 > ENR-50/$LiClO_4$ > ENR-50/$LiClO_4$/TiO_2 at constant salt concentration. The highest conductivity achieved is ~10^{-7} S cm^{-1} for PEO/$LiClO_4$ system. From differential scanning calorimetry (DSC) analysis, the trend of glass transition temperature(s) which represents the segmental motion of polymer(s) is different for each particular system. The glass transition temperature shows that most of the $LiClO_4$ salt dissolves in the amorphous phase of PEO rather than ENR-50 in the blend. The role of TiO_2 filler contributing to the ionic conductivity of PEO-blend CPEs is still ambiguous. This underlines the importance of polymer(s)-salt-filler interaction, polymer(s) segmental motion, morphologies, location of salt, location of filler *etc* in understanding conductivity percolation path of immiscible PEO/ENR-50 blend-composite polymer electrolytes.

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"If you don't sacrifice for what you want, then what you want becomes the sacrifice"
-Anonymous-

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