UNIVERSITI TEKNOLOGI MARA

PREPARATION AND CHARACTERIZATION OF UV-IRRADIATED PMMA/ENR 50 BLENDS ELECTROLYTES

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Thesis submitted in fulfillment of the requirements

for the degree of

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Candidate'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 acknowleged 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

A transparent and flexible freestanding film were obtained when poly (methy methacrylate) (PMMA) was blended with 10% of 50% epoxidised natural rubber (ENR 50) by solvent casting method. However, the film was not homogeneous in which phase separations can be observed on the surface of the film and was confirmed from its optical micrograph. The presence of two glass transitions temperatures, T_g in its differential scanning calorimetry (DSC) thermogram further confirmed the in-homogeneity of the blending. Interestingly, the film became more transparent when it was exposed under UV-irradiation for 90 seconds indicating an improvement in the homogeneity of the blending which has been supported by the diminishing of the greyish patches of highly viscous phase of ENR 50 in its optical micrograph. This has been further supported by the DSC analysis in which the distance of the two T_gs were almost merging. From thermo gravimetric (TG) analysis, this 90 seconds irradiated blend system also exhibited the highest stability amongst all irradiated PMMA/ENR 50 blends. From its FTIR spectrum, it was found that the intensity of C=O and O-CH_3 bands at 1725 cm^{-1} and 1389 cm^{-1} respectively were increased indicating an increased in the number of free PMMA chains. This was due to the breaking of interchain crosslinking via hydrogen bonding between PMMA-PMMA chains or ENR 50-ENR 50 chains or PMMA-ENR 50 chains which was confirmed by the reduction in the intensity of OH band at ~3600 cm^{-1}. Therefore, this 90 seconds irradiated PMMA/ENR 50 film exhibited the highest ionic conductivity of 4.22 x 10^{-8} S/cm at room temperature and the lowest activation energy, Ea when 0.2g of lithium triflate ($LiCF_3SO_3$) was added into the blend system. This was due to the highest solubility of lithium salt in the system which was confirmed from its optical micrograph and its FTIR spectrum. However, further increment of salt in this 90 seconds irradiated system causing the blend to be congested due to the inability of this system containing a more viscous phase of ENR 50 to dissolve a large amount of salt. It was also found that above 90 seconds of irradiation time, reformation of interchain crosslinking via covalent bond was formed due to the formation of excessive ENR 50 chain radicals. This can be confirmed from reformation of greyish patches of highly viscous ENR 50 in their optical micrographs causing poor solubility of lithium salt in the system. This can be further confirmed from the lowest intensity of $\nu(SO_3)$ band at ~1044 cm^{-1} obtained from the highest irradiated system hence exhibited the lowest ionic conductivity. All irradiated doped PMMA/ENR 50 blends obey Arrhenius rules in which the ionic conduction mechanism was via ion hopping that was thermally assisted.

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