# THE IMPACT OF UV-MODIFIED EPOXIDISED NATURAL RUBBER ON PMMA/ENR 50 BLENDS ELECTROLYTE FOR LITHIUM ION BATTERY


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## PENGHARGAAN

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# ABSTRACT

This research focused on the development of a new thin film electrolyte based on Poly (methyl methacrylate) / Irradiated- 50% epoxidized natural rubber (iENR 50). Before the blending was carried out by solvent casting technique, the rubber was irradiated under UV light for 30 seconds (30iENR 50), 120 seconds (120iENR 50) and 600 seconds (600iENR 50) to reduce the number of inter-chain cross-linking of ENR 50. From the DSC analysis, it was found that the $T_g$ of un-irradiated ENR 50 was reduced from -25°C to -26°C when it was irradiated for 30 seconds indicating that it has the highest chain flexibility as a result of breaking of the inter-chain cross-linking. Therefore, it can be concluded that it requires only 30 seconds of UV irradiation to heal the inter-chain cross-linking in the ENR 50 system. The reduction of the number of inter-chain cross-linking has been confirmed by the reduction of the intensity of the OH band at 3440-3424 $cm^{-1}$ followed by the increased in the intensity of the epoxy ring at 1255 $cm^{-1}$. When this 30iENR 50 was blended with PMMA, it produced the most flexible freestanding film as compared to un-irradiated and other irradiated ENR 50 systems. Furthermore, this PMMA / 30iENR 50 exhibited the highest conductivity of 1.03 X $10^{-4}$ S/cm due to the flexibility of the polymer chain and the formation of a less viscous phase that favor the migration of lithium ion in the blend matrix. The addition of PC plasticizer further enhanced the conductivity of the PMMA / 30iENR 50 / $LiCF_3SO_3$ electrolyte to 1.16 X $10^{-3}$ S/cm. The ionic conduction of the doped PMMA / 30iENR 50 system was found to obey the Arrhenius behaviour in which the migration of ions was thermally assisted. Interestingly, there were two activation energies ($E_a$) were observed from the doped PMMA / 30iENR 50 electrolytes in which the $E_{a2}$ at higher temperature was less than $E_{a1}$ observed at lower temperature due to the change of the phase from crystalline to an amorphous phase at 70°C. This was confirmed from the DSC thermogram of the blend system. However, for the plasticized PMMA / 30iENR 50/ $LiCF_3SO_3$ electrolyte, the ionic conduction was due to the segmental motion of the polymer indicating that the presence of PC enhanced the mobility of the polymer.

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