PREPARATION AND CHARACTERIZATION OF RADIATED POLYMERS FOR VARIOUS ELECTROCHEMICAL APPLICATIONS

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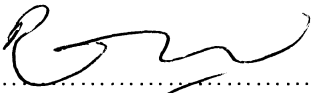

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ABSTRACT

In this study, the high density polyethylene (HDPE) and low density polyethylene (LDPE) sheets were prepared by compression moulding technique. Both sheets were irradiated by electron beam irradiation at 100 to 800 kGy of irradiation dose. Unfortunately, the HDPE sheet showed degradation above 700 kGy of irradiation dose. On the other hand, LDPE can withstand higher irradiation dose up to 800 kGy without showing any degradation. Both sheets became harder after irradiation due to the formation of crosslinking in the polymer structure. This has been confirmed from the thermal gravimetric and differential scanning calorimetry analysis in which the decomposition and the melting temperatures of these irradiated systems were higher than in their un-irradiated systems. The formation of crosslinking in these irradiated HDPE and LDPE system were further confirmed from the formation of interpenetrating structure which were observed from the electron micrograph of these irradiated polymers. From the hot-point probe measurement, both irradiated HDPE and LDPE were *p*-type semiconductors. The presence of charge carriers in these systems were due to the delocalization of electrons from the conjugated C=C bonds that formed in these irradiated systems. The formation of these conjugated C=C bonds in these irradiated HDPE and LDPE systems has been confirmed from the FTIR analysis in which the C=C bonds of *trans*-vinylene and *end*-vinyl were detected at 965 cm^{-1} and 888 cm^{-1} respectively. However, it was found that irradiated HDPE system exhibited higher concentration of conjugated bonds than LDPE due to the closer chain arrangement in the HDPE system that in turn enhance the electrons delocalization along the HDPE chain hence giving lower band gap energy of 2.75 eV compared to LDPE which was 3.97 eV. Interestingly, it was found that the band gap of irradiated HDPE was lower than the polyphenylene and silicon carbide semiconductor.

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