Crystallinity and Mechanical Properties of Recycled, Gamma Irradiated HDPE/EPDM Blends

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High Density Polyethylene (HDPE) is a commodity and its wide range of uses comprises several plastic processing in the industry due its conformability, high thermal and chemical resistance and a relative low cost [1]. Also, this material can be recycled many times, which is an important characteristic to decrease the environmental impact when plastic goods reach their end of life. EPDM is one of thermosetting elastomers widely applicated in automotive industry because of its high mechanical, thermal and ageing resistance [2]. The mixture of this both components generate a material with high impact resistance and tensile strength at break [3]. HDPE/EPDM blends are obtained by extrusion of these polymeric components with addition of compatibilizers agents to achieve a homogenous and compatible mixture [4].

In this work the High Density Polyethylene (HDPE) matrix has been recycled four times from original substrate and mixed to non-vulcanized EPDM rubber in proportions from 1 % to 10 % with no addition of compatibilizer agents. The gamma irradiation process was applied at 50 kGy and 100 kGy to both original and recycled blend samples.

Characterization of samples was performed by X-ray diffraction and stress-strain assay. These results showed an increase of degree of crystallinity at recycled non-blended HDPE compared to this same parameter to pristine HDPE. It was also observed that crystallinity decreases as EPDM concentration increases. In irradiated samples, this parameter increase with high absorbed doses. The crystallite grain size increases in EPDM concentration from 1 % to 5 %; however, this parameter decreases in blends with 10 % of EPDM contents. This behavior suggests a co-crystallization effect on each polymeric component present in the blend and it may explain the miscibility and compability of both components in this material without addition of other agglutinative substances. The parameter stress at yield is high in pristine HDPE and low in recycled HDPE; this parameter decreases with as EPDM concentration increases in the non-irradiated polymeric blend. In irradiated blends the stress at yield increases in high doses. The irradiation process promotes blend crosslinking, and it is evident in blends with high EPDM concentration where high stress at 100 % strain is observed.

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