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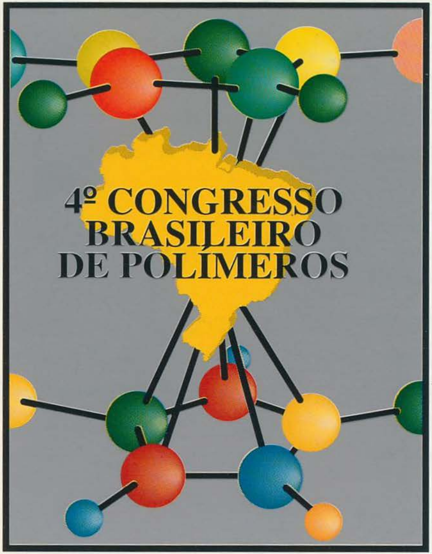

Promoção:

Associação Brasileira de Polímeros

CHARACTERIZATION OF TUBES OF OF HMWPE CROSSLINKED BY THERMAL ANALYSIS AND DYNAMICAL MECHANICAL TECHNIQUES

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1. Introduction

Polyethylene (PE) has been one of the most widely used thermoplastics, offering reasonably balanced economical and technological properties. However, its use is limited its low melting point, its solubility in hydrocarbons and its tendency to crack when stressed[1] Introducing crosslinks into the high molecular weight polyethylene (HMWPE) is known to mitigate these disvantages.

Samples of crosslinked high density polyethylene were characterized using the following thermal analysis techniques : TGA (Thermogravimetry Analysis), DSC (Differential Scanning Calorimetry), TMA (Thermomechanical Analysis), DMTA (Dynamic Mechanical Analysis).

Three samples with different gel percentages, an irradiated sample and one uncrosslinked sample were analysed.

2. Experimental

The samples studied were produced by reactive extrusion, in the form of tubes.

Chemical crosslinking was performed using 2,5-dimethyl-2,5-di(t-butylperoxy) hexyne-3 (Luperox 130, Wallace an Tieman GmbH). The liquid peroxide was mixed into the polymer powder prior to molding. Crosslinking in the solid state was performed on 3mm thick speciments kept in vacuum using γ radiation at a rate of 0,136 Mrad/hr[2].

The crosslinked polymer were characterized by determining their thermal degradation, linear expansion coefficients and α and δ transitions processes along the dimension axial (Y).

3. Results

A comparasion of the degradation resistence obtained for the uncrosslinked and crosslinked samples is shown in Figure 1. TGA analysis demonstrated that the irradiated materials exhibit a higher resistence for thermal degradation when compared with the PE samples crosslinked with peroxide.

The results of linear expansion coefficientes along the axial (Y) dimension were obtained by TMA standart techniques, Figure 2. It must be noticed that the samples for all crosslinked materials demonstrated partial shrinkage in the tangencial (X) and axial (Y) dimensions, during the first temperature scanning, whereas an expansion in the dimension Z, was observed. The expansion coefficients were determined in different temperatures during the first and second runs.

The DMTA enables the determination of the α and δ transitions processes, shown in Figure 3.

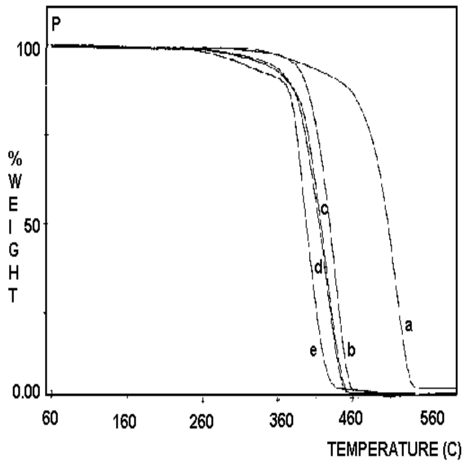

Fig. 1 Thermal Degradation of HMWPE (a) uncrosslinked; (b) irradiated; (c), (d), (e) crosslinked with peroxide, 78%, 70%, 55%.

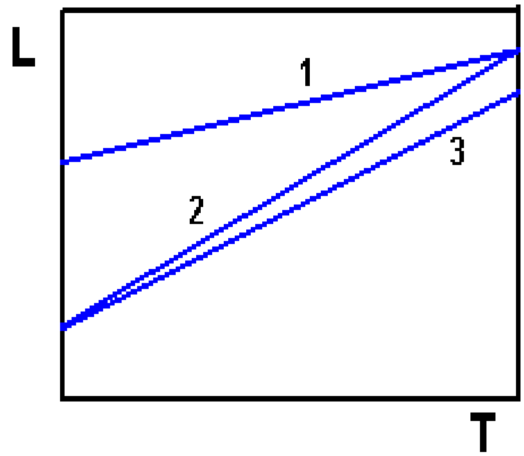

Fig. 2 Thermal mechanical behavior of HMWPE tubes along the axial dimension (Y).

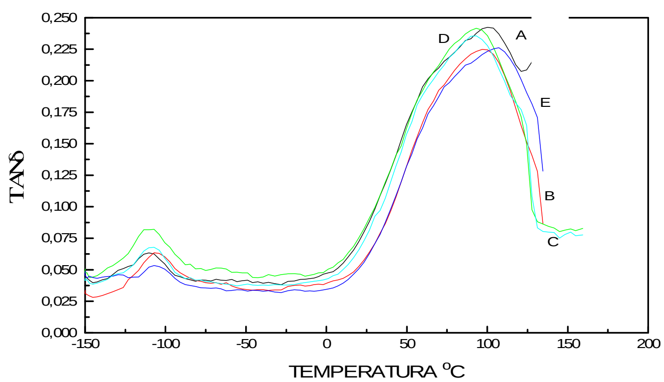

Fig 3. Dynamical mechanical behavior of HMWPE tubes along the axial dimension (Y). (A) uncrosslinked; (B) irradiated; (C), (D), (E) crosslinked with peroxide, 78%, 70%, 55%.

4.References

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