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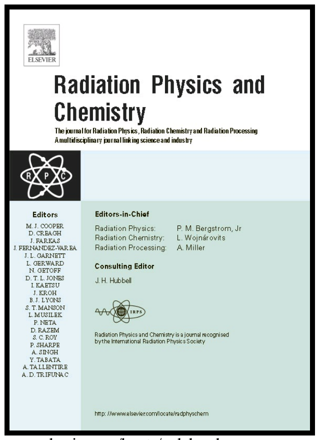

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Structural, Morphological and mechanical properties of gamma Irradiated Low density polyethylene/paraffin wax blends

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Abstract

The effect of gamma irradiation on the lattice structure, surface morphology, and mechanical properties was invested for LDPE/ paraffin wax blend films. Blends of LDPE/wax in content of 100/0, 98/2, 96/4, 94/6, 92/8, 90/10 and 85/15 (w/w) were prepared by melt-mixing at the temperature of 150°C and then irradiated by gamma irradiation. It was found that increasing the wax content more than 15% lead to phase separation. The effect of gamma radiation on the structure, surface morphology, and mechanical properties has been investigated using the X-ray diffraction, scanning electron microscope and mechanical tests. Both The blending and gamma irradiation process has an influence on the structure and consequently on the surface morphology of the samples. The values of lattice parameters were calculated. The grain size, inter chain distance and interplanar spacing decrease with increasing paraffin and increase with increasing gamma absorbed doses. While the dislocation density, the microstrain, and the distortion parameters increase with increasing paraffin wax content and decreases with increasing gamma absorbed doses. The obtained values from X-ray indicates that notable changes of the atomic lattice structure for both unirradiated and irradiated blends, which also confirmed by studying the surface morphology of all blends. It was found that an increase in wax content induces a linear decrease in tensile strength; elongation at break, Young's modulus, and hardness. A linear increase of these mechanical parameters was observed with increasing gamma absorbed dose. The final results show the reliability of gamma radiation as a practical method for the control of long-term properties.

Keyword, LDPE/paraffin wax blend, X-ray diffraction, lattice parameters, scanning electron microscope, mechanical tests, gamma radiation

1. Introduction

Blending of polymers has long been applied as a technique to modulate their physical properties. Polymer blends are polymeric systems created by the physical mixing of two or more polymers and/or copolymers without an advanced degree of chemical reactions between them [1]. To be considered a blend, the compounds should have a minimum