ELABORATION AND CHARACTERIZATION OF EVA/SILICA NANOMPOSITE FILMS WITH IMPROVED MECHANICAL AND WATER BARRIER PROPERTIES

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Abstract

There has been growing attention for the use of polymer films, such as poly(ethylene-co-vinyl acetate) (EVA), in the separation industry and food packaging due to their potential energy saving capacity. Moreover, various researchers have explored the possibility of using organic-inorganic hybrid materials for many applications due to their extraordinary properties arising from the synergizing effect of both components. In the present study, the hybrid nanocomposites based on EVA films (~130 μm) and silica nanospheres (Aerosil® 90, ~20 nm) were elaborated by the solution-casting method. The silica concentration (A90) was varied from 5 to 50 wt.%. The results of SEM and EDX measurements revealed the homogeneous distribution of silica fillers in the EVA matrix for A90 < 37.5 wt.%. In addition, the TGA measurements confirmed well the silica filler content. The obtained results also showed the increase of the mechanical properties (apparent Young's modulus) with A90 increase - from ~3 MPa for EVA up to ~ 180 MPa for EVA with 37.5 wt.% of silica. The lower water permeability coefficient (P) for the hybrid nanocomposite (~ 8350 Barrer) compared to that for neat EVA (~ 16100 Barrer) was attributed to the effect of tortuosity generated by the silica dispersion. The correlation between the water transport properties of the EVA/silica nanocomposite films and their structure was established. One can conclude that the silica addition into EVA improved the hardness and water barrier properties of the hybrid nanocomposites.

Keywords: Hybride material, transport properties, dispersion of fillers, tortuosity

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