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ANALYSIS OF THE MECHANICAL PROPERTIES AND EFFECTIVE DIFFUSION COEFFICIENT UNDER STATIC CREEP LOADING OF LOW-DENSITY FOAMS BASED ON POLYETHYLENE/CLAYS NANOCOMPOSITES

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Abstract

In several applications, cellular materials are required to be subjected to static loads that could affect their properties due to the plastic deformation and the gas diffusion from the cells. In this work, the gas diffusion behavior under static creep loading has been determined in low-density cellular materials based on polyethylene and different contents of clays and coupling agent. To understand the role played by these components in the barrier properties, an analysis of the properties of both solid and foamed formulations has been performed including, thermal properties, clays morphology, density and cellular structure. Tensile and compression mechanical properties have also been analyzed. When adding clays the polymer crystallinity increases and the polymer degradation window is broadened. The addition of clays does not have a significant effect on the density and structure of the foamed materials. Both, tensile and compression properties improved by the addition of clays. Mechanical properties in compression are also influenced by the coupling agent content. Regarding the effective diffusion coefficients, lower reductions than those expected by the addition of clays are obtained. This result could be explained considering a poor adhesion between the clays and the polymer. It has also been found that the highest reductions in diffusivity are obtained when increasing the coupling agent content.

Key words

A. Foams; A. Polymer-matrix composites (PMCs); B. Creep; Gas diffusion