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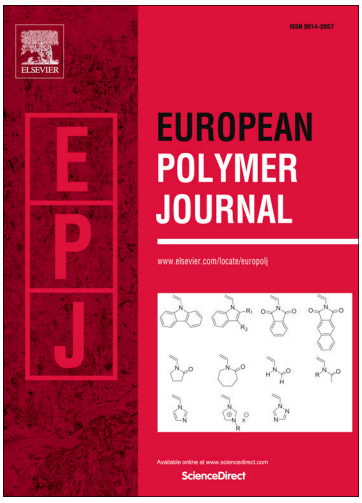

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Evaluation of the thermal conductivity and mechanical properties of water blown polyurethane rigid foams reinforced with carbon nanofibers

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KEYWORD

Polyurethane foam, carbon nanofibers, thermal conductivity, compression test

ABSTRACT

This article studies the effect of carbon nanofibers (CNFs) on the morphological, thermal and mechanical properties of water-blown rigid polyurethane (PUR) foams with densities in the range of 55 to 60 kg/m^3. Different amounts of CNF have been used, 0.1, 0.2, 0.3 and 0.4 wt.%. CNFs are located in the struts and produce minor modifications on open cell content, cell size, cell size distribution and anisotropy ratio of the foams. The contributions of the heat conduction mechanisms have been quantified by measuring the extinction coefficient and by modelling the thermal conductivity. The inclusion of CNFs reduces the radiative contribution by increasing the extinction coefficient and increases the conduction through the solid phase mainly due to an increase in density and an increase of the conductivity of the polymeric matrix. Due to this, a clear reduction of the heat flow by radiation and a reduction of the total thermal conductivity is achieved with only 0.1 wt.% of CNFs. Moreover, the addition of this low amount of CNF allows maintaining the mechanical properties of the foams.

1. Introduction

One of the most important classes of specialty polymers are polyurethanes (PUs) [1]. They are composed by urethanes-linking moieties, obtained by the polyaddition of polyisocyanates to

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