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Plasma modification of polypropylene microparticles for use as a polar compatibilizer in polymer/clay nanocomposites

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We have developed a new type of polypropylene-based polar compatibilizer by plasma treatment of microparticles of this polymer, which can be used as an additive in inmiscible polymer blends and composites. The case of polypropylene/clay nanocomposites require the addition of compatibilizer agents to increase the affinity of the matrix with the inorganic nanoparticles, but the common compatibilizers have lower molecular weights and crystallinity than the matrix affecting the properties of the nanocomposites. With our method we have prepared a polar compatibilizer perfectly compatible with the matrix, without reduction of the molecular weight, and with the necessary polar functionalization to promote the interfacial interactions polypropylene-nanoclay. In addition, the plasma prepared compatibilizer exhibits higher thermal stability and higher modulus than the original polypropylene material.
The plasma modified microparticles have been characterized by x-ray absorption near-edge spectroscopy (XANES) and electron paramagnetic resonance (EPR) to study in detail the chemical modification taking place at the surface region. In addition, more conventional techniques were used to study the overall composition of the modified microparticles, the particle shape, and the thermal stability of the modified polymer.
The modified polypropylene microparticles were melt-processed to produce polymer films and polymer nanocomposite films with embedded clay nanoparticles. The influence of the particle modification on the final morphology of the nanocomposites was studied by scanning transmission x-ray microscopy (STXM), a XANES spectromicroscopy [1]. The thermal and mechanical properties of these nanocomposite films were also studied.
[1] Z. Martin, I. Jiménez, M. A. Gómez-Fatou, M. West, A. P. Hitchcock, Macromolecules 44, 2179-2189 (2011).

Keywords
polypropylene
powder
nanocomposite
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