

Crystallographic arrangement of clay/polymer nanocomposites

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Clay/polymer nanocomposites (CPN) exhibit enhanced physical properties compared to the neat polymer which make them suitable for sophisticated industrial applications (Kojima et al., 1995; Wang et al., 2004). The improvement of mechanical, thermal and barrier properties of CPN, among others, has been related to the close interaction between the clay particles at low filler loadings (typically 5 wt.%) and the polymer matrix. In polyamide-6 (PA6) systems, certain nanoclays (e.g. montmorillonite) induce the nucleation of the thermodynamically less stable polyamide-6 γ phase (Fornes et al., 2002; Yebra-Rodríguez et al., 2009). The aim of this work is to study the crystallographic arrangement of two different clay minerals (montmorillonite and sepiolite) in PA6 matrix. For this purpose injection molded neat PA6 (nPA6 samples), PA6/Montmorillonite (PA6/Mt samples) and PA6/sepiolite (PA6/S samples) nanocomposites with 5 wt.% loading were manufactured (BABYPLAST 6/10, CRONOPLAST). Tensile analyses (UNE-EN ISO 527-1:1993 and UNE-EN ISO 527-2:1993 standard procedures, Universal Testing Machine MTS InsightTM) were carried out to determine mechanical properties. X-Ray diffraction (SC-XRD Smart APEX D-8 Bruker, Karlsruhe, Germany) and Raman spectrometry (Renishaw in Via Reflex) were used to determine the crystal phase and orientation of PA6 crystals. Differential Scanning Calorimetry (DSC 822e, Mettler Toledo) was used to determine the crystallinity of the samples. Higher tensile strength and stiffness and reduction of the strain to failure are observed in the nanocomposites compared to pure PA6. The observed increase in tensile strength is lower in PA6/S samples than that obtained by other authors in the same PA6/Mt systems (Uribe-Arocha et al., 2003), which is related to the unusual crystallographic organization of the polymer and the sepiolite in the PA6/S nanocomposites.

References

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