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Properties Study of Polypropylene/Graphite Nanosheets Nanocomposites by *In Situ* Polymerization

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Extended Abstract

Isotactic polypropylene (i-PP) has good thermal, mechanical and physical properties when used at ambient temperature. However, its range of applicability and their properties can be further increased when combined with other materials such as nanofillers (Mazrouaa, 2012). A nanofiller that has gained prominence in recent years is the graphite and its derivatives (Milani et al., 2013). Due to the excellent electrical, mechanical and thermal properties presented by graphene or graphite nanosheets (GNS) when well dispersed in the polymer, these nanofillers can transform i-PP in an electrically semi-conductive material with enhanced rigidity and heat resistance (Singh et al., 2011).

This present work pretends to make a detailed study of the properties of polypropylene nanocomposites with graphite nanosheets (GNS) obtained by *in situ* polymerization.

Isotactic polypropylene/graphite nanosheets nanocomposites have been successfully synthesized by *in situ* polymerization using a metallocene catalyst. Crystallization is moved to higher temperatures as GNS content increases due to its effect as nucleating agent. GNS incorporation also improves thermal stability and a shift of more than 20 °C is found in the degradation temperature.

XRD profiles show an almost complete exfoliation of graphite in nanocomposites with the smallest graphene amounts. TEM images confirm this assumption, allowing to observe a good GNS dispersion within the polymeric matrix.

Nanocomposites show a continuous increase of Young's modulus (up to 50 %) and a rise of tensile strength (up to 30 %). Dynamic mechanical properties corroborate the GNS reinforcement effect within PP, which is seen to be more important once glass transition is overcome. Nanocomposites do also exhibit a superior dimensional stability than PP.

Impedance measurements prove that the polymer conductivity increases 10^{12} times, the iPP being transformed from an isolating polymer to a semiconductor material. The percolation threshold is found at 3 vol.%. This value is higher than others reported in literature using melt mixing methods. This is, probably due to the fact that the *situ* polymerization favors the growth of polymeric chains around GNS facilitating their overall dispersion but hindering a more efficient interparticle contact.

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