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“IN-SITU” GENERATION OF ALUMINUM NANOPARTICLES IN A PP MATRIX

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Polymer nanocomposites have drawn considerable attention in recent years due to its unique properties. The inclusion of inorganic solid nanoparticles with huge surface area (typically in form of fibres, flakes, spheres or fine particles) leads to remarkable changes in physical and mechanical macroscopic properties. Even though a lot of work has been done to obtain inorganic particles homogeneous dispersed in a polymeric matrix, it still a very difficult task, due to the tendency of inorganic particles to form agglomerates. This can be associated with the hydrophilic nanoparticles and the hydrophobic polymers that are not compatible in nature, and consequently results in poor interfacial bonding. All of these deficiencies limit the effective use of inorganic nanoparticles in polymer nanocomposites. The core of the problem lays on how to well distribute nanoparticles over a polymeric matrix and how to improve nanoparticles/polymer interaction. Many approaches have been proposed to overcome these difficulties, including coupling agents, grafting modification and sol-gel reactions. In the last case a nanocomposite can be formed via hydrolysis-condensation reactions of the metal alkoxides in polymeric matrix.

The present work aims to generate aluminum nanoparticles in a polypropylene (PP) matrix. The inorganic nanoparticles were obtained by a sol-gel process in melt, using PP modified with maleic anhydride (PP-g-MA) and an aluminum alkoxide precursor. Chemical, morphological and rheological characterization was performed.

FTIR results showed that Al-O bonds were formed as a result of chemical reaction between MA groups and aluminum precursor, moreover the spectrum confirmed the formation of Al-OH group. The rheological behavior evidences the formation of a branched/crosslinking structure.

Morphological observations by EDX and TEM confirmed the presence of Al nanoparticles dispersed in the polymer matrix, with diameter between 200 and 100 nm.

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