EFFECT OF MODIFICATON ON THE PROPERTIES OF LAYER SILICATE/POLYMER NANOSTRUCTURED COMPOSITES

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Polymer clay nanocomposites are a new class of materials which show improved properties at very low loading levels compared with conventional filler composites. Among these improved properties are mechanical, dimensional, permeability, thermal stability and flame retardant enhancements with respect to the bulk polymer [1]. In order to obtain good interfacial adhesion and mechanical properties the hydrophilic clay needs to be modified prior to introduction in most polymer matrices which are organophilic. Clay modification is generally achieved by ion exchange reactions of organophilic cations for sodium ions [2,3], and the polymer-clay nanocomposites may be obtained mainly by three methods: intercalation of a suitable monomer followed by polymerization [4,5], polymer intercalation from solution [6], and direct polymer melt intercalation [7].

Nanocomposites materials have attracted great interest because the nanoclays can reinforce almost all types of polymer matrices with similar properties to the traditional composites but less weight and better processability. Most of the previous works on the preparation and characterization of polymer-layered nanocomposites used commercial modified layered silicate (LS). However there are a few papers dealing with the modification process in order to improve the quality of the nanoclays to produce nanocomposites with

enhanced properties. The majority of the LS are treated with several organic onium bases to reinforce clays-polymers materials. Most of the modification processes on LS use around 2-5% weight of solids in order to diminish the viscosity to get a more homogenous solid solution. Isomorphic substitution within the layers generates a negative charge, defined through the cation-exchange capacities (CEC). This excess negative charge is balanced by cations (Li^+, Na^+, Ca^+) which exist hydrated in the interlayer. To render nanoclays miscible with polymers one must exchange the alkali counterions with cationic surfactants, such as alkylamoniums. Although an excess of surfactants is normally used to complete the interchange reaction, the properties of the final nanocomposite can diminish and, therefore, several drying processes in hot water or water/alcohol mixing must be realized.

The aim of this study is to investigate the effect of the modification process of the LS on the morphology and mechanical properties of a Polyamide-6 nanocomposite. A series of different parameters have been controlled during the clay modification in a bid to reduce cost attempting to achieve a nanocomposite with optimal properties. Thus, a bentonite directly obtained from the deposit has been used to be modified and the mechanical properties of the PA6 nanocomposites produced were studied.

TEM analysis of the layer silicate reveals that the organic modication not only intercallate into the galleries. There is an interaction of the modificant on the face and edge regions of the silicate layer. The characterictics of the nanoclays were correlated with the properties of the nanocomposite by TGA and TEM.

References

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