11th International Conference
on Advanced Materials

ICAM2009

Rio de Janeiro Brazil
September 20 - 25

Polypropylene-Fatty Acid Functionalized Anionic Clay Nanocomposites: Synthesis and Characterization

R. F. da Silva(1)*, R. K. Donato(1), R. Guzatto(2), C. C. Moro(3), D. Samios(2) and H. S. Schrekker(1)

(1) LTPC, Universidade Federal do Rio Grande do Sul, e-mail: renato.figueira@ufrgs.br
(2) LINDIM, Universidade Federal do Rio Grande do Sul, CEP 91501-970, Porto Alegre, RS, Brazil
(3) Institute of Chemistry, Universidade Federal do Rio Grande do Sul, CEP 91501-970, Porto Alegre, RS, Brazil
* Corresponding author.

Abstract – Polypropylene-Fatty acid functionalized anionic clay nanocomposites have been prepared by melt blending. Sodium oleate was used to modify the Mg-Al based hydrotalcite, which resulted in an increased interlamellar distance of 1.77 nm. Various techniques were used to characterize the nanocomposites, including TEM, XRD, TGA, SAXS, DSC and DMA. A good dispersion of the oleate modified anionic clay was observed within the polypropylene matrix, together with partial exfoliation. Incorporation of the modified clay increased both the polypropylene crystallinity and stiffness. Furthermore, the thermal resistance to decomposition increased, and the glass transition temperature decreased.

Polymeric nanocomposites based on inorganic nanofillers have attracted intensive academic and industrial interest. The addition of small quantities of inorganic nanofillers, such as clays, can significantly increase the properties of polymer matrices [1]. One of the most important factors for acquiring these advanced properties is related to the degree of clay dispersion in the polymer matrix, which is difficult to achieve due to the incompatibility between the apolar polymer matrix and the polar clay. A good strategy to increase the interaction between the polymer matrix and the clay is the functionalization of the polar clay surface with apolar organic groups [2].

In this study, sodium oleate was used to modify the Mg-Al based hydrotalcite, which resulted in an increased interlamellar distance of 1.77 nm (Fig. 1). Polypropylene-Fatty acid functionalized anionic clay nanocomposites have been prepared by melt blending using the oleate modified anionic clay, and a pre-heated (180 °C) twin rollers mill (Haake Rheomix 600) at 60 rpm. Isotactic polypropylene was previously molten during 5 min, followed by addition of the organofunctionalized clay (0.75 or 1.5 wt.-%, not including the mass of organic oleate). The mixtures were heated for another 5 min at 180 °C. The polymeric nanocomposites were characterized by TEM, XRD, TGA, SAXS, DSC and DMA.

The TEM study showed a good dispersion of the oleate modified clay in the polypropylene nanocomposite with 1.5 wt.-% of clay, and the micrograph shown in Fig. 2 indicates that partial exfoliation occurred during its preparation. XRD analysis showed an increase in the values of the intensity of the different polypropylene crystal planes, indicating that a strong change in the polypropylene crystallinity occurred as a result of the nanometric filler. The stiffness of the nanocomposites was studied by dynamic-mechanical analysis, which was increased in comparison to pure polymer. The results related to the thermal properties of the nanocomposites showed an increase in resistance to thermal decomposition and a decrease in the glass transition temperature. In conclusion, these results demonstrate that this technology can be used for the preparation of polymeric nanocomposites with differentiated properties, using low contents of modified clay.

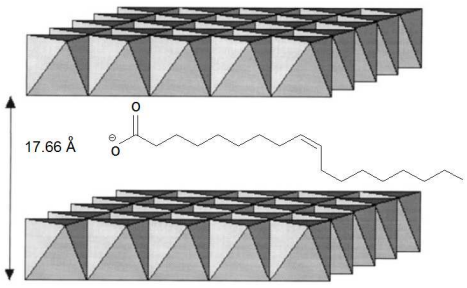

Figure 1: Representation of the oleate modified anionic clay.

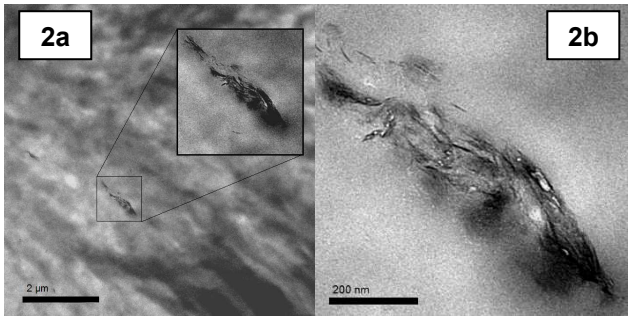

Figure 2: TEM micrograph of the nanocomposite with 1.5 wt.-% of clay. **a**) scale bar = 2 μm and **b)** scale bar = 200 nm.

[1] K.H. Höchstötter, G.T. Lim, and V. Altstädt, Composites Science and Technology 69 (2009) 330-334.
[2] F. Leroux, A. Illaik, and V. Verney, Journal of Colloid and Interface Science 332 (2009) 327-335.