

On-line optical monitoring of the crystallization of PA6 / MMT nanocomposite during injection molding

Beatrice Cesar Augusto Gonçalves, Bonel Alan Baio, Favaro Márcia Maria, Branciforti Márcia Cristina, Bretas Rosario Elida Suman

This work had as main objective to monitor the non-isothermal crystallization of PA6 and a nanocomposite with 5 wt% of montmorillonite, during the injection molding process, using an optical device, inserted in the cavity wall of the mold. This system is based on the optical properties changes of the materials during their crystallization process. The nanocomposite was produced in a twin-screw extruder using a low dispersive screw profile. Transmission electron microscopy and wide-angle x-ray scattering indicated that an exfoliated structure was obtained for this material. The morphologies of the samples were studied by polarized light optical microscopy, analyzing the thicknesses of the "skin", the transition layer and the size of the spherulites of the "nucleus". Resultant morphologies of the injected samples were also analyzed observing the influence of the following process parameters: mold temperature, packing pressure and flow rate, besides the presence of the lamellar nanoclay. These morphologies were correlated with the curves of intensity of light versus time obtained from the optical system. A non-isothermal crystallization study of these materials in a heating rheological stage was also done using the same microscope. The following parameters were modified in this study: cooling rate, temperature of crystallization and shear rate values during crystallization. As a result, the induction time and the global time of crystallization for each set of parameters were measured. It was concluded that the optical device was extremely sensible to the presence of the nanoclay and to the injection parameters. The induction time and the global time of crystallization were influenced by the conditions of crystallization.