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Room: Fez 1

MICROSTRUCTURE OF THE PS / ORGANOCLAY NANOCOMPOSITES: INJECTION MOLDING VERSUS UNIAXIAL HOT PRESSING

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When inorganic nanoparticles are mixed with polymer matrices, a material with unique and fascinating properties can be obtained. The nanoparticle filled polymers can present tremendous improvement in many physical and engineering properties, mainly when compared to the pure polymer or conventional composites. These composites present the advantages of organic materials, such as flexibility and easy moldability, and of inorganic materials, such as high strength and heat stability [1]. The nanoparticles that have been most studied in polymer nanocomposites are the clays, mostly the ones of smectite group [2].

In this work, nanocomposites of Polystyrene (PS) and commercial smectitic organoclay (Cloisite 20A) were obtained by melt intercalation method. After drying, the clay was diluted into an organic solvent suspension. The clay / polymer mixture was prepared adding the organoclay into the molten polymer, using an internal mixer. Then, the composites were molded by two different methods: uniaxial hot pressing and injection molding. The microstructure of the nanocomposites was characterized by X-ray diffraction (XRD), small angle X-ray scattering (SAXS), transmission electron microscopy (TEM), optical microscopy, and small amplitude oscillatory shear (SAOS) tests.

The X-ray patterns of the nanocomposites showed increase in the basal spacing of the organoclays when compared to the ones for the clays without polymer addition. TEM and Optical images suggested intercalation or even some exfoliation of the clay platelets in the polymeric matrix. In particular, the injection molded composites exhibited a better dispersion of the clay particles in the matrix than the press-molded samples. The rheological properties of the composites confirmed the morphological results; it is observed an increase of the elasticity at small frequencies for injection molded nanocomposites. The storage and loss moduli for the injection molded materials presented a deviation from the terminal behavior, resulting in the presence of a plateau at low frequencies. The SAXS patterns of the injected composites showed preferential alignments of the clay platelets, according to their location in the injection machine mold.

1. Utracki L. A. (2004). Clay-Containing Polymeric Nanocomposites, 1st Ed., Rapra Technology Limited: Shawbury, Shrewsbury, Shropshire, Vol. 1, p. 507.
2. Alexandre, M.; Dubois, Ph., (2000) P. Mat. Sci. Eng., 28, 1-63.