

MELTING BEHAVIOR OF POLYPROPYLENE NANOCOMPOSITES: X-RAY DIFFRACTION VERSUS DIFFERENTIAL SCANNING CALORIMETRY

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In this work structural details of polymeric composites produced by melt intercalation of polypropylene and layered silicates have been studied at process-related temperatures (ranging from 25 to 200°C). The investigated materials included pure polypropylene, an unmodified and an organically modified montmorillonite (OMMT), a master batch (polypropylene filled with 20 wt% OMMT) and a dilute nano-composite (5 wt% OMMT). For determining the long period of polypropylene and the interlayer distance of the silicate platelets, small angle X-ray scattering (SAXS) was used. Wide angle X-ray diffraction (WAXD) was used to determine the degree of crystallization and the crystal lattice.

The degree of crystallinity determined by WAXD and by differential scanning calorimetry (DSC) had the same characteristics during the heating and cooling. However the temperature dependence of the long period under heating conditions was expected due to DSC literature [1].

At process-related temperatures, the gap distance in the pure OMMT was significantly larger than at room temperature and, therefore, the attracting forces between clay platelets were reduced, which helps dissipating the nanofiller in the polymeric matrix. Whereas the interlayer distance of the fillers in both reinforced polymers rapidly decreased at the melting temperature.

By combining the results from both types of experiments, it was possible to gain knowledge about the melt intercalation of layered silicates reinforced polypropylene. It was also possible to assign energy-related parameters to structural details.

[1] G. W. Ehrenstein, G. Riedel and P. Trawiel, Praxis der Thermischen Analyse von Kunststoffen, Carl Hanser Verlag (2003).