

INFLUENCE OF THE MORPHOLOGY ON MELTING KINETICS OF NANOCOMPOSITES

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S u m m a r y

Specimens of a pure polyamide 6 (PA6) homopolymer and a number of commercial polymer nanocomposites (PNCs) containing up to 7.5 wt.% of exfoliated organoclay nanoparticles fabricated by crystallizing them under non-isothermal conditions have been studied at room temperature by the wide- and small-angle X-ray scattering (WAXS and SAXS) methods. The melting behavior of the specimens has also been studied making use of temperature-modulated differential scanning calorimetry (TMDSC) at three underlying heating rates and five modulation frequencies. The α - and γ -modifications of PA6 crystals were found to be independently formed from the melt during its cooling, with their content ratio (α/γ) tending to grow as the organoclay content or the cooling rate becomes higher. Organoclay platelets strongly scattered in the PNC were demonstrated to become spatially ordered into two different fractal-like structures (mass fractals) with the characteristic structural scales of 5–14 and 14–100 nm. The melting endotherm profiles for pure PA6 and a PNC were found to be described by a simple Debye's model with a single corresponding characteristic time dependent on the temperature and the underlying cooling rate. The mechanisms of structural rearrangements in the melting intervals of pure PA6 and a PNC turned out practically identical. However, the spatial scale of such rearrangements in the PNC proved to be significantly smaller, owing to the presence of considerable steric constraints imposed by the infinite cluster of nanoparticles onto the mobility of PA6 chains in the melt.