

Nucleating Agent Assisted Dispersion of POSS in PP: Properties of Nanocomposite Fibers and Films

Roy Sayantan, Lee Byoung J., Jana Sadhan C.

The study developed fundamental understanding of nanocomposite formation by “bottom-up” self-assembly of inorganic-organic hybrid molecules (POSS) in polypropylene (PP) matrix. A nucleating agent compatible with POSS was used to promote dispersion of POSS molecules and to provide templates for self-assembly of POSS molecules into spherical nanoparticles of 25-200 nm diameter. Typical formulations containing 0.3-0.7 wt% nucleating agent and 0-30 wt% POSS were spun into fibers and converted into films and their mechanical properties studied. It was found from the mechanical properties of spun fibers that optimum mechanical properties resulted with 10 wt% POSS. Microscopic POSS particles formed at POSS concentration higher than 10 wt%. The optimum formulation resulted in a 50% reduction in fiber diameter, 70% increase in tensile modulus, and 30% increase in tensile strength compared to unfilled PP. The interactions between POSS and nucleating agents were studied using infra-red spectroscopy, differential scanning calorimetry, and oscillatory shear rheology. It was found that fibrillation of nucleating agent was subdued due to hydrogen bonding interactions with POSS.