Abstract

Polypropylene (PP) exhibits good heat resistance, stiffness, low density, good chemical stability and easy to process, etc, and is widely used in injection molding, film, fiber, blow molding, extrusion, etc, covers a lot of industrial , agricultural and daily applications. However, the biggest shortcoming of PP is its poor toughness and sensitive to notches, which is especially egregious at low temperatures or at high strain rate. So, how to enhance the toughness of PP has been the subject of much attention.

In this work, we attempt to improve the toughness of PP through the combination of elastomer and carbon nanotubes. The carbon nanotubes (CNTs) are added into ethylene vinyl acetate (EVA) to prepare the master batch, then a certain content of master batch is melt blended with polypropylene and EVA to prepare PP/EVA/CNTs ternary composites with desirable properties. A lot of studies on the mechanical properties, morphologies and crystallization behaviors of the ternary composites have been carried out.

It is discovered that, the toughness of the blends increases with the increase of EVA content and displays an obvious brittle-ductile transition in impact strength when the EVA content increases up to 40 wt%. The SEM results show that the EVA phase is sea-island phase morphology and the presence of the CNTs has little effect on the toughness when EVA content is below 40 wt%. When the EVA content increases up to 40 wt%, the composites change from sea-island to co-continuous phase morphology. Compared with the morphologies of PP/EVA, the incorporation of 1.0 wt% CNTs significantly speeds up such phase transition. An analysis of the morphologies of the impact-fractured surfaces suggests that the yilding and fibrillation of EVA is the main mechanism for energy absorption during the impact process. On the other hand, the addition of the functionalized CNTs could most efficiently toughen the composite, the impact strength increases by nearly 4 times, due to the enhanced miscibility between EVA and CTNs and the improved distribution of CNTs in EVA. The study of the crystallization behavior shows that the EVA induces β-phase PP formation during the isothermal crystallization process. However, in the ternary composites, the crystallization of PP is mainly controlled by CNTs and only α-phase PP with smaller spherulites diameters can be induced Further results based on the morphologies of CNTs in ternary composites show that CNTs are mainly dispersed in EVA phase and in the interface of PP/EVA, indicating the double effects of controlling the elastomer

morphologies and affecting the crystallization behavior of PP.