Effect of SEBS on the Mechanical Properties and Miscibility of Polystyrene Rich Polystyrene/ Polypropylene Blends

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ABSTRACT

Blends of polystyrene (PS) with polypropylene (PP) are usually developed to overcome the inherent brittleness of PS. However, PS with PP are immiscible and (in the absence of a compatibiliser) incompatible. The present study investigated the effects of styrene-b (ethylene-co-butylene)-b-styrene (SEBS) on the mechanical properties and compatibility of PS-rich PS/PP blends. Using a Brabender PL2000 twin-screw extruder, blends of PS/PP in various compositions ranging from 100-60 wt% PS with and without SEBS were prepared and injection moulded. The overall results clearly showed that the mechanical properties of PS/PP blends are dependent on blend composition (ratio of PS/PP) and SEBS content. The impact strength and elongation at break of the PS/PP blends increase with SEBS content, at the expense of tensile strength and flexural modulus. The improvements in impact strength and elongation at break with the addition of SEBS are due to the improved interfacial adhesion between the dispersed phase (PP) and matrix phase (PS).

The improvement in miscibility of the PS/PP blend with the addition of SEBS is supported by DMA analysis. This showed that the 60/40 PS/PP blends possess two endothermic peaks whereas 60/40/25 PS/PP/SEBS blends have a single endothermic peak at 102 °C, indicating that they have an improved miscibility.

The effectiveness of SEBS in enhancing the blends depends on the blend composition. A significant improvement was observed upon addition of more than 10 phr of SEBS into the 70/30 and 60/40 PS/PP blends, but not much improvement

in the case of the 90/10 and 80/20 PS/PP blends. However, a higher SEBS content is more effective at higher PS contents, as illustrated by the 90/10/25 PS/PP/SEBS blends having higher impact strengths than 60/40/25 PS/PP/SEBS. The optimum blend, based on achieving a balance between toughness (impact strength) and stiffness (flexural modulus), is 90/10/25 PS/PP/SEBS, followed by 80/20/25 PS/PP/SEBS.