

Thermo-Mechanical Properties of PBI Fiber Reinforced HDPE Composites: Effect of Fiber Length and Composition

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Abstract : High density polyethylene (HDPE) and poly benzimidazole fiber (PBI) composites were prepared by melt blending in a twin screw extruder (TSE). The thermo-mechanical properties of PBI fiber reinforced HDPE composite samples (1%, 4% and 8% fiber content) of fiber lengths 3 mm and 6 mm were investigated using differential scanning calorimeter (DSC), universal testing machine (UTM), rheometer and scanning electron microscopy (SEM). The effect of fiber content and fiber lengths on the thermo-mechanical properties of the HDPE-PBI composites was studied. The DSC analysis showed decrease in crystallinity of HDPE-PBI composites with the increase of fiber loading. Maximum decrease observed was 12% at 8% fiber length. The thermal stability was found to increase with the addition of fiber. T50% was notably increased to 40oC for both grades of HDPE using 8% of fiber content. The mechanical properties were not much affected by the increase in fiber content. The optimum value of tensile strength was achieved using 4% fiber content and slight increase of 9% in tensile strength was observed. No noticeable change was observed in flexural strength. In rheology study, the complex viscosities of HDPE-PBI composites were higher than the HDPE matrix and substantially increased with even minimum increase of PBI fiber loading i.e. 1%. We found that the addition of the PBI fiber resulted in a modest improvement in the thermal stability and mechanical properties of the prepared composites.

Keywords : PBI fiber, high density polyethylene, composites, melt blending

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