Mechanical and thermal properties of calcium carbonate-filled PP/LLDPE composite

Abstract:

Polymer blends typically are the most economical means to develop new resins for specific applications with the best cost/performance balance. In this paper, the mechanical properties, melting, glass transition, and crystallization behavoir of 80 phr polypropylene (PP) with varying weights of linear low density polyethylene (LLDPE) at 10, 20/ 20 wt % CaCO3, 30, 40, and 50 phr were studied. A variety of physical properties such as tensile strength, impact strength, and flexural strength of these blends were evaluated. The compatibility of these composite was examined by differential scanning calorimetry (DSC) to estimate Tm and Tc, and by dynamic mechanical analysis (DMA) to estimate Tg. The fractographic analysis of these blends was examined by scanning electron microscopy (SEM). It has been confirmed that increasing the LLDPE content trends to decreases the tensile strength and flexural strength. However, increasing the LLDPE content led to increases in the impact strength of PP/LLDPE blends. It was also found that up to 40 phr the corresponding melting point (Tm) was not effected with increasing LLDPE content. Each compound has more than one Tg, which was informed that there is a brittle-ductile transition in fracture nature of these blends, the amount of material plastically deformed on the failure surface seems to increase with the increasing the LLDPE content. And PP/LLDPE blends at temperature (23°C) showed a ductile fracture mode characterized by the co-existence of a shear yielding process; whereas at lower temperature (-20°C) the fractured surfaces of specimens appear completely brittle. The specimens broke into two pieces with no evidence of stress whitening, permanent macroscopic deformation or yielding.