Enhanced flame retardancy, thermal and mechanical properties of hybrid magnesium hydroxide/montmorillonite reinforced polyamide 6/polypropylene nanocomposites

ABSTRACT

In this study, the effects of hybrid magnesium hydroxide/montmorillonite (MH/MMT) on the flame retardancy, thermal, mechanical, morphological and thermo-mechanical properties of polyamide 6/polypropylene (PA6/PP) nanocomposites prepared by melt blending technique were investigated. The partial replacement of MH with MMT (2 and 4 wt%) was done at total filler content of 30 wt% and maleated polypropylene was used as compatibilizer. Mass loss calorimeter analysis revealed that the peak heat release rate and total heat evolved values reduced in the presence of MMT due to the formation of the protective surface and insulation layer by MMT within the MgO layer formed on the surface upon combustion. The char residue also strengthened by migration of MMT layers to the surface of char. The thermal stability and flame retardancy of PA6/PP/MH/MMT nanocomposites improved with increasing MMT content. The MMT layers were well dispersed in the nanocomposites. The stiffness and toughness of PA6/PP/MH nanocomposites increased while the strength maintained with incorporation of MMT. The degree of crystallinity of both PA6 and PP increased with the addition of MMT while the melting point remained unaltered. The synergistic combination of MH and MMT has indeed maintained the mechanical properties of nanocomposites while further improving the flame retardancy.

Keyword: Polyamide 6/polypropylene; Magnesium hydroxide; Montmorillonite; Flame retardancy; Nanocomposites