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ABSTRACT:

Polymers with highly effective flame retardancy and optimal mechanical properties remain difficult to achieve. In this study, polyamide 6(PA6)/clay nanocomposites with excellent flame retardancy and mechanical properties were prepared through melt compounding of PA6 and a novel salt of phosphinic acid, namely, aluminum diisobutylphosphinate (ABPA), combined with organically modified layered montmorillonite (OMMT). The dispersion of ABPA and OMMT in the flame retardant composites was characterized by X-ray diffraction, transmission electron microscopy, and viscoelastic measurements. The flame retardancy and thermal degradation behavior of PA6/ABPA and PA6/OMMT/ABPA composites were investigated by limiting oxygen index (LOI) assessment, UL94 testing, cone calorimetry, and thermogravimetric analyses. The morphologies and chemical compositions of the char residue were determined by scanning electron microscopy–energy-dispersive X-ray spectroscopy, and Fourier transform infrared spectroscopy analyses. Results demonstrated that the ratio of ABPA and OMMT at a constant total flame retardant level of 12 wt% considerably influenced the thermal stability, flame retardancy, and mechanical properties of the resulting PA6 nanocomposites. When ABPA was introduced solely at a loading amount of 12 wt%, the specimens passed the UL-94 V-0 flammability rating, and the LOI reached 34.8%. When OMMT (ABPA: OMMT 5:1, 12 wt% in total) was incorporated into the ABPA/PA6 composites, the samples passed the UL-94 V-0 flammability rating, and the LOI reached 36.0%. The samples successfully passed the UL-94 V-0 flammability rating when incorporated with OMMT as high as 6 wt.% (ABPA: OMMT 1:1, 12 wt.% in total; considerable decrease in ABPA loading). The cone test results revealed that the