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SYNERGISTIC EFFECT OF POLYPROPYLENE CLAY NANOCOMPOSITES WITH A PHOSPHORUS INTUMESCENT FLAME RETARDANT

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There is considerable interest in the substitution of conventional halogenated flame retardants compounds due to the release of toxic gases and smoke during combustion. Thermal degradation of phosphorus-containing flame retardant causes the formation of char residue that can act as barriers to protect the underlying polymer from attack by oxygen and radiant heat reducing the heat release rate or even extinguishing the fire. However, to achieve acceptable performance the amount usually lies between 15-30 wt.% deteriorating the mechanical properties of the polymeric material. Nanocomposite of polymer and organically modified montmorillonite (MMT) often exhibit remarkably improved mechanical and various other properties compared to those of the virgin polymer and may present a synergistic effect with halogen free flame retardants. In this work, nanocomposites of polypropylene (PP) / organophilic clay (Cloisite 15A) were obtained through melt intercalation in a twin screw extruder using polypropylene grafted with maleic anhydride (PP-g-MA) as compatibilizing agent. The concentration of phosphorous intumescent flame retardant (CHARMAX NH2000) was varied whereas the amount of Cloisite 15A related to polymer was fixed in 5 wt.%. The nanocomposite was characterized by X-ray diffractometry (XRD) and transmission electron microscopy (TEM). The effects of the nanocomposite and the different amounts flame retardant on the thermal and thermooxidative degradation and the flammability of PP was investigated by thermogravimetry analysis (TGA), Cone Calorimetry, limiting oxygen index (LOI) and UL-94 tests. Finally, using tensile test, the mechanical properties of the samples are studied to determine any changes caused by those additives. The results indicated a strong synergy between the nanocomposite and the intumescent agent. An increased thermal stability was observed for the nanocomposite when compared to virgin PP and the addition of the organophilic clay also allowed to reduce in 50% the phosphorous intumescent flame retardant in order to obtain a polymeric material with classification V-0.