B.2.2.

Fire retardant mechanism in intumescent EVA compositions

A. Riva[1], G. Camino[1,2], P. Amigouët[3]
[1] Centro di Cultura per l'Ingegneria delle Materie Plastiche, V. T. Michel 5, 15100 Alessandria, Italy
[2] Politecnico di Torino, Sede di Alessandria, V. T. Michel 5, 15100 Alessandria, Italy
[3] NEXANS-NRC, 170, Avenue Jean Jaurès, 69353 Lyon Cedex 7, France

The thermal and combustion behaviour of an intumescent fire retardant system based on Polyamide 6 (PA6) and Ammonium Polyphosphate (APP), used to improve flame retardant properties of poly(ethylene-co-vinylacetate) (EVA), added with $Mg(OH)_2$ (MH) was examined.

The study of interactions between the additives introduced in EVA was focused in particular on the MH-APP interaction. The TG-IR data of figure 1 show NH_3 evolution from APP thermal degradation, as evaluated from IR absorption at $966cm^{-1}$. Ammonia evolution is accompanied by water elimination from the freed acidic hydroxy groups, leading to ultraphosphate structures which undergo fragmentation to volatiles above 500°C as reported in literature.

The MH TG curve showed that evolution of water from MH takes place at about 400°C, with a fair overlap with ammonia and water evolution from APP degradation.

In fig. 2 the TG curve carried out on a 50% w/w mixture APP-MH is compared with that calculated from TG carried out on pure APP and MH. In the experimental TG curve of the mixture, a three-step degradation is seen (Derivative curve) instead of the expected single step of the calculated curve, showing that an interaction occurs between the two additives.

With the TG-FTIR technique it is possible to associate the DTG peak with maximum at 330°C to NH_3 evolution (figure 2). It is clear that the ammonia evolution from APP is anticipated by the MH presence, since the NH_3 IR absorbance curve is characterized by a peak at about 330°C instead of 380°C found for pure APP (figure 1). The two DTG peaks with maxima at 380°C and 430°C are not yet assigned, and may be due to water release, as no other product should evolve from these two compounds in this temperature range.

UL94 tests show that the interaction between MH and APP modifies the combustion behaviour of the intumescent mixture.

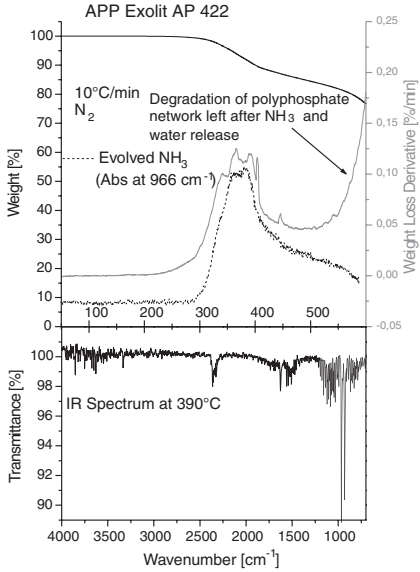

Fig. 1. TG-IR of pure APP.

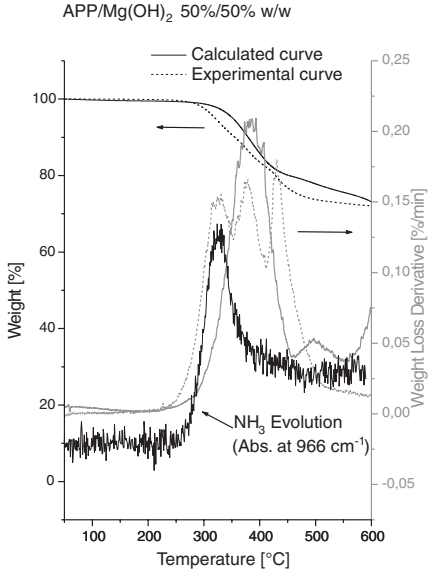

Fig. 2. TGA of a 50% w/w MH/APP mixture. Experimental and calculated.