FIRE BEHAVIOR OF ETHYLENE VINYL ACETATE/KAOLINITE COMPOSITES

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Kaolinite is a dioctahedral aluminosilicate, which is built with a tetrahedral SiO_4 and an octahedral $AlO_4(OH)_2$ sheets bonded together by oxygen atoms[1]. It is widely used as paper filler and coating pigment. At the best of our knowledge, kaolinite is not widely used in polymer industry and few studies have concerned its use in polymers. Therefore, in this study, the flame retardant effect of kaolinite in ethylene vinyl acetate copolymer (EVA) was studied and compared with an alumina trihydrate (ATH).
Compositions were extruded and injection molded. Specimens were tested in cone calorimeter, microcalorimeter (PCFC) and TGA. Also, viscosity measurements were conducted.

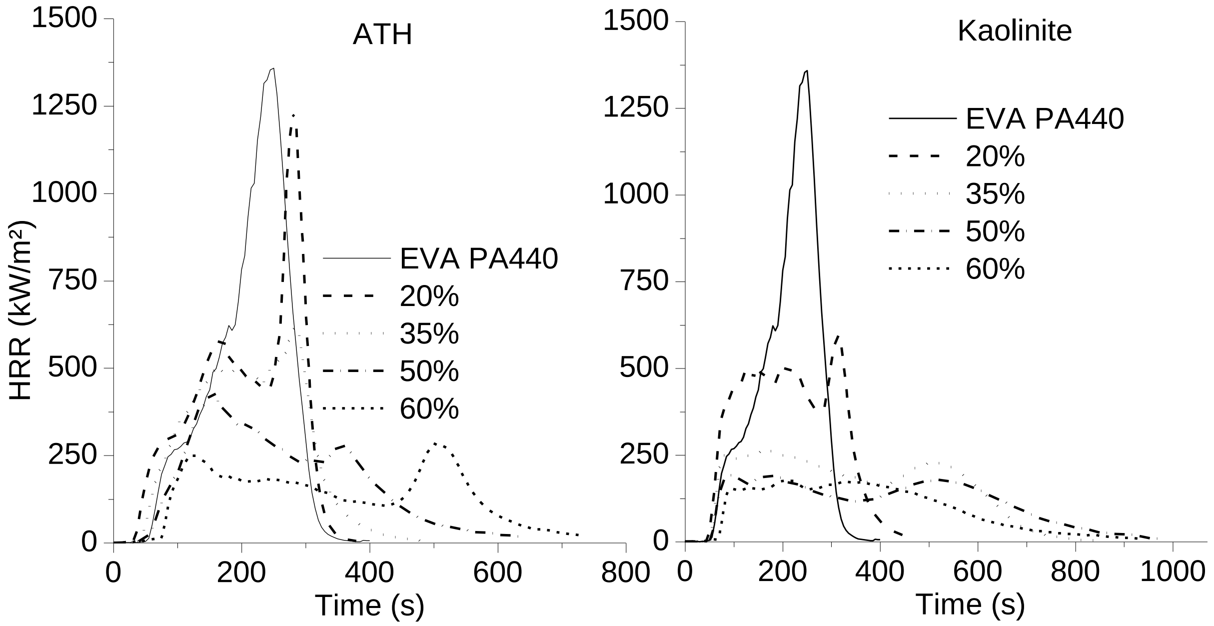

Fig. 1. Cone calorimeter results at 50 kW*m^{-2}.

The addition of ATH or Kaolinite to the polymer strongly decreases value of pHRR (Fig. 1). The results obtained shows that the weight percentage of ATH must be at least 50 wt. % in order to reach an improvement in fire retardancy in terms of pHRR. When kaolinite is used, even with 35 wt. % the pHRR is largely reduced. Furthermore, it was observed during tests that kaolin forms a protective layer on the surface of the samples, which could insulate the material. This behavior could reduce the transfer of the degradation products to the flame allowing radical recombination reactions[2] and improve time to ignition (TTI). In addition, a slightly intumescent behavior was observed.

Viscosity measurements showed an improved viscosity for kaolinite/EVA composites that could explain the intumescence observed. Also, it seems that pHRR is dependent on the viscosity of the composites, particularly to the rate of η”/η’ (Fig. 2). It should be noted that the increase of this parameter in kaolinite/EVA composites is obvious, that could lead to the improved fire behavior observed.

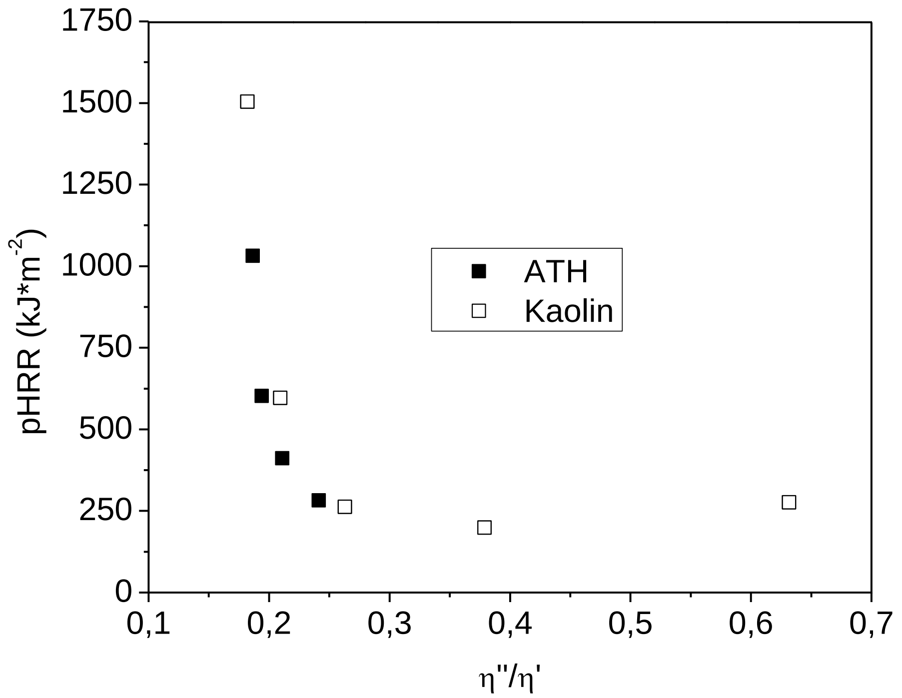

Fig.2. Rheological measurements of composites at 0.15 Hz. (Dynamical mode at 160°C).

1. Van Olphen, H. An introduction to clay colloid chemistry: for clay technologists, geologists, and soil scientists. New York: Wiley Interscience publication, 1977.
2. Costache, M., Heidecker, M. J. *et al.*, Polymer 48:6535-6545, 2007.