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Key role of magnesium hydroxide surface treatment in the flame retardancy of glass fiber reinforced polyamide 6

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Abstract

In this paper, the fire retardant properties of two magnesium dihydroxide (MDH) were compared into glass fiber reinforced polyamide 6 (PA6 GF). The difference between the additives lies in the presence of a vinylsilane treatment at the surface of one of the two MDH (H5A grade) whereas the other is a non-treated MDH (H5 grade). The investigations showed that better fire properties were obtained with PA6 GF/H5A formulation compared to the PA6 GF/H5 one. More precisely, a higher UL-94 rating, a higher glow wire ignition temperature (GWIT) and a higher time to ignition (TTi) at the mass loss calorimeter (MLC) were obtained. To understand the differences between H5 and H5A in terms of fire performances, the mechanisms of degradation of the two fire retarded (FR) formulations was investigated, analyzing both the gas phase and the condensed phase. A significant part of the study was also devoted to the characterization of the ceramic protective layer formed thanks to the use of MDH. The analysis of the gas phase revealed that the degradation products of the two FR formulations were similar. Moreover, as shown by the condensed phase analysis, no chemical reaction occurs between PA6 and H5 or H5A, proving that the MDH surface treatment was not involved in chemical reactions during the processing of the formulation or its degradation. On the contrary, the main differences between the two formulations concern the properties of protective layer formed during the degradation. It was shown that the silane treatment and the