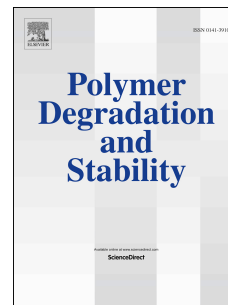


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# Fire Retardant Action of Zinc Phosphinate and Polyamide 11 blend Containing Lignin as a carbon source

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## ABSTRACT

This study investigates the thermal decomposition and fire behavior of zinc phosphinate (ZnP) in combination with low sulphonate content alkali lignin (LS) in a polyamide 11 (PA11) matrix. The influence of ZnP with LS on PA11 was assessed by using thermogravimetric analysis coupled with FTIR spectroscopy (TG-FTIR). Such decomposition products as hydrocarbons, amide and carbonyl units, phenolic and phosphinate compounds control the decomposition. The chemical structure of the condensed phase was evaluated by FTIR measurements carried out on the residues. The fire behavior was investigated using UL 94 vertical flame spread tests and cone calorimetry tests. In the ternary blends, the addition of LS promotes char formation as assessed by TG analyses; furthermore, ZnP contributes to flame inhibition mainly by radical trapping and partially by dilution of fuel, due to phosphinate ions and a small amount of phosphinic acid released in the gas phase. Besides, phosphate compounds are formed in the condensed phase. The combination of LS and ZnP enhanced flame-retardant properties due to the formation of a stable char layer with barrier features.

**KEYWORDS:** Lignin; Polyamide 11; Zinc phosphinate; Thermal decomposition; Flame retardancy

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