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# Fire retardant mechanism intumescent EVA compositions

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**Abstract**: 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 the interactions between the additives introduced in EVA was focused in particular on the MH-APP interaction.

The evolution of water from MH takes place at about 400°C with a fair overlap with ammonia and water evolution from APP degradation.
Ammonia evolution from APP is anticipated by the MH presence, in their mixture heated alone or in the polymer matrix.
UL 94 tests shows that the interaction between MH and APP modifies the combustion behaviour of the intumescent mixture.

**Keywords** : EVA , Intumescence, Ammonium Polyphosphate, Polyamide 6, Magnesium Hydroxide, flame retardancy.

**Résumé**: Ce papier présente du comportement thermique et de la tenue l'étude au feu d'un système intumescent, basé sur une composition Polyamide 6 (PA6) et Polyphosphate d'ammonium (APP), utilisé pour améliorer les propriétés de tenue au feu d'un poly(éthylène-co-vinylacétate) (EVA), contenant $Mg(OH)_2$ a été examiné.

L'étude des interactions entre les différents additifs introduits dans l'EVA s'est focalisée sur les interactions MH-APP.
L'évolution du dégagement d'eau, issue de la dégradation de MH a lieu à 400°C avec un chevauchement des produits issus de la dégradation de l'APP, l'ammoniac et l'eau.
L'évolution de l'ammoniac de l'APP est anticipée par la présence de MH, que ce soit en les mélangeant seuls ou dans la matrice polymère.
Les essais UL 94 montrent que l'interaction entre MH et APP modifie la combustion du mélange intumescent.

**Mots clés**: EVA , Intumescence, Polyphosphate d'ammonium, Polyamide 6, Hydroxyde de Magnesium, Retardateur à la flamme.

## Introduction :

Polyethylenic polymers and co-polymers are widely used in many fields, and particularly in electrical engineering applications. Due to their chemical compositions, these polymers are easily flammable and this is because flame retardancy of these materials is a deeply studied matter. The main approach used up to now to impart flame retardant properties to this class of polymeric materials has been the incorporation of additives, specifically of halogen compounds. The combustion products coming from these materials have a number of negative characteristics (corrosiveness, toxicity,...) that pushed the industry and legislation to improve some new approaches to flame retardance [1-3].

One of these developing approaches is that of intumescence. The intumescence mechanism consists in creating on the polymer surface an expanded shield, able to reduce both the heat flux from the flame to the polymer matrix, responsible for the fuel production, and the transfer of fuel to the flame, limiting the spread of fire [4-5].

Generally intumescent formulations consist of three ingredients : an acid source (phosphates, borates, etc.), a carbonising compound (polyols, polyamides, polyurethanes, etc.) and a blowing agent (melamine, ammonium polyphosphate, etc.).