Intergrating Flame Retardancy and Weathering Resistance in Halogen Free PP compounds intended for outdoor cable protection conduits

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Cable protection pipes (conduits) are typically manufactured from PVC, which exhibits flame retardant (FR) behavior due to the inherent chlorine[1]. Nevertheless, due to the current strict EU safety regulations for conduits regarding halogen content, smoke density and corrosiveness of released gases (EN50642, EN61034-2, EN60754-2), PP is rising as a viable alternative[2]. However, PP requires halogen free additivation for flame retardancy in order to comply with the aforementioned regulations. Furthermore, when it comes to outdoor electrical installations, additional UV and heat stabilization is needed, so as to incease the life cycle performance of these materials[4]. The reasearch challenge that arises is to combine FR and UV functionalities at concentrations below 30 wt.% and without any antagonistic effect[3]. For this purpose 4 different FR/UV PP compounds were developed (FR1-FR4), consisting of different commercial organo-phosphorous FRs and several commercial light stabilizers such as hindered amines (HALS) or N-alkoxy hindered amine (NOR-HAS). The oxygenation level of the organo-phosphorous compounds determines the FR mechanism[4], therefore in FR1, FR2 where a phosphate and a char forming agent (CFA) is used, flame retardancy occurs mainly in the condensed phase *via* char formation. Additionally, an aminoether HALS or a NOR-HAS compound is added for UV stabilization, resulting in total loading in the range of 20-25wt%. On the contrary, in FR3 and FR4, where a phosphonate or a phosphinate are used as FRs, along with the NOR-HAS compound for UV stabilization, self-extinguishing occurs in the gaseous phase, and the loading level is reduced to 5-11wt%. The developed halogen free FR/UV compounds were monitored prior to and after accelerated weathering by means of UL94, mechanical and thermal properties (DSC, TGA) and MFR. Their overall performance rendered these compounds as promising candidates for the manufacture of conduits for outdoor applications.

Keywords: polypropylene, flame retardants, halogen free, weathering.

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