# POLYPHOSPHONATE FLAME RETARDANTS IN AVIATION APPLICATIONS

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In the past years, polyphosphonates have proven to be very versatile polymeric flame retardants. Globally, more than 200 companies from different industries have been evaluating these materials in their applications. Polyphosphonates are incorporated in commercial formulations and can be used in industrial carpeting, textiles, electronics, building and construction applications, and transportation. Commercial production of these polyphosphonates has started in Antwerp, Belgium, where FRX Polymers built the first of its kind production plant in 2013.

The flame retardant (FR) mechanism of polyphosphonates and poly(phosphonate-co-carbonates) is not yet fully understood. There is a strong condensed phase activity and polyphosphonates yield a very dense glassy char, which lead to an immediate extinguish of a burning polyphosphonate sample as soon as a flame is removed from the part. However, when doing cone calorimetry, an increase in the CO/CO2 ratio is observed, indicating some gas phase activity as well.

Polyphosphonates can be utilized for aviation applications in many different ways. They can be incorporated in fibers during the spinning process to make inherently FR fabrics. Also, the reactive phosphonate oligomers can react with isocyanates yielding an inherent FR polyurethane material that can be used for rigid and flexible foam and coating applications. Finally, it has been demonstrated that blends of phosphonates with polycarbonate (PC) and polyphosphonate-co-carbonates can be used to make transparent, very thin (0.2mm) films, sheets, and injection molding products with a UL VTM0 or V0 rating. More interestingly, they also show a very good performance in heat release tests like the cone calorimetry and OSU tests. The current commercially available transparent phosphonate copolymers almost meet the ‘65/65’ criteria. This is already much better than regular PC that does not meet these requirements but has obtained a waiver to be used in aviation applications. Developments in the past year have focused to develop a new class of transparent phosphonate copolymers that actually meet all of the aviation specifications. The results from these developments will be highlighted.