

## WEATHERING RESISTANCE OF THE FLAME RETARDANCY OF POLYMERIC MATERIALS

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### Abstract

Fire retardant substances have to be added to polymers to reduce their inherent flammability. Especially for outdoor use of the resulting materials, not only the polymer itself can be degraded but also the flame retardant additive can be reduced in its effectiveness, which potentially could lead to reduced safety of the application.

While no artificial weathering tests of the stability of flame retardants exist so far, a test was setup in BAM to investigate the question if a reduction in flame retardancy would be observed after weathering compared to the unexposed state. Cone calorimeter measurements were chosen as the property test representing flame retardancy.

The artificial weathering test used in this investigation applied UV-A fluorescent lamp irradiation, rain phases, temperature, and humidity. Halogen-free flame retardant polymeric materials were exposed for 28 and 84 days, respectively. This maximum exposure duration can be roughly estimated to be comparable to a rather short period of about one year of outdoor exposure in central Europe. Additionally, IR analytics was used to characterize the UV degradation of polymer and stabilizer.

The results of the cone calorimeter test of flame retardancy of unexposed samples then were compared to the result for weathered samples. For samples that were protected using an intumescent flame retardancy mechanism, which is a surface orientated process, indeed reduction of flame retardancy protection after 84 days weathering was found. In contrast to that, for materials protected with a bulk mechanism, which therefore should not be expected to be influenced by a short weathering exposure, no significant change was observed.

This result does not mean that the flame retardancy concept of intumescence is inferior to bulk protection mechanisms but it shows that a test of the weathering stability can be useful for flame retardant materials in outdoor use.