Firebrake ZB in polyolefins

Firebrake® ZB, a boron-based multi-functional fire retardant, has been used as a flame retardant, smoke suppressant, and afterglow suppressant in both halogen-containing and halogen-free polyolefin. Its applications extend from wire and cable products to electrical parts, appliance components, wall covering, foam insulation, mechanical parts, and roofing membrane.

Firebrake ZB has a typical median particle size of 9 microns. To enhance fire performance and achieve the best physical properties, *Firebrake* ZB is offered in a fine grade (*Firebrake* ZB Fine) with a typical particle size of 2.3 microns, and an extra-fine grade (*Firebrake* ZB-XF) with a typical median particle size of 1.8 microns and a top particle size of 12 microns.

Halogen-containing polyolefins

- Synergy with antimony oxide in fire test performance such as in the limiting oxygen index (LOI - see Figure 1), UL 94, or wire and cable vertical burn tests
- Partial replacement of 25-50% of antimony trioxide in most polyolefin formulations to provide cost savings
- Smoke suppressant
- Promotion of char formation
- Afterglow suppressant due to its borate moiety
- Reduction of HCl and HBr in combustion off-gases
- Improvement of aged elongation properties.

Halogen-free polyolefins

- Reduction in the rate of heat release (see Figure 2)
- Smoke suppressant
- Reduction of carbon monoxide generation
- Afterglow suppressant
- Improvement of mechanical properties (except tensile strength)
- Improvement of electrical properties (dielectricconstant, anti-arcing function)
- Improvement of processability in metal hydroxide-containing systems
- Promotion of a strong char/ceramic residue in conjunction with metal hydroxides due to its sintering aid functionality, which can be further augmented with the use of co-additives such as silicone/silica, phosphate ester, melamine polyphosphate, ammonium polyphosphate, or red phosphorous

Figure 1: Improvement in LOI of cross-linked EVA due to synergistic effect of *Firebrake* ZB and antimony oxide

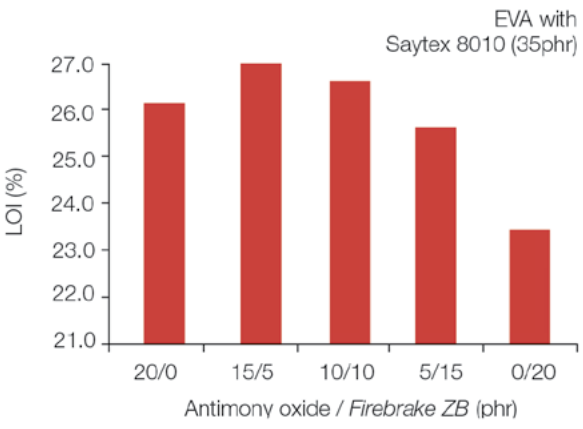
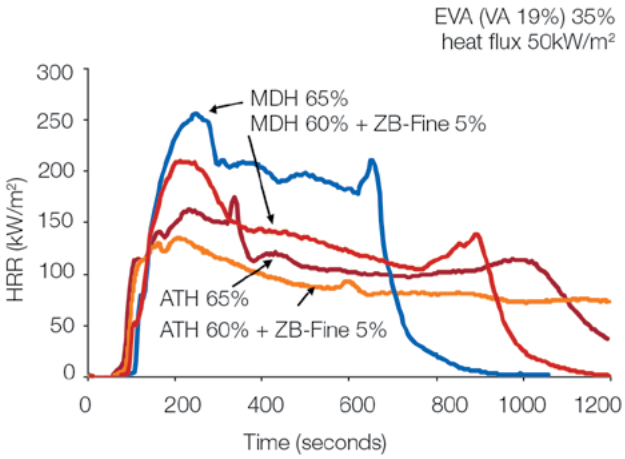


Figure 2: Improvement in HRR due to addition of *Firebrake* ZB Fine to MDH or ATH in an EVA formulation



General guidelines

Recommendations for levels of treatment depend on the desired fire test performance, the need for halogen-containing or halogen-free formulations, and the presence of other co-additives.

In a halogen-containing polyolefin, a good starting-point is the replacement of 30 to 50 wt% of antimony trioxide with *Firebrake* ZB in an existing formulation. If this results in equal or improved fire test performance, a higher antimony oxide replacement level can be tried. The beneficial interaction in terms of fire test performance can be augmented by using alumina trihydrate (ATH), magnesium hydroxide (MDH), talc, or wollastonite.

About U.S. Borax

U.S. Borax, part of Rio Tinto, is a global leader in the supply and science of borates—naturally-occurring minerals containing boron and other elements. We are 1,000 people serving 500 customers with more than 1,700 delivery locations globally. We supply 30% of the world's need for refined borates from our world-class mine in Boron, California, about 100 miles northeast of Los Angeles. We pioneer the elements of modern living, including:

- Minerals that make a difference: Consistent product quality secured by ISO 9001:2015 registration of its integrated quality management systems
- People who make a difference: Experts in borate chemistry, technical support, and customer service
- Solutions that make a difference: Strategic inventory placement and long-term contracts with shippers to ensure supply reliability

Firebrake® ZB

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