

Firebrake ZB in epoxy



Firebrake[®] ZB, a boron-based multi-functional fire retardant, has been used as flame retardant, smoke suppressant, and afterglow suppressant in both halogen-containing and halogen-free epoxy. It has been used in applications such as intumescent coating, adhesives, flooring, glass-reinforced laminates, potting, and encapsulation of electrical components.

Firebrake ZB has a typical median particle size of 9 microns. To enhance the 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.

In halogen-containing epoxy:

Flame retardant synergist

Firebrake ZB acts as a synergist of halogen sources and antimony oxide in the formulation. Based on the performance results presented in Figures 1 and 2, *Firebrake* ZB can replace 40% to 100% of antimony trioxide in epoxy formulations with same performance.

Smoke suppression

Firebrake ZB is shown to suppress smoke formation even in the presence of antimony oxide, which adversely affects smoke generation (Figure 3).

Char formation

Firebrake ZB is an effective char promoter, which helps with intumescent applications of epoxy resins (Figure 4).

In halogen-free epoxy:

Flame retardant synergist

Firebrake ZB displays synergy in fire test performance when used in conjunction with ammonium polyphosphate, alumina trihydrate, and silica.

Smoke suppression

Firebrake ZB is an effective smoke suppressant in many formulations.

Char /ceramic formation

Firebrake ZB promotes char formation and development of strong ceramic structure for intumescent applications.

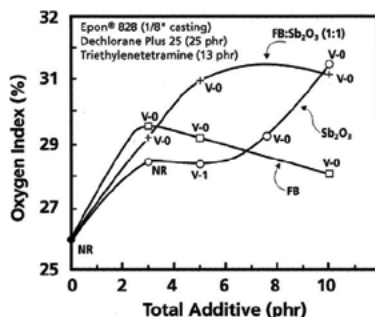


Figure 1

Oxygen Index and UL-94 Test of Epon 828 (FB is *Firebrake* ZB, NR- Not Rated due to complete combustion)

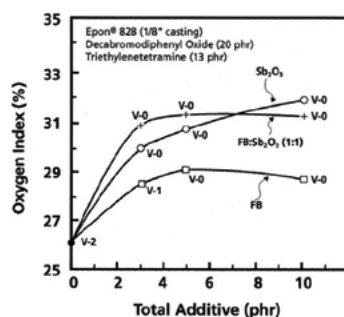


Figure 2

Oxygen Index and UL-94 Test of Epon 828 (FB is *Firebrake* ZB)

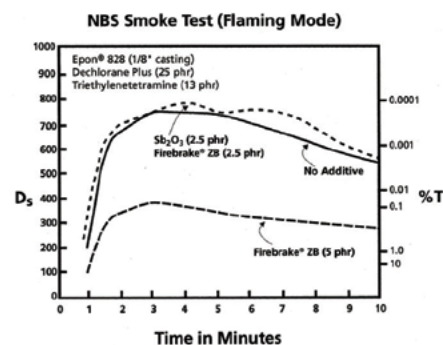


Figure 3

ASTM E-662 Smoke Test of Epoxy Containing Dechlorane Plus and *Firebrake* ZB



General guidelines

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

- In a halogen-containing epoxy, a good starting-point is the replacement of 30 to 50 wt% of antimony trioxide with *Firebrake* ZB in flame retardant formulations. If equal or improved fire performance is achieved, complete antimony oxide replacement can be targeted.
- In halogen-free epoxy, depending on the specific end-use application and fire standard to be met, one can either use *Firebrake* ZB alone or *Firebrake* ZB in conjunction with ammonium polyphosphate, silica, phosphate ester, or aluminum trihydrate. Specific formulation recommendations are available upon request.



Figure 4
Intumescent Char of Epoxy
Containing *Firebrake* ZB and
Dechlorane Plus (sample on the right)

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



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