MICRONISED HYDRATED ZINC BORATE

HZBR-10 | HZBR-20 | HZBR-30

Polymer Add offers three controlled top-cut grades of micronised hydrated zinc borate, differentiated by guaranteed maximum particle sizes of D100 below 10, 20 and 30 µm.

The HZBR range is based specifically on the commercially important, hydrated zinc borate commonly described as ZB-2335: $2ZnO{\cdot}3B_2O_3{\cdot}3.5H_2O$. It must not be confused with anhydrous zinc borate, which has different composition, thermal stability and high-temperature applications.

Hydrated zinc borate is a multifunctional inorganic additive used as a flame-retardant synergist, smoke suppressant, afterglow suppressant, char promoter and anti-arcing additive in polymer, rubber and coating systems. Micronisation controls coarse particles and supports more uniform distribution; it does not change the underlying zinc-borate chemistry.

Material identity and typical properties

Property	Description
Product type	Hydrated zinc borate / ZB-2335
Chemical representation	$2ZnO{\cdot}3B_2O_3{\cdot}3.5H_2O$
Appearance	White, crystal-like inorganic powder
Theoretical ZnO content	37.44%
Theoretical B_2O_3 content	48.05%
Water of crystallisation	14.51% theoretical
Anhydrous equivalent	85.49% theoretical
Specific gravity	Approximately 2.77
Refractive index	Approximately 1.58
Water solubility	Less than 0.28% at room temperature for the reference commercial grade
Thermal stability	Stable to approximately 290°C before release of water of hydration
Principal functions	Flame-retardant synergist, smoke and afterglow suppressant, char promoter and anti-arcing additive

Hydrated versus anhydrous zinc borate

Characteristic	HZBR hydrated series	Anhydrous zinc borate
Composition	$2ZnO{\cdot}3B_2O_3{\cdot}3.5H_2O$	Approximately $2ZnO{\cdot}3B_2O_3$
Bound water	Approximately 14.5% theoretical	No water of crystallisation
Thermal stability	Approximately 290°C	Greater than 600°C for the reference grade
Primary use	PVC, polyolefins, epoxy, polyester, coatings and elastomers	PPA, PA66, PEEK, polysulfones, fluoropolymers and other very-high-temperature systems
Polymer Add grade family	HZBR-10 / HZBR-20 / HZBR-30	Not included in this report

Available micronised grades

GRADE	CLASSIFICATION	PRINCIPAL PARTICLE-SIZE SPECIFICATION
HZBR-10	Ultra-fine	D100 <10 µm
HZBR-20	Fine	D100 <20 µm
HZBR-30	Standard micronised	D100 <30 µm

D50 values are reported as typical batch data. The principal grade specification is the guaranteed D100 value. Chemical composition and water of crystallisation remain common requirements across the HZBR series.

[Insert comparative PSA graphs for HZBR-10, HZBR-20 and HZBR-30]

Why controlled particle size is important

Fine zinc borate is already an established commercial category. Comparable suppliers offer standard and fine products because particle size can influence dispersion, film formation, adhesion, surface finish, feeding and the uniformity of additive distribution.

- Reduced risk of coarse inclusions in thin polymer sections and coating films
- More uniform distribution through polymer, rubber and liquid coating formulations
- Improved surface smoothness where coarse particles would create visible defects
- Greater consistency at relatively low zinc-borate addition levels
- Better suitability for fine masterbatches, cable compounds and demanding coating applications

Particle size alone does not establish equivalence to a reference zinc borate. Crystal morphology, agglomerate structure, bulk density, soluble impurities and hydration state also affect powder flow, processing and final performance.

[Insert SEM comparison of feedstock, HZBR-10, HZBR-20 and HZBR-30]

Functions in flame-retardant systems

FUNCTION	CONTRIBUTION IN THE FORMULATION
Flame-retardant synergist	Works with halogen sources, antimony oxide, ATH, MDH, phosphorus and silicone-based systems depending on the polymer.
Char and residue formation	Promotes and stabilises protective char or ceramic-like residue during burning.
Smoke suppression	Can reduce smoke generation in suitable halogen-containing and halogen-free formulations.
Afterglow suppression	Helps inhibit oxidation of the residual char after flame exposure.
Anti-dripping	Supports residue formation and can reduce flaming drip in selected systems.
Anti-tracking and anti-arcing	Provides functional benefits in electrical and electronic insulation formulations.
Water release	Releases water of hydration above approximately 290°C, contributing an endothermic cooling and dilution effect.

Applications and grade-selection guide

PRINCIPAL APPLICATION	APPLICATION REQUIREMENT	SUGGESTED GRADE
Fine fire-retardant coatings	Minimum grit, film formation, adhesion and smooth surface	HZBR-10
Thin electrical insulation and fine cable compounds	Minimum coarse particles and uniform additive distribution	HZBR-10
High-quality PVC compounds	Fine dispersion, smoke suppression and surface appearance	HZBR-10 / HZBR-20
Epoxy encapsulation and electrical systems	Fine dispersion, anti-arcing and controlled inclusions	HZBR-10 / HZBR-20
Polyolefin and EVA flame-retardant compounds	Balanced dispersion, processing and commercial economy	HZBR-20
Rubber, conveyor belts	Flame, smoke and afterglow	HZBR-20 / HZBR-

PRINCIPAL APPLICATION	APPLICATION REQUIREMENT	SUGGESTED GRADE
and elastomers	suppression with reliable dispersion	30
Unsaturated polyester and general thermosets	General flame-retardant and smoke-suppressant formulations	HZBR-20 / HZBR-30
General PVC and industrial compounds	Controlled micronised grade where D100 <30 µm is sufficient	HZBR-30
Cost-sensitive, filled formulations	Economical top-cut control for less particle-sensitive systems	HZBR-30

Application sectors

SECTOR	TYPICAL SYSTEMS	PRINCIPAL ROLE
Wire and cable	PVC, EVA, PE, EPDM and silicone compounds	Flame-retardant synergist, smoke suppression, char/ceramic formation and electrical performance
Flexible and rigid PVC	Cable insulation, flooring, profiles, coated fabrics and construction products	Partial replacement or synergist for antimony oxide; smoke and afterglow suppression
Polyolefins	PE and PP compounds, masterbatches and flame-retardant parts	Synergist with metal hydroxides, phosphorus or other flame-retardant systems
Rubber and elastomers	Neoprene, SBR, EPDM, conveyor belts, roofing and foamed insulation	Char promotion, smoke suppression and afterglow control
Thermosets	Epoxy, unsaturated polyester, phenolic and acrylic systems	Flame retardancy, smoke suppression and anti-arcing functions
Coatings	Fire-retardant, intumescent, anticorrosive and wood coatings	Char promotion, smoke suppression, corrosion inhibition, adhesion and tannin-stain control
Electrical/electronics	Encapsulation, insulation and components	Anti-tracking, anti-arcing and flame-retardant performance

Feedstock qualification and quality control

Commercial development must begin with a chemically correct and consistent ZB-2335 feedstock. Micronisation can adjust particle size but cannot correct unsuitable hydration, impurities or crystal morphology.

CONTROL ITEM	REASON FOR CONTROL
ZnO, B_2 O_3 and water of crystallisation	Confirms the correct hydrated zinc-borate chemistry and anhydrous equivalent.
TGA / dehydration profile	Confirms thermal stability and release of bound water near the intended temperature range.
D50, D90 and D100	Defines the complete particle-size distribution and verifies the guaranteed top cut.
SEM and morphology	Checks crystal form, agglomerate structure and changes created by micronisation.
Moisture and soluble matter	Controls storage stability and compatibility with moisture-sensitive formulations.
Chloride, sulfate and sodium	Limits ionic impurities that may affect electrical performance or cause corrosion.
Heavy metals and regulatory compliance	Required for customer and end-market qualification.
Whiteness / colour	Important for light-coloured polymers and coating systems.

Processing and safety

Hydrated zinc borate is an inorganic, non-flammable material. The reference Firebrake ZB safety information describes it as not flammable, combustible or explosive. Normal fine-powder controls nevertheless remain necessary to minimise airborne dust and occupational exposure.

- Use enclosed dry air-jet-mill processing and effective dust collection.
- Avoid contamination with chemically different hydrated or anhydrous zinc borates.
- Control mill temperature so that the hydration state is not altered.
- Use suitable respiratory, eye and skin protection for fine inorganic dust.
- Manage zinc- and boron-containing waste and spills in accordance with applicable environmental requirements.

Toll micronisation service

Customer-supplied hydrated zinc borate can be evaluated for toll micronisation in dedicated production batches. The service can include micronisation, particle-size analysis and repacking. Final feasibility, achievable particle size, processing yield and commercial terms are confirmed after evaluation of the customer’s specific feedstock.

Important formulation note

HZBR-10, HZBR-20 and HZBR-30 define maximum particle size by D100 and apply only to hydrated ZB-2335 chemistry. Flame-retardant performance depends on the base polymer, zinc-borate dosage, other flame-retardant additives, dispersion, processing conditions and the required fire-test standard. Product selection and dosage must therefore be confirmed through customer formulation and fire-performance trials.