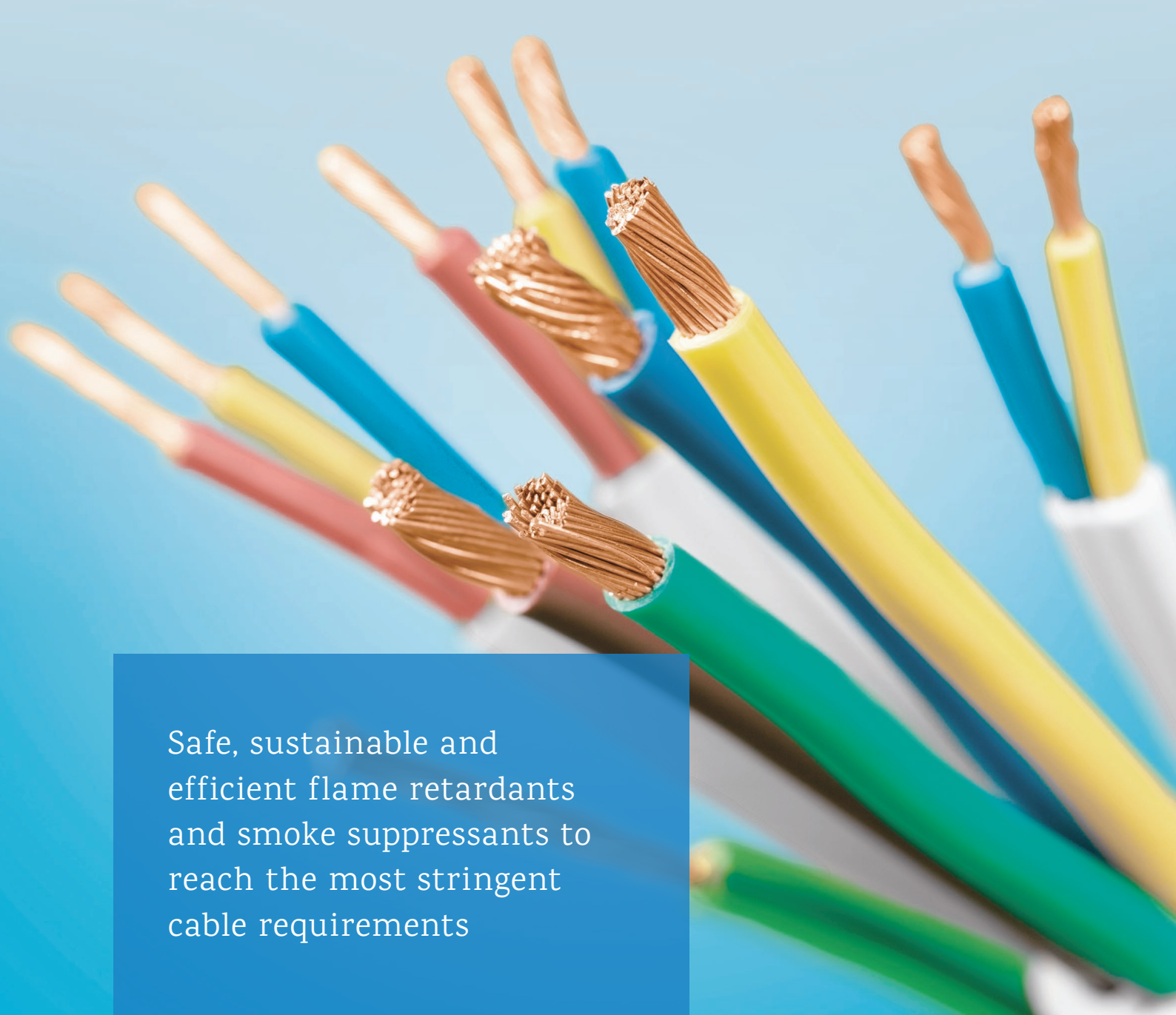
HUBER

ADVANCED MATERIALS

Halogen-Free Fire Retardant Additive Solutions

For Wire and Cable



Safe, sustainable and efficient flame retardants and smoke suppressants to reach the most stringent cable requirements

Huber Advanced Materials

Halogen-Free Fire Retardant Additive Solutions:

Huber Advanced Materials offers a broad array of high performing halogen-free fire retardant additives to surpass the needs of wire and cable compounders and producers. The following are the primary brands of Huber flame retardants and smoke suppressants that meet and exceed the most demanding performance requirements of our customers:

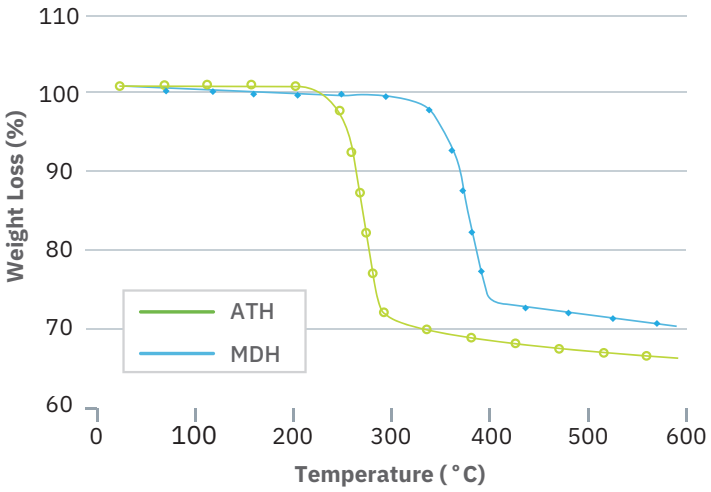
- Hydral® Fine Precipitated Aluminum Hydroxide
- Micral® Aluminum Hydroxide
- Hymod® Surface-Treated Aluminum Hydroxide
- Vertex® Magnesium Hydroxide
- Zerogen® Surface-Treated Magnesium Hydroxide
- Kemgard® Flame Retardants and Smoke Suppressants (Molybdate Compounds)
- Martinal® Fine Precipitated Aluminum Hydroxide

Aluminum Hydroxide (ATH) and Magnesium Hydroxide (MDH)

Aluminum hydroxide(ATH) and magnesium hydroxide (MDH) are widely used to make low-smoke and/or halogen-free flame retardant wire and cable compounds for a range of insulation and jacketing applications. ATH and MDH serve to retard both flame and smoke via an endothermic reaction that releases water when heated to decomposition. The metal oxide by-product from decomposed ATH and MDH, Al_2O_3 and MgO respectively, also helps form a char on the polymer, which insulates the polymer from heat and oxygen.

The chart below compares the decomposition characteristics of ATH and MDH. ATH decomposes at about 220˚C while MDH decomposes at about 330˚C, thus, having a higher thermal stability allowing for a wider window for compounding processing. In some applications, blending ATH and MDH can help to achieve an improved balance of flame retardance and mechanical properties.

Thermal Stability Comparison of ATH and MDH



Decomposition temperature of ATH and MDH measured by TGA.

ATH and MDH: Ideal Solutions for the Most Demanding Wire and Cable Applications

ATH is suitable to use in PVC- and polyolefin-based wire and cable compounds where compounding processing temperatures are typically below 220˚C. MDH is preferred for formulating compounds that need to be processed at temperatures near or above the ATH decomposition temperature, such as polypropylene and engineering thermoplastics. Use of MDH also enables processing of PVC or polyolefin compounds at higher temperatures not permissible for ATH, thus, enhancing the compounding efficiency or extrusion throughput.

Key material parameters considered when selecting an ATH or MDH product for flame retardant wire and cable applications are particle size, particle size distribution, surface area, particle shape or morphology, chemical purity and color. These parameters will directly affect compounding performance and compound properties. Other common considerations may include the type and level of surface treatment based on the polymer type and compound performance requirements.

Physical Property Comparison of ATH and MDH

PROPERTY	ATH	MDH
Physical Form	Powder	Powder
Particle Morphology	Hexagonal platelet	Hexagonal platelet
Color	White	White
Specific Gravity, g/cm3	2.42	2.36
pH Value	9-10	10-11
Mohs Hardness	2.5-3.5	2.0-3.0
Refractive Index	1.57	1.58
Decomposition Temperature	220˚C / 428˚F	330˚C / 626˚F
Heat of Decomposition, cal/g	280	328
Theoretical Loss on Ignition, %	34.6%	31.0%

The ATH or MDH particle properties directly affect compound performance. For your specific application, let Huber assist you with a product recommendation based on our technical expertise.

Huber's Untreated ATH and MDH Products for Wire and Cable Applications

	PRODUCT	PARTICLE SIZE, MICRONS	PRODUCT DESCRIPTION	RECOMMENDED USES	
				Jacketing	Insulation
ATH	Micral® 932	2.1	Fine particle size, ground ATH	•	
	Micral® 1500	1.5	Fine particle size, ground ATH	•	•
	Hydral® 710	1.1	Ultrafine precipitated ATH, low electrolytes	•	•
	Hydral® PGA-SD	1.1	Ultrafine precipitated ATH, spray-dried	•	•
	Hymod® M9400 SP Surface Treated	1.1	Ultrafine Precipitated ATH	•	•
	Martinal® OL-104 LEO	1.8	Ultrafine precipitated ATH, spray-dried	•	•
MDH	Vertex® 60	2.7	Broad particle size distribution	•	
	Vertex® 100	1.5	Fine, uniform particle size distribution	•	
	Zerogen® 50	1	Fine particle size, low electrolytes	•	•
	Zerogen® 100 SP Surface-Treated	0.8	Ultrafine particle size, very low electrolytes	•	•

Huber's Surface-Treated ATH and MDH Products for Wire and Cable Applications

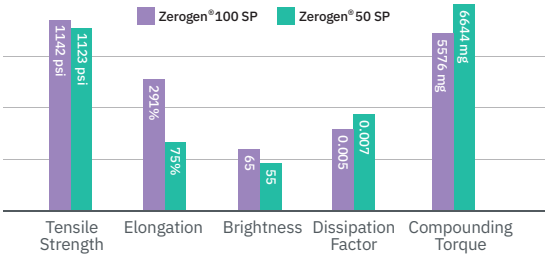
Our material know-how to enhance your application performance

	TYPE	POLYMER SYSTEM	PERFORMANCE BENEFITS
SURFACE TREATMENTS	ST (FATTY ACID)	Polyolefins; PVC	Processability, dispersion
	SG (ALKYL SILANE)	Polyolefins; Elastomers	Processability, dispersion, hydrophobicity
	SA (AMINOSILANE)	Polyamides; Polyolefins	Low temperature properties, mechanical properties
	SP (VINYL SILANE)	Polyolefins; Elastomers	Mechanical properties, flame retardant (FR)
	PK (POLYMERIC)	Polyolefins; Elastomers	Processability, FR
	SV (PROPRIETARY)	Polyolefins	FR (Lower smoke, higher limiting oxygen index [LOI])
	SF (PHENYL SILANE)	PVC	Dynamic thermal stability, hydrophobicity

Introducing **Zerogen® 100 SP MDH:**

Delivering Enhanced Compound Performance

Zerogen® 100 SP is an MDH product introduced to offer improved mechanical property balance and enhanced electrical and color performance benefits when high temperature wet electrical properties are needed. Zerogen 100 SP is designed for wire and cable applications where electrical and mechanical performance considerations are most critical. The chart at right highlights improved performance for EVA compounds made with silane-treated Zerogen 100 SP versus a similarly treated Zerogen® 50 additive. Zerogen 100 SP also provides enhanced compounding rheology as shown.



64% of MDH in EVA (28% VA, 2 MI)

Kemgard® Fire Retardants and Smoke Suppressants

Huber's Kemgard® products are molybdate-based flame retardants and smoke suppressants used in EVA and PVC wire and cable compounds. When the compound burns, molybdates chemically influence the formation of organic char, effectively insulating the polymer from the heat and oxygen source, thereby lowering smoke and heat release. Kemgard grades are manufactured by patented processes in which molybdates are precipitated on an inert mineral core. This "coated core" approach makes more efficient use of the molybdate species by maximizing the active surface area, and at a much lower cost than pure molybdate chemicals, such as ammonium octamolybdate (AOM).

Compounders can utilize Kemgard products to replace AOM or antimony trioxide (ATO) to achieve desirable fire retardance and smoke suppression performance while reducing costs and minimizing regulatory concerns over antimony oxide use.

PRODUCT	PRODUCT DESCRIPTION	PERFORMANCE BENEFITS
Kemgard® 620	Zinc Molybdate / Aluminum Hydroxide Complex	Excellent product in rigid PVC and PVC wire and cable applications
Kemgard® 984	Zinc Molybdate / Magnesium Silicate Complex	Excellent smoke suppression with added support for fire retardance performance
Kemgard® 605	Zinc Molybdate / Aluminum Hydroxide Complex	Balanced fire retardant and smoke suppression in PVC wire and cable applications
Kemgard® 631	Zinc Molybdate / Aluminum Hydroxide Complex	Highly effective fire retardant additive for a broad range of PVC applications
Kemgard® MZM	Zinc Molybdate / Magnesium Hydroxide Complex	Balanced fire retardance and smoke suppression in critical PVC applications

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