PERFORMANCE
FIRE RETARDANT
ADDITIVES
FOR WIRE AND CABLE

NON-HALOGEN
FLAME RETARDANCE
SMOKE SUPPRESSION
ELECTRICAL PERFORMANCE
PHYSICAL PROPERTY ENHANCEMENT

FLAMES AND SMOKE DON’T LIKE US
Huber Fire Retardant Additive Solutions:
Exceeding the Requirements of Wire and Cable Compounders and Producers

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

- Micral® Alumina Trihydrate
- Hymod® Surface-Treated Alumina Trihydrate
- Vertex® Magnesium Hydroxide
- Zerojen™ Magnesium Hydroxide
- Kemgard® Flame Retardants and Smoke Suppressants
- Hydral® Precipitated Ultrafine Aluminum Trihydroxide

Alumina Trihydrate (ATH) and Magnesium Hydroxide (MDH)
Alumina trihydrate (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, Al₂O₃ 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.

Thermal Stability Comparison Of ATH and MDH

[Graph showing thermal stability comparison between ATH and MDH]
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 cleanliness 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.

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.

**Physical Property Comparison of ATH and MDH**

<table>
<thead>
<tr>
<th>Property</th>
<th>ATH</th>
<th>MDH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Form</td>
<td>Powder</td>
<td>Powder</td>
</tr>
<tr>
<td>Particle Morphology</td>
<td>Hexagonal platelet</td>
<td>Hexagonal platelet</td>
</tr>
<tr>
<td>Color</td>
<td>White</td>
<td>White</td>
</tr>
<tr>
<td>Specific Gravity, g/cm³</td>
<td>2.42</td>
<td>2.36</td>
</tr>
<tr>
<td>pH Value</td>
<td>9.10</td>
<td>10.11</td>
</tr>
<tr>
<td>Mohs Hardness</td>
<td>2.5-3.5</td>
<td>2.0-3.0</td>
</tr>
<tr>
<td>Refractive Index</td>
<td>1.57</td>
<td>1.58</td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>220°C / 428°F</td>
<td>330°C / 626°F</td>
</tr>
<tr>
<td>Heat of Decomposition, cal/g</td>
<td>280</td>
<td>328</td>
</tr>
<tr>
<td>Theoretical Loss on Ignition, %</td>
<td>34.6%</td>
<td>31.0%</td>
</tr>
</tbody>
</table>

**Huber’s Untreated ATH and MDH Products for Wire and Cable Applications**

<table>
<thead>
<tr>
<th>Product</th>
<th>Particle Size, Microns</th>
<th>Product Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Micral® 932</td>
<td>2.1</td>
<td>Fine particle size, ground ATH</td>
</tr>
<tr>
<td>Micral® 1500</td>
<td>1.5</td>
<td>Fine particle size, ground ATH</td>
</tr>
<tr>
<td>Hydral® 710</td>
<td>1.1</td>
<td>Ultrafine precipitated ATH, low electrolytes</td>
</tr>
<tr>
<td>Hydral® PGA-SD</td>
<td>1.1</td>
<td>Ultrafine precipitated ATH, spray-dried bead</td>
</tr>
<tr>
<td>MDH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vertex® 60</td>
<td>2.7</td>
<td>Broad particle size distribution</td>
</tr>
<tr>
<td>Vertex® 100</td>
<td>1.5</td>
<td>Fine, uniform particle size distribution</td>
</tr>
<tr>
<td>Zerogen™ 50</td>
<td>1</td>
<td>Fine particle size, low electrolytes</td>
</tr>
<tr>
<td>Zerogen™ 100</td>
<td>0.8</td>
<td>Ultrafine particle size, very low electrolytes</td>
</tr>
</tbody>
</table>

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

Huber’s state-of-the-art surface treatments enhance the performance of the untreated fire retardant additives listed above.

<table>
<thead>
<tr>
<th>Type</th>
<th>Polymer System</th>
<th>Performance Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST (Fatty Acid)</td>
<td>Polyolefins, PVC</td>
<td>Processability, dispersion</td>
</tr>
<tr>
<td>SG (Alkyl Silane)</td>
<td>Polyolefins, Elastomers</td>
<td>Processability, dispersion, hydrophobicity</td>
</tr>
<tr>
<td>SA (Aminosilane)</td>
<td>Polyamides, Polyolefins</td>
<td>Low temperature properties, mechanical properties</td>
</tr>
<tr>
<td>SP (Vinyl Silane)</td>
<td>Polyolefins, Elastomers</td>
<td>Mechanical properties, flame retardant (FR)</td>
</tr>
<tr>
<td>PK (Polymeric)</td>
<td>Polyolefins, Elastomers</td>
<td>Processability, FR</td>
</tr>
<tr>
<td>SV (Polymeric)</td>
<td>Polyolefins</td>
<td>FR [lower smoke, higher limiting oxygen index (LOI)]</td>
</tr>
<tr>
<td>SF (Phenyl Silane)</td>
<td>PVC</td>
<td>Dynamic thermal stability, hydrophobicity</td>
</tr>
</tbody>
</table>
Introducing Zerogen™ 100 MDH: Delivering Enhanced Compound Performance

Zerogen™ 100 is a new line of MDH products introduced to offer improved mechanical property balance and enhanced electrical and color performance benefits. The Zerogen 100 products are designed for wire and cable applications where electrical and mechanical performance considerations are most critical. The chart above highlights improved performance for EVA compounds made with silane-treated Zerogen™ 100SP versus a similarly treated Zerogen™ 50 additive. This Zerogen 100 grade also provides enhanced compounding rheology as shown.

**Kemgard® Flame 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 partially replace antimony oxide to achieve desirable smoke suppression performance while reducing costs and minimizing regulatory concerns over antimony oxide use.

**Kemgard® Smoke Reduction Performance**

Flexible PVC contains plasticizer which generally means higher flame spread, lower LOI values and more smoke.
Flame Retardant/Smoke Suppression Applications

- Building Wire
- Power/Utility Cable and Accessories
- Electrical/Electronic Cable and Components
- Security Cable
- Transit/Transportation Cable
- Mining Cable
- Communications/Data Cable
- Automotive Wire
- Appliance Cable
- Windmill Cable

Huber Wire and Cable Capabilities

Huber’s technical and commercial expertise is the foundation to developing innovative products that meet the exacting performance requirements for each application. Huber Engineered Materials is a supplier of metal hydroxide products (ATH and MDH) used for fire retardant material applications. Huber specializes in the design, manufacture and marketing of a comprehensive product portfolio based on ATH, MDH and metal molybdates and phosphate.

Fire Testing Capabilities

- ASTM E1354: Cone Calorimeter
- ASTM E662: NBS Smoke Chamber
- ASTM D3806: Two-Foot Tunnel
- ASTM D2863: Limiting Oxygen Index
- UL 94: Horizontal and Vertical Burn Tests
- ASTM E648: Radiant Panel

Huber Engineered Materials: Over a Century of Advancing Technology

Huber Engineered Materials is part of J.M. Huber Corporation, one of the largest family-owned companies in the United States. J.M. Huber Corporation is a global company with a diverse portfolio of businesses serving a wide range of industries. Huber Engineered Materials develops engineered specialty ingredients that enhance the performance, appeal and processing of a broad range of products used in industrial, paper and consumer-based applications.

Huber Engineered Materials

Fire Retardant Additives
Technical Papers

Huber offers an array of technical papers offering guidance in using its fire retardant performance additives in wire and cable applications. The following articles are available upon request:

- **Molybdate / Borate Complexes for Enhanced Cable Compound Fire Performance**
  60th International Wire and Cable Symposium, 2011

- **Fire Performance Synergies of Metal Hydroxides and Metal Molybdates in Antimony-Free Flexible PVC**
  SPE Vinytec, 2010

- **Flame Retardant (FR) Olefinic Polymers Containing Metal Hydroxides — Fire Performance vs. Other Properties Optimization by Surface Modification**
  2010 BCC Conference on Flame Retardant Polymeric Materials

- **Enhanced FR Performance Enabled by Magnesium Hydroxide with Metal Molybdates in EVA Wire and Cable Compounds**
  Earned the Jack Speigel Memorial Award for Outstanding Technical Paper, 58th International Wire and Cable Symposium, 2009

- **Synergies of Metal Hydroxides and Metal Molybdates in Low-Smoke Flexible PVC**
  57th International Wire and Cable Symposium, 2008

- **New Magnesium Hydroxides Enabling Low-Smoke Cable Compounds**
  Wire and Cable Technology International, January 2008

- **Non-Halogen Flame Retardant Polyolefin Compounds via Synergistic Blends of Metal Hydroxides and Mineral Fillers**
  SPE International Polyolefins Conference, 2007

- **Low-Smoke Flexible PVC Compounds via Metal Hydroxides as Flame Retardants**
  SPE Vinytec, 2006

- **Synergistic Benefits of Metal Hydroxides and Zinc Borate in Flame Retardant Wire and Cable Performance Compounds**
  54th International Wire and Cable Symposium, 2005

- **Use of Surface-Modified Magnesium Hydroxide for Low-Smoke Flame Retardant Thermoplastics Applications**
  Intertech’s Conference on Functional Fillers for Plastics, 2005

- **Effects of Morphological and Surface Characteristics of Magnesium Hydroxide on Performance of Flame Retardant Wire and Cable Compounds**
  53rd International Wire and Cable Symposium, 2004

- **Comparison of Ground vs. Precipitated Fine Aluminum Trihydrate for Flame Retardant Wire and Cable Applications**
  52nd International Wire and Cable Symposium, 2003

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**For more information or to sample our products, please contact us:**

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**Call:** 1-866-JMHUBER (1-866-564-8237)

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