



ADVANCED MATERIALS

**Hymod® Treated
Aluminum Hydroxide (ATH):**
Surface modification competence
to enhance polymer compound
performance

Hymod® 
ALUMINUM HYDROXIDE



Hymod® treated Aluminum Hydroxide (ATH): **Surface modification competence to enhance polymer compound performance**

Most inorganic additives used in thermoset, thermoplastic and elastomer formulations have hydrophilic surfaces and are therefore incompatible or poorly compatible with polymers. The surface chemistry of aluminum hydroxide (ATH) and magnesium hydroxide (MDH) is characterized by the presence of large quantities of hydroxyl groups and a percentage of free moisture (0.1.-0.8 weight %). The surfaces of both materials are highly hydrophilic. Incompatibility between the inorganic additive and polymer often leads to incomplete dispersion of the additive in the formulation, and deterioration of physical properties, including mechanical properties and flame retardancy. Surface modified grades of ATH and MDH are used to overcome this problem.

Surface-modification technology is one of the core competencies of Huber's fire retardant additives business. Our halogen-free Hymod® ATH products have been a global leader for decades in terms of performance and pushing the boundaries required for improved mechanical and processing properties.

We achieve optimized product modification conditions based on staged product development and manufacturing scale-up. To meet the demanding requirements of our customers, we continue to look for opportunities to develop new products and to improve the quality and performance of our surface-modified materials.

Our surface-treatment science laboratory, pilot plant and two manufacturing facilities are dedicated to serving customers requiring surface-modified grades of ATH and MDH. These operations are in the US and Germany. If existing surface-treated products do not meet your requirements, Huber will work with you to design the ideal product for your specifications.

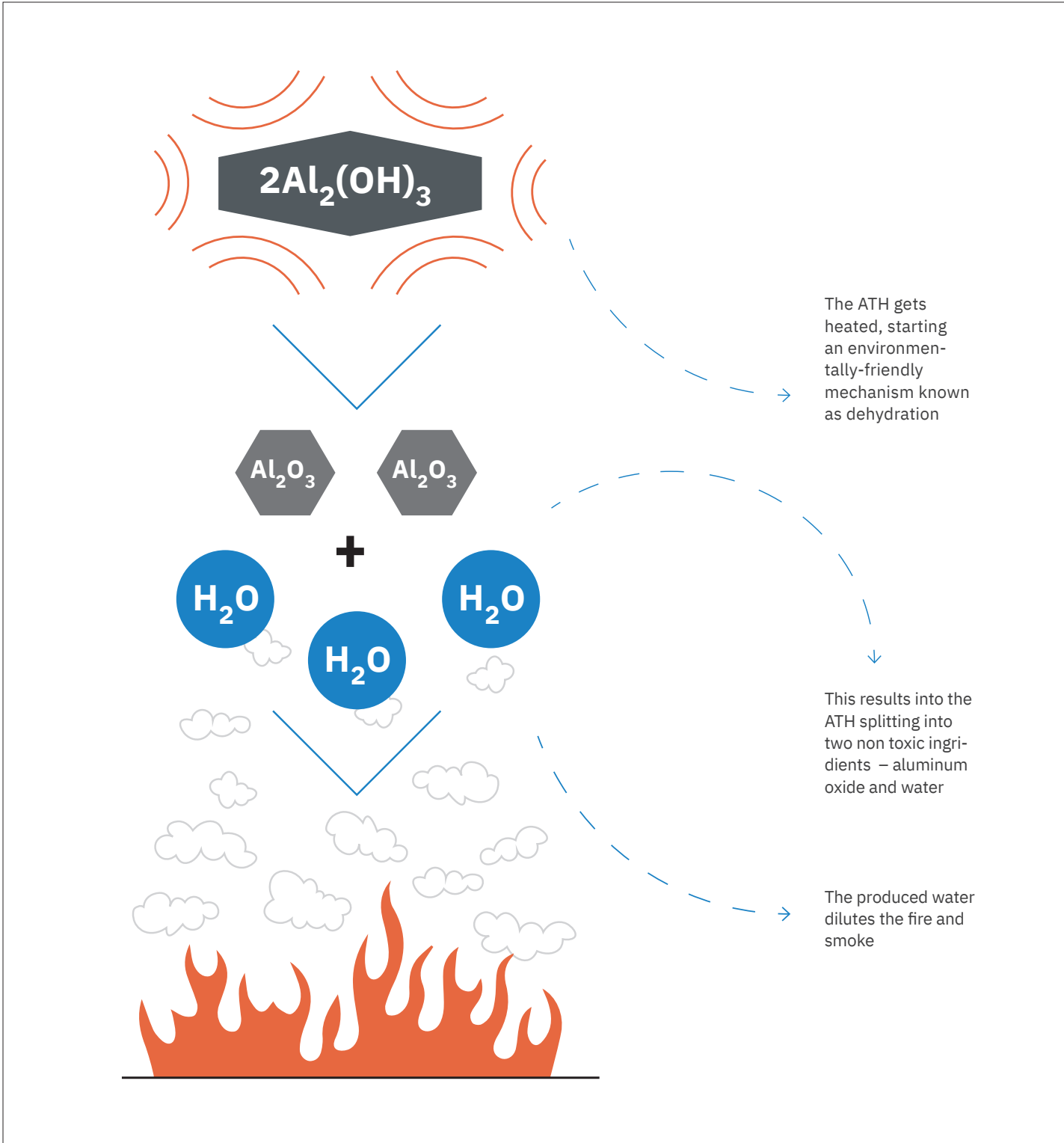


Key Benefits of Huber's Surface-Treated Hymod ATH Products

- ✓ Improved Compatibility with Polymers
- ✓ Better Wet-Out
- ✓ Lower Viscosity, Higher Loadings
- ✓ Higher Throughput Rate
- ✓ Reduced Absorption of Expensive Additives
- ✓ Improved Cure Properties
- ✓ Better Hydrophobicity
- ✓ Improved Mechanical Properties

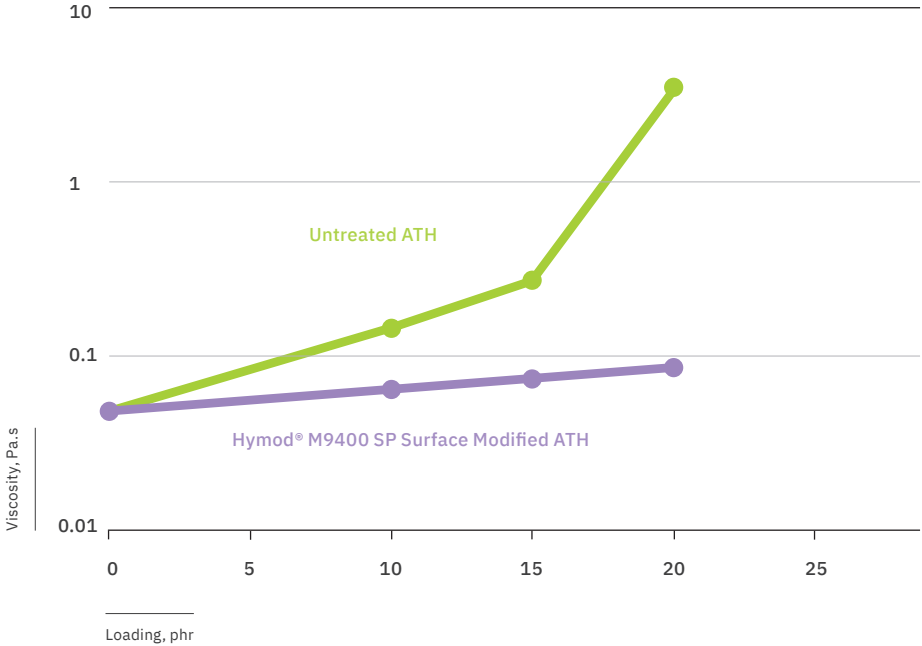
How Huber's **Precipitated** and **Surface-Treated ATH** Products Function

ATH decomposes in an environmentally-friendly mechanism known as dehydration. This endothermic reaction results in the formation of two non-toxic ingredients – aluminum oxide, which forms an inert residue, and water, which dilutes the smoke (see illustration below).



Surface modification delivers **significant benefits to polymer compounds**, including:

Improved Rheology



Surface modification drastically decreases the viscosity of ATH and silicone oil mixture

Untreated ATH and Hymod® M9400 SP vinyl-silane treated ATH in 50 cSt silicone oil mixture

Benefits of using Huber Advanced Materials surface modified grades vs. “in-situ” treatment

Some polymer processing companies elect to use untreated ATH materials in applications where surface modified grades are desirable. They add surface treatment chemicals (most often silane coupling agents) during compounding. These companies should consider the following benefits of using Huber’s surface modified grades of ATH:

1. Surface treatment is more uniform

Huber's surface modified products are engineered to achieve uniform surface treatment. Uniformity of the surface treatment is very difficult to achieve by adding surface treatment chemicals during the compounding process. Nonuniform surface treatment may lead to an undesirable variation in composite performance.

2. Less surface treatment chemical is used

“in-situ” surface treatment requires the addition of larger quantities of surface treatment chemical to achieve desired results. This may lead to the presence of unreacted chemicals in the formulation resulting in application problems.

3. No by-products released

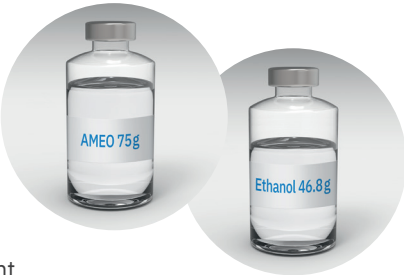
The reaction of silane coupling agents within the surface of ATH with free moisture generates large amounts of volatile by-products, normally methanol or ethanol (see table at right). These by-products may present health risks for employees, in addition to possible safety risks associated with detonation of alcohol vapors. The presence of alcohol in a polymer formulation can cause problems in the end-use application.

4. Handling of silanes is a challenge for manufacturing

Most silanes are hazardous chemicals, some of them are flammable. Silanes are also moisture sensitive. Silanes need to be stored in electrically grounded containers, preferably under controlled temperature conditions. By using Huber's surface treated grades of ATH and MDH, you avoid dealing with these potential problems.

5. Other benefits

- Fewer ingredients to handle
- Cleaner work environment (no liquid spills)



75 grams of Gamma-Aminopropyltriethoxysilane (AMEO) generates 46.8 grams of ethanol during hydrolysis

Amount of alcohol liberated from some common silanes

Silane	Amount of alcohol liberated from 100 lbs of silane
Vinyltriethoxysilane	72.6 lbs of ethanol
Isobutyltriethoxysilane	62.7 lbs of ethanol
Gamma-aminopropyltriethoxysilane	62.4 lbs of ethanol
Phenyltrimethoxysilane	48.5 lbs of methanol

Our surface science laboratory is available to assist our customers currently using “in-situ” treatments, with the selection or development of new surface treated products for their target applications



Huber's Comprehensive Hymod® and Micral® Product Portfolio

Product	Particle size, microns	Surface area, m²/g	Surface treatment	Typical applications	Performance benefits
Hymod® M9400 SP	1.3	4.0	Vinyl-silane	Silicone Rubber HVI	Improved mechanical properties; Increased water resistance; Improved low temperature properties
Hymod® M1500 SPD	1.5	9.5	Vinyl-silane	Wire & cable	Improved mechanical properties; Increased water resistance; Improved low tempature properties
Hymod® M632 SP	3.5	8.7	Vinyl-silane	Silicone rubber HVI	Improved mechanical properties; Increased water resistance; Improved low tempature properties
Hymod® SB632 ST1	3.5	8.7	Stearic acid	Aluminum sandwich panels; Rubber compounds	Improved processing for high throughput applications.
Hymod® M932 SP	2	14	Vinyl-silane	Silicone rubber HVI	Improved mechanical properties; Increased water resistance; Improved low tempature properties
Hymod® SB 136 SG	18.5	1.6	Alkyl-silane	Thermal management; Silicone compounds; Polyolefins	Lower viscosity allows for higher loading level; Polymer: increased water resistance
Hymod® SB 336 SE	15.5	1.8	Epoxy-Silane	Epoxy compounds	Lower viscosity allows for higher loading level; Better air release; Improved water resistance
Hymod® SB 432 SH2	9	2.5	Alkyl-silane	Cured in place pipes	Lower viscosity allows for higher loading level; Polymer
Hymod® SB 432 Hyflex	9	2.5	Silane, polyether functional	Pultrusion; Thermoset applications	Lower viscosity allows for higher loading level
Hymod® SB 432 SG	9	2.5	Alkyl-silane	Thermal management; Silicone compounds; Polyolefins	Lower viscosity allows for higher loading level; Polymer: increased water resistance
Hymod® SB 432 SP	9	2.5	Vinyl-silane	Silicone rubber HVI	Improved mechanical properties; Increased water resistance; Improved low tempature properties
Hymod® SB 432 ST1	9	2.5	Stearic acid	Aluminum sandwich panels; Rubber compounds	Improved processing for high throughput applications
Hymod® SB 36 SG	25	1.2	Alkyl-silane	Thermal mangement; Silicone compounds; Polyolefins	Lower viscosity allows for higher loading level; Polymer: increased water resistance

Our global footprint

The Huber Advanced Materials (HAM) SBU is a specialty chemicals business with a global, leading position in the development and production of halogen-free fire retardants, smoke suppressants, thermal management solutions, specialty aluminum oxides and organic matting agents and carriers touching lives and enhancing safety for millions of people around the world.

Americas

Fairmount, GA
Atlanta, GA
Kennesaw, GA
Marblehead, IL
Bauxite, AR

Europe

Bergheim, Germany
Breitenau, Austria

Asia Pacific

Qingdao, China



2

R&D Centers

6

Manufacturing plants

3

Customer Care
Centers



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