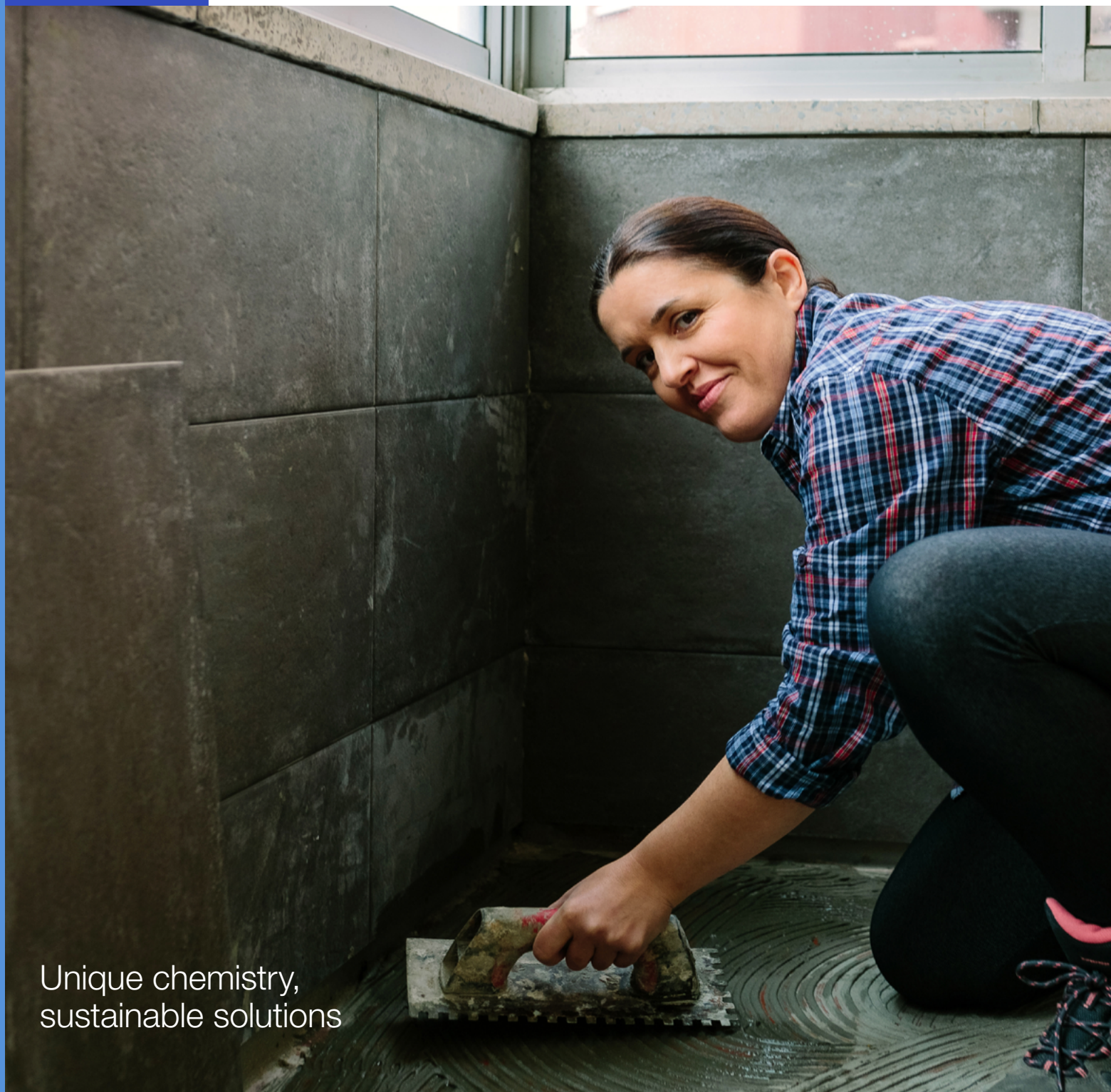
ELEMENTIS

Construction additives



Unique chemistry,
sustainable solutions

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Introduction

Elementis is a leading global producer of rheological additives and other surface related chemistries for a wide range of industries including construction, coatings and inks, adhesives and sealants and many others. It has ISO 9001 approved production facilities in the USA, Europe, Brazil, India and China. Elementis product range includes natural, clay-based and synthetic rheological additives for both aqueous and non-aqueous systems.

In construction systems such as mortars, renderings, stuccos, flooring systems and building adhesives, flow control is very important. The system performance and application behavior can be significantly improved by using clay-based thickeners in combination with cellulose ethers.

Elementis offers a range of rheological additives made from hectorite clay, sold under the brand names BENTONE® and BENAQUA®.

These products offer the following benefits:

- Workability and tooling
- Improved sag resistance
- Anti-settling properties
- Storage stability
- Improved pumpability & shear-thinning
- Anti-bleeding

Product overview

Elementis offers mainly hectorite clay-based additives to the construction industry. The range includes unrefined, refined and organically modified grades.

Rheological additives for construction systems

Product	Description	Form	% Active matter	Typical use level %
Hectorite based				
BENTONE® OC	Unrefined natural hectorite clay, 40 – 60% active hectorite, Ca-carbonate as gangue, brownish color	Powder	40-60	0.05 - 4.0
BENTONE® CT	Unrefined natural hectorite clay, min. 50% active hectorite, Ca-carbonate as gangue, white color	Powder	Min. 50	0.05 - 4.0
BENTONE® GS	Refined and beneficiated hectorite	Powder	100	0.05 - 3.0
BENTONE® LT	Organically modified refined hectorite	Powder	100	0.05 - 3.0
BENAQUA® 4000	Hectorite / polymer composite	Powder	100	0.05 - 3.0
BENAQUA® 5000	Hectorite / polymer composite	Powder	100	0.05 - 3.0
Other chemistries				
RHEOLATE® 1	Alkali swellable polyacrylate	Liquid	30	0.2 - 4.0
RHEOLATE® 101	Alkali swellable polyacrylate	Powder	100	0.05 - 2.0
RHEOLATE® 255	Polyether polyurethane	Liquid	25	0.2 - 4.0

Product overview

Selection chart Construction systems	BENTONE® OC	BENTONE® CT	BENTONE® GS	BENTONE® LT	BENAQUA® 4000	BENAQUA® 5000	RHEOLATE® 1	RHEOLATE® 255
Renderings / Plasters / Stucco								
- lime-cement	•	x	x		•	x		
- gypsum	•	x	x		•	x		
- emulsion (synthetic)		•	•		x	•		
Flooring / Screeds / Underlayments								
- gypsum anhydrate based	•	x	x					
Cement based grouts	•	x	x		•			
	•	x	x		•			
Title mortars / Adhesives								
- emulsion based (pre-mix)		•	•	•	•	x	•	
- cement based	•	x	x		•	x		
- emulsion / cement	x				•	x		
Emulsion based EIFS Mortars / Adhesives								
- pasty systems (pre-mix)		•	•		•	•	x	x
- powdered systems		•	•		•			
Asphalt systems								
- sealers	•		•			•	•	
- road repair (pourable / brushable)							•	•

• Best Choice
x Alternative

The selection chart is a guide to choose the right additive for a particular application. In some cases there is more than one choice depending on the exact properties the formulator would like to achieve.

Use of hectorite clay in construction systems

The hectorite clays can be used in a variety of construction systems to modify flow and application properties. They are used mainly in combination with cellulose ethers, however, they can compliment or partly replace cellulose ethers, especially the poly-mer-modified grades, for example BENTONE®LT or BENAQUA®4000. The ratios or substitution levels depend mainly on the thickening efficiency and water retention properties of the individual clay product.

Tile adhesives

- Sag resistance
- Improved workability

Tile adhesives are cement or polymer dispersion based systems. Rheological additives used for tile adhesives provide the right consistency for the application: improved workability, sag resistance, and water retention for the optimum hardening of cement and the control of open/correction times. Hectorite clay based additives may be combined with cellulose ether thickeners to improve the sag resistance and workability of tile adhesives.

The hectorite clay generates a stronger internal network, thus increasing the yield value of the tile adhesives to prevent sagging. Moreover the clay platelets reduce the stickiness on the tools and reduce the viscosity during application, which significantly improves the tooling properties.

Renderings / Plasters / Stuccos

- Improved workability and tooling
- Improved sag resistance
- Homogeneous surface

Renderings, plasters and stuccos are all special coatings for both exterior and interior walls and ceilings. Binders used can be hydraulic hardening cement, gypsum or liquid polymer dispersions. Hectorite clays improve the sag resistance of the renderings by providing a fast recovery of the viscosity after application. The pumping, workability and tooling require less energy due to the slip effect of the platelets reducing the friction between sand and cement particles. The stickiness on the steel float and trowel is reduced, which leads to smoother surfaces. Water resistance in polymer dispersion based plasters can also be improved by partial replacement of cellulose ether with hectorite clay.

In cement and gypsum based renderings/plasters, products llike BENTONE® OC are used in addition to cellulose ethers, which mainly control water retention and consistency.

EIFS

- Improved workability and tooling
- Improved sag resistance
- Improved pump-ability

A modern building technique is the use of exterior insulation and finishing systems (EIFS) for the thermal insulation of walls. They consist of expanded poly-styrene boards, which are adhered to the substrate, reinforced and coated with a finishing plaster.

The adhesive can be based on cement, powder or liquid polymer dispersions. The co-use of hectorite clay products like BENTONE®CT, BENTONE®GS, BENAQUA®4000, BENAQUA®5000 as partial cellulose ether replacements improves sag resistance and workability without negatively affecting adhesion strength.

Gypsum flooring

- Anti-settling
- Anti-bleed

Gypsum flooring is widely used in residential houses to cover the concrete floor. The self-levelling flooring builds the ideal surface for tiles, wood, carpets or other decorative floor coverings. Hectorite clays like BENTONE®OC are used as a stabilizer in gypsum flooring to prevent settling of coarse particles and reduce bleeding of water on the surface, leading to smoother finishes. Flooring systems, based on cement, are more difficult to stabilize with clays due to the high pH and the resulting reduced thickening effect.

Bituminous and asphalt systems

- Improved workability
- Improved sag resistance

Bituminous and asphalt emulsions are extensively used as waterproofing and sealing materials for buildings and roads. Workability and sag resistance are important properties which can be controlled by formulating with hectorite clays like BENTONE® OC or BENTONE® GS. The clays generate a stable viscosity for storage and the thixotropic flow behavior ensures excellent application properties.

Mineralogy

Hectorite is a member of the smectite group of minerals, a family of naturally occurring layered swelling clays. This family includes hectorite, bentonite (montmorillonite) and saponite. Hectorite and bentonite are the most important because of their availability and efficiency.

The morphological clays are layered silicates which can swell in water and are therefore widely used as rheological additives. The silicate platelets consist of three layers, two silicone dioxide layers embedding a metal oxide layer. The metal oxide layer in bentonite consists mainly of aluminium, whereas in hectorite the metal is magnesium. The surfaces of both hectorite and bentonite platelets are negatively charged because the divalent magnesium

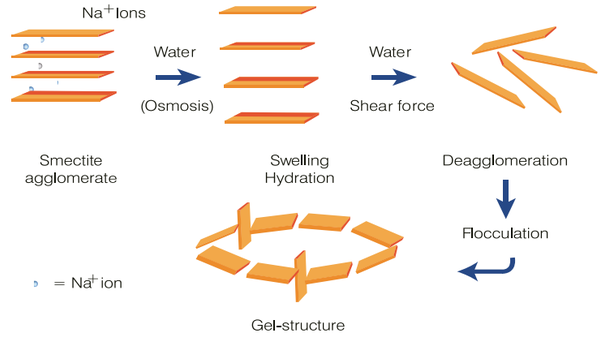
in hectorite is partly replaced by monovalent lithium, which results in a charge deficiency. Similarly, the aluminium in bentonite is partly replaced by magnesium. The negative surface charge is balanced by cations; in the case of Elementis' hectorite these are sodium ions. Bentonites, on the other hand, mainly occur in the calcium form, which reduces the swelling ability of the clay and its rheological efficiency.

The morphological differences result in different platelet shapes and sizes for hectorite and bentonite. The hectorite platelets are much smaller and elongated compared to the more equidimensional bentonite platelets. Hectorite clay has more platelets per gram providing greater swelling capacity and improved rheological efficiency compared to bentonite particles.

Thickening mechanism

In powder form the platelets are agglomerated into stacks (tactoids). In water, the platelets start to swell by hydration of the sodium cations and further mechanical shear can separate them from each other. Under ideal conditions (pH 7-11 and low electrolyte concentration) these dispersed platelets will form an open three-dimensional network by edge-to edge alignment which thickens the water phase.

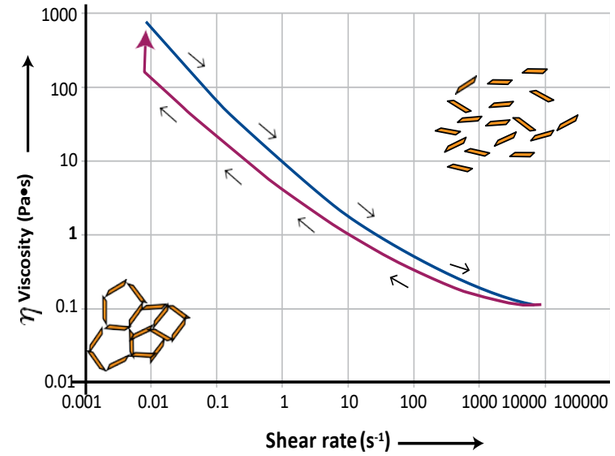
Thickening mechanism of hectorite products



Properties and performance characteristics

The flocculated network of the hectorite clay imparts thixotropic flow. At low shear rates the clay network generates a relatively high viscosity. When shear forces are applied either by mixing, pumping or trowelling, the network breaks down and the viscosity decreases enabling easy application. When the shear forces are removed, the platelets rebuild the original flocculated network and the viscosity gradually rebuilds. Furthermore, the individual clay platelets reduce the friction aggregate particles, which results in easier trowelling.

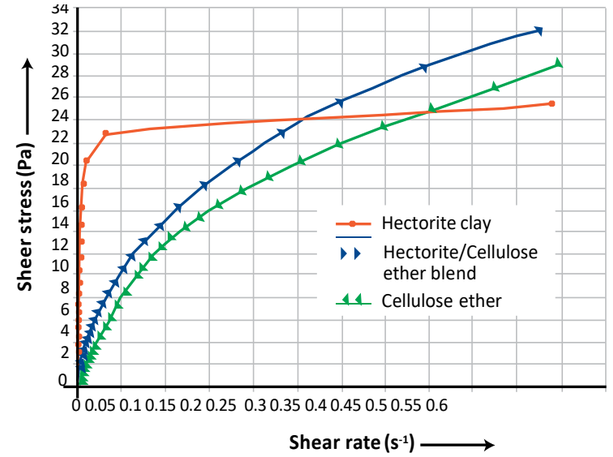
Rheology of hectorite clays in aqueous systems



Yield value

The strong network formation is used in construction products and other systems to modify flow behavior, to control sag on vertical substrates and sedimentation of solid particles. This performance is rheologically expressed as the yield value. The yield value is the minimum shear stress applied to a system to induce flow. Compared with cellulose ethers, (which do not have significant yield values). The hectorite clay builds a network with a high yield value. This improves sag and slump resistance and controls settling and bleeding.

Yield value

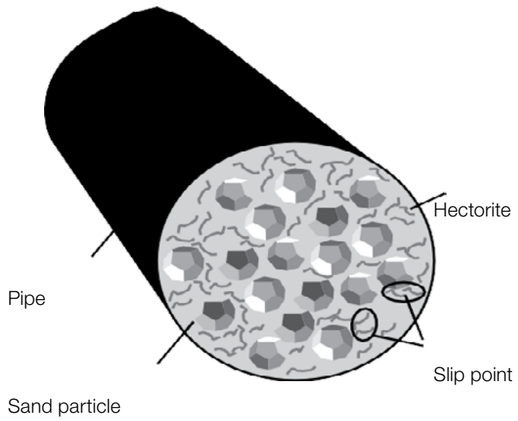


Influence of pH

The pure hectorite clays have a high thickening efficiency in the pH-range of 6-12. In systems outside of the above mentioned pH range, the hectorite losses performance. Due to the unique platelet structure, the clays improved workability, slip, and sag resistance in cementitious systems. The polymer-modified BENTONE® and BENAQUA® grades have higher thickening efficiency in stronger alkaline systems than the unmodified grades and can therefore partly replace cellulose ethers.

Slip effect

The improved workability and tooling in construction systems can mainly be attributed to the platelet structure which reduces the friction between aggregate sand and cement particles. The clay platelets can reduce stickiness on tools caused by cellulose ethers or re-dispersion powders and improves application behavior in respect to surface quality and application speed. In addition, the clay network breaks down when shear is applied to the system (via pumping, mixing, tooling) and the resulting viscosity is lower than cellulose ethers, thus improving the performance at high shear rates.



Construction defoamers

Elementis offers dry powder defoamers for use in products for the construction industry. Mortars, joint compounds, and cementitious blends that are mixed with water before use are the most common applications for this family of defoamers.

Dry defoamers are required and are particularly useful with vinyl, acrylic, and protein binders where typical liquid defoamers are not suitable. By using dry defoamers, a denser concrete can be obtained, thus improving the properties and appearance of the cured concrete.

For applications that require the addition of a liquid defoamer during water addition, DAPRO® DF 17, DAPRO® DF 19, DAPRO® DF 39, and DAPRO® DF 605 are recommended.

Product	Appearance	Bulk density lbs/cu ft	Application
DAPRO® Powder defoamers			
DAPRO® PD 801 S	Gray-white powder	27	Powdered antifoam developed to defoam entrained drywall joint compounds and other cement mixes
DAPRO® PD 801 W	Off-white powder	22	Outstanding antifoam for removing entrained air in powder applications
DAPRO® PD 827	Gray-white powder	21	Drywall joint compound, cement mixes
DAPRO® PD 829	Gray-white powder	29	Drywall joint compound; cement mixes; good with vinyl, acrylic, and protein binders

NOTE:

The information herein is currently believed to be accurate. We do not guarantee its accuracy. Purchasers shall not rely on statements herein when purchasing any products. Purchasers should make their own investigations to determine if such products are suitable for a particular use. The products discussed are sold without warranty, express or implied, including a warranty of merchantability and fitness for use. Purchasers will be subject to a separate agreement which will not incorporate this document.

For more details
please contact:

North America
Elementis
469 Old Trenton Road
East Windsor
NJ 08512, USA
T +1 609 443 2500

Europe
Elementis UK Ltd
c/o Elementis GmbH
Stolberger Strasse 370
50933 Cologne, Germany
T +49 221 2923 2066

Asia
Deuchem (Shanghai)
Chemical Co., Ltd.
99, Lianyang Road
Songjiang Industrial Zone
Shanghai, China 201613
T +86 21 577 40348

elementis.com

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