GYPSUM
– a modern building material
Forward-looking solutions for your customers

AkzoNobel –
Your dedicated partner for gypsum building products
AkzoNobel is the biggest paints and coatings company in the world and a leading producer of specialty chemicals. Our Performance Additives business unit (part of our Functional Chemicals business) is made up of two reliable world class brands in the building and construction industry.

BERMOCOLL® and ELOTEX® are world leaders in their field: making performance enhancing additives and solutions for the dry and ready-mixed mortar industry.

We have more than 50 years of experience in powder technology. This allows us to develop special products for you in order to provide you with Tomorrow’s Answers Today.

BERMOCOLL® is very keen on the EHEC and MEHEC technology which is widely used in paints and construction building materials. BERMOCOLL® products are based on cellulose, which is a natural polymer found in wood pulp and cotton linters. We use a process known as etherification to change the water insoluble cellulose into the water soluble ethers ethyl hydroxyethyl cellulose and methyl ethyl hydroxyethyl cellulose. These cellulose ethers are not only used in the paint industry, they are also very important for the dry and ready mix mortar industry to:

- Increase water retention
- Make thin layer products workable
- Provide suitable consistency
- Prevent separation
- Improve adhesion on porous surfaces
ELOTEX® is very knowledgeable when it comes to the crucial steps of the production and processing of water based latex dispersions. These are based on monomers such as vinyl acetate, vinyl versatate, ethylene and acrylate, which are turned into a free-flowing redispersible powder using our spray dry technology. These so-called polymer powders are mainly used in the dry mix mortar industry to:

- Improve mortar workability
- Increase adhesion to various surfaces
- Reduce rigidity and provide flexibility
- Increase surface abrasion resistance
- Reduce water absorption
- Ensure long term durability

The combined strength of BERMOCOLL® and ELOTEX® Specialty Additives will set us apart from our competitors in the market and will make it possible for you to develop unique products in your own market. Unique solutions developed by us over the last ten years include:

- Specialized construction starch ether
- Silane based hydrophobic additives
- Flooring compound additives
- Efflorescence reduction additives
- Anti corrosion additive
- Unique polystyrene adhesive
- Air entraining additive
- Stain resistant additive

Experience the difference.
Global warming is an increasing concern. The biggest contributor to this is CO₂ emissions, and the carbon footprint of construction and building materials is currently under investigation. Cement used in construction is responsible for 4% of global CO₂ emissions. The CO₂ emissions from gypsum, however, are very low, and it can therefore be considered as an environmentally friendly construction material. Furthermore, a large percentage of the gypsum used today is based on synthetic gypsum. This is a by-product of power stations and the fertilizer and detergent industry. Gypsum is also infinitely recyclable, although some energy is used to process and transport it.

As if these ecological advantages were not enough, gypsum also offers many additional advantages as a building material due to its superior performance. Prefabricated boards or blocks of the raw material allow for faster construction of fire-resistant interior walls and divisions which offer thermal and sound insulation as well as room moisture balance for increased everyday comfort in both public and private buildings. Gypsum based leveling plasters and decorative finishes also offer the same advantages. The versatility of gypsum based materials also allows architects, building owners and decorators to design attractive features for modern interiors. Large joint-free gypsum based floor leveling compounds speed up the finishing process, ideal for use with underfloor heating systems or in colder climates.

The use of gypsum products also allows us to earn credits or points towards achieving a higher Green Building Rating.

The only disadvantage of using gypsum in building materials is its sensitivity to moisture which causes the structure of the gypsum to break down. Through the use of modern building chemicals, however, even problems such as these can be overcome with the help of our products and experts.

All this combines to make gypsum based building materials ideal for use in sustainable building construction and renovation projects.
People have been using natural gypsum in building construction for thousands of years. It was first discovered and used in the Middle East. Since then, its usage has spread throughout the world. At first, gypsum was used as masonry mortar and plaster, but later people started to use it to make decorative ornaments as well. Knowledge of moisture protection techniques even allowed it to be used for exterior applications. Nowadays, natural gypsum is mainly used as plaster.

Over the last few decades, synthetic gypsum has increasingly been used in modern building materials. Most of the synthetic gypsum used is a by-product of electricity production in coal-fired power plants. During the production of power, a large amount of flue-gas desulfurization gypsum (FGD) is produced as a result of pollution treatment. There are other synthetic gypsums of less importance such as Phosphor gypsum, Titan gypsum, Citro gypsum and others, which are by-products of other chemical processes. Synthetic gypsum is mostly used in plaster and fiber boards.

Gypsum is actually the mineral calcium sulfate. Its chemical name is calcium sulfate dihydrate (CaSO$_4$ · 2H$_2$O).

Different types of gypsum can be produced by changing the temperature of the calcining process and the way in which it is carried out. Higher temperatures generally lead to a reduced reaction with water. The main types of gypsum are:
α-calcium sulfate hemihydrate (α-CaSO₄ • ½ H₂O) from autoclave production at a temperature of around 100–150° C. Crystalline structure requires less mixing water, delivers higher final strength. Used for molding plasters and floor troweling and leveling compounds.

β-calcium sulfate hemihydrate (β-CaSO₄ • ½ H₂O, Bassanite, Stucco) is produced at 130 –160° C in a rotary kiln or kettle. Amorphous structure requires more mixing water, delivers lower strength. Used for plastering applications and filling compounds.

α-Anhydrite III (α-CaSO₄) from autoclave production. β-Anhydrite III (β-CaSO₄) from rotary kiln or kettle production. Fast formation of hemihydrate phases. Used for plastering applications.

Anhydrite II (CaSO₄) comes in 3 types (Anhydrite II, IIu, IIE) and is made at temperatures of over 200° C. Slow formation of insoluble hydrate phases. Used in screeds (must be accelerated).

Anhydrite I (CaSO₄) is produced above 1180° C. Used as an additive in screeds.

Multiphase gypsum is produced by modern calcination processes and includes all kinds of calcium sulfates.
Today’s construction market is very demanding. Buildings must be finished more quickly, at a higher quality and with longer durability, all at a reasonable cost and using sustainable materials. Gypsum based materials are ideal for this. The following materials and applications are widely used in the construction industry and show great future potential:

**Gypsum plaster and fiber boards**
These boards are commonly used in private houses and public buildings as indoor walls, ceilings and floors. Their main advantage is their quick dry installation. They also offer excellent thermal and acoustic insulation, as well as fire-resistance.

**Massive gypsum wall blocks and ceiling tiles**
These blocks and tiles are commonly used in private houses and public buildings as indoor walls, ceilings and floors. Their main advantage is their quick dry installation. They also offer excellent thermal and acoustic insulation, as well as fire-resistance.

**Gypsum adhesives**
Gypsum adhesive mortars are mainly used to bond gypsum blocks together or as plasters to bond plaster/fiber boards to solid walls made from concrete or brick, etc. Gypsum based ceramic tile adhesives are also available.

**Gypsum jointing compounds**
Gypsum based filler materials are used between board divisions and for filling holes. A special paper tape or a fiber mesh is often placed into the jointing compound mortar as reinforcement between the boards.
Gypsum or anhydrite screeds

Gypsum or gypsum-lime based undercoat

Gypsum or gypsum-lime based final coat

Gypsum based building plasters
Plasters based on gypsum or combined with hydrated lime are commonly used as interior leveling plasters for walls and ceilings. They are applied using a spray machine to increase efficiency.

Gypsum smoothening or decorative plasters
Selected types of gypsum and fillers, applied in thin layers, are used to create an aesthetically pleasing atmosphere. The final wall and ceiling surface can be either very smooth or can have a decorative pattern.

Gypsum based floor screeds
Thick layer leveling compounds for indoor applications to ensure level floor construction. In colder countries, modern heating systems can even be integrated into the screed system.

Gypsum based floor leveling compounds
Gypsum based thin layer floor leveling compounds are used to ensure that the floor is level and smooth.

Gypsum plaster for casting moulds
Special natural Gypsum plasters are used for moulds in the ceramic and pottery industry as well as to make decorative ornaments.
CURRENT SITUATION REGARDING STANDARDIZATION OF GYPSUM BUILDING MATERIALS

After a good start which saw gypsum and gypsum products being standardized by the International Standard Organization (ISO) under Technical Committee TC 152 “Gypsum, Gypsum plasters and Gypsum products”, the work is currently on hold and no ISO standards have been put in place.

At the moment, there are many different standards and regulations in place for gypsum and gypsum products, both regionally and country-wide.

In Europe, the CEN (Centre Européen de Normalisation) uses Technical Committee TC241 to regulate gypsum and gypsum based products. The following are some published key EN standards for gypsum products:

- EN 520 Gypsum plasterboards
- EN 12859 Gypsum blocks
- EN 12860 Gypsum based adhesives for gypsum blocks
- EN 13279 Gypsum binders and gypsum plasters
- EN 13454 Binders and factory made mixtures for floor screeds based on calcium sulfate
- EN 13915 Prefabricated gypsum plasterboard panels with a cellular paperboard core
- EN 13950 Gypsum plasterboard thermal/acoustic insulation composite panels
- EN 13963 Jointing materials for gypsum plasterboards
- EN 14190 Gypsum plasterboard products from reprocessing
- EN 14246 Gypsum elements for suspended ceilings
- EN 14496 Gypsum based adhesives for insulation composite panels and plasterboards
- EN 15283 Gypsum boards with fibrous reinforcement

Current information on EN standards can be found on the CEN/TC241 website: http://www.cen.eu/cen/Sectors/Sectors/Construction/Pages/Workprogramme.aspx

In America, the ASTM (American Society for Testing and Materials) regulates gypsum and related building materials and systems through Technical Committee C11. The following are some key ASTM standard chapters relating to gypsum products:

- C11.01 Specifications and Test Methods for Gypsum Products
- C11.02 Specifications and Test Methods for Accessories and Related Products
- C11.03 Specifications for the Application of Gypsum and Other Products in Assemblies

Current information on ASTM standards can be found on the C11 subcommittee website: http://www.astm.org/COMMIT/SUBCOMMIT/C11.htm
In Russia, the GOST (Standards of the Soviet Union) is today managed by the EASC (Euro-Asian Standardization Council) of CIS (Commonwealth Independent States). Below some published GOST key standard chapters for gypsum products.

GOST R 51829 Gypsum Fiberboards.
GOST 6267-97 Gypsum Plasterboards.
GOST 6428-83 Gypsum Boards for partitions.
GOST 125-79 Gypsum Binders
GOST 31376 Gypsum Binder based Dry Mortars for Construction
GOST 31386 Gypsum Binder based Dry Adhesive Mortars for Construction
GOST 31387 Gypsum Binder based Dry Putty Mortars for Construction

In China following building material industry standard are in place for Gypsum products.

JC/T 517-2004 all types of Gypsum plaster
JC/T 1025-2007 gypsum binder (adhesive mortar)
JC/T 1023-2007 gypsum based flooring compounds
JC/T 1024-2007 decorative renders and plasters

In Japan following Japanese Industrial Standards (JIS) are in place for gypsum products.

JIS A6901; Gypsum boards
JIS A6904; Gypsum plasters

For further information on regional standards for gypsum and gypsum products please feel free to get in touch with one of our sales or technical experts.
Even when gypsum was in its infancy as a building product, people knew that certain properties could be changed using different techniques. Depending on the intended use of the gypsum, its final properties could be influenced during the selection of the rock itself, by its burning temperature, ground particle size, or through the use of fillers, retarders and accelerators. The gypsum product could then be further modified at the construction site. Examples of this would be the addition of fibers (e.g. straw, horse hair, etc.) to increase resistance, gypsum stone filler to increase strength, or proteins to increase the time that the gypsum product took to set.

During the 19th century, more and more knowledge was built up on how to manufacture building materials (the development of cement, for example) as well as on chemicals and chemical modifications of building materials.

Today we know that there are two main classes of additives for gypsum and gypsum building products.

Additives which influence:
- The viscosity of the gypsum, for example starch ethers, plasticizers, fibers
- the water retention of the gypsum, for example cellulose ethers
- the adhesion and cohesion force, for example latex or polymer powders
- the density and volume size, for example air entraining or defoamer additives

Chemical additives which influence the setting time of gypsum:
- Setting accelerators
- Setting retarders

Furthermore there are some additional additives with different functions and properties:
- Anti-fungal additives
- Anti-corrosion additives
- Color pigments
- Hydrophobic additives
Today, cellulose ethers are used in a very wide range of products in various industries such as agriculture, pharmaceutics, food, paint and construction. In construction, cellulose ethers are used in cement and gypsum based mortars, like plasters, adhesives, jointing compounds and floor screeds.

Cellulose ethers are the most important additives for:

- Viscosity and mortar consistency, even at different temperatures
- Water retention for excellent workability and proper curing
- Improved adhesion to substrate and surface material of bonding product

Cellulose ethers are based on cellulose, which is a natural polymer derived from wood or plant fibers. The following main cellulose ether groups are obtained through a chemical substitution process known as etherification:

- Ethyl Hydroxyethyl Cellulose (EHEC)
- Methyl Ethyl Hydroxyethyl Cellulose (MEHEC)
The BERMOCOLL® product portfolio offers you a wide product range from pure cellulose ethers to highly modified cellulose ethers. The viscosity range also ranges from low, e.g. for use in flooring compounds, to very high, e.g. for use in high suction substrates. As well as products for the dry mix mortar industry, there are also soluble retarded cellulose ethers for use in pastes.

The main BERMOCOLL® building and construction cellulose ethers for gypsum building products are from the following product lines:

CCA grades based on EHEC technology with the best balance between water retention and workability. The CCA grades are modified to prevent slip/sagging on vertical surfaces and prevent lump formation in the wet mixing stage. These are products for every gypsum based application.

CCM grades are based on MEHEC technology, giving the highest viscosity and best water retention of all BERMOCOLL grades. All CCM grades are modified to fit certain applications like hand, machine or mounting plaster.

BCM grades are based on MEHEC technology and differ from CCM in degree of substitution. These products are mainly used in gypsum based jointing compounds.

EBM grades are based on MEHEC technology from our experiences of paint applications and only used in pasty products, like latex based jointing compound. EBM grades are not influenced by other raw materials in the pasty product and give very stable shelf life.
Today, aqueous polymer dispersions and spray dried redispersible polymer powders made from aqueous polymer dispersions are used in several industries, such as paints, adhesives, plastics and construction materials. In construction, these polymers are often used for gypsum smoothing/decorative plasters, jointing compounds and adhesives.

Polymer powders are important additives for:

- Viscosity and consistency improvement enabling better workability
- Adhesion improvement, second binder to substrate and bonding product
- Reduced rigidity, improved flexibility
- Increased surface abrasion resistance
- Improved durability

Synthetic aqueous polymer dispersions are made from petrochemical monomers using emulsion polymerization technology. In an additional step, the emulsion is spray dried to form the redispersible polymer (latex) powders. Depending on the monomer composition, manufacturing technology and modification, several product properties can be achieved.

In general, the following main monomers provide the following properties:

- Vinylacetate (VA) high strength in dry conditions
- Vinylversatate (Veo Va) high flexibility, high water resistance
- Ethylene (E) very high flexibility, good water resistance
- Acrylate (Ac) high flexibility, high water resistance
ELOTEX® has been well known in the dry mix mortar industry for its redispersible polymer powder technology. This includes innovative technologies such as core shell technology.

The ELOTEX® product portfolio offers you a wide range of products with many different monomer compositions and modifications. Additional modification of certain grades can improve, for example, the compatibility with superplasticizers, provide higher water resistance and surface water repellence, and can provide higher thixotropicity for wall and overhead application.

The main ELOTEX® redispersible polymer powders for gypsum building and construction products are from the following product lines:

**AD Vinylacetate homo polymers with very high dry adhesion strength**

**MP Multi-purpose co-polymer products based mainly on Vinylacetate/Ethylene**

The dosage of ELOTEX® redispersible polymer powders can be as low as 0.5% or more than 5%, depending on the properties needed for application and the layer thickness.

In order to select the correct product for your intended application, please consult the included product selection guide, visit our website, or, even better, get in touch with one of our sales or technical experts.
Besides the two key additives already mentioned (cellulose ether and redispersible polymer powder used in the dry mix mortar industry), there are several additional additives to improve the raw and final properties of construction mortars and building materials, including gypsum based products.

We at AkzoNobel can offer you a range of special additional additives for building and construction materials from our Performance Additive Building & Construction unit. Alongside our special products for cement-based materials, we also have several specialty products for gypsum based materials. The following is a list of our innovative specialty products with short product descriptions:

**ELOTEX® ELOSET**
Starch ethers based on chemically modified maize or potato starches are widely used as thickeners for gypsum plasters to improve workability and yield. Depending on the type of starch used, linear increase in viscosity with increasing dosage or non linear, the dosage is usually very low and can range from 0.01% to 0.20%

**ELOTEX® SEAL**
Encapsulated silane-based powders for highest water repellency and lowest water adsorption. Special grades can even make gypsum based products highly moisture resistant. Dependant on the grade, application or material, the dosage can be from 0.1% to 0.5%.

**ELOTEX® FLOW**
Based on the latest generation of polycarboxylate superplasticizer technology we can provide you with various products for flooring compounds and screeds, even for gypsum based products. Dependant on the grade, application or material, the dosage can be from 0.1% to more than 1%.

**BERMOCOLL® AEA**
Non-ionic, powder surfactants are used as an air entraining agents. Air entraining agents are widely used in gypsum plastering for improved workability and to enable improved spray machine pump ability. The AEs are very powerful and the dosage is usually very low at around 0.01%

In order to select the correct product for your intended application, please consult the included product selection guide, visit our website, or, even better, get in touch with one of our sales or technical experts.
Within AkzoNobel and Performance Additives Building & Construction we have organized our sales organization and technical centers worldwide in such a way as to allow us access to the full range of equipment needed to undertake the required testing in accordance with current specifications. This also gives us the flexibility to adapt customer tests.

Our sales people have years of business excellence, and our technical staff have decades of expertise and experience in the area of formulation development, testing and assessment.

BERMOCOLL® and ELOTEX® offer you, our customer, a first-class technical service, including advice and laboratory work in developing and optimizing appropriate products, whilst always taking the regional raw material situations and requirement profiles into consideration. Gypsum products, particularly dry mortar materials based on gypsum, are complex formulations using numerous raw materials and additives that can vary depending on the requirement profiles and the local raw material situation.

Are you curious to get “Tomorrow's Answers Today”?

water droplet on gypsum surface