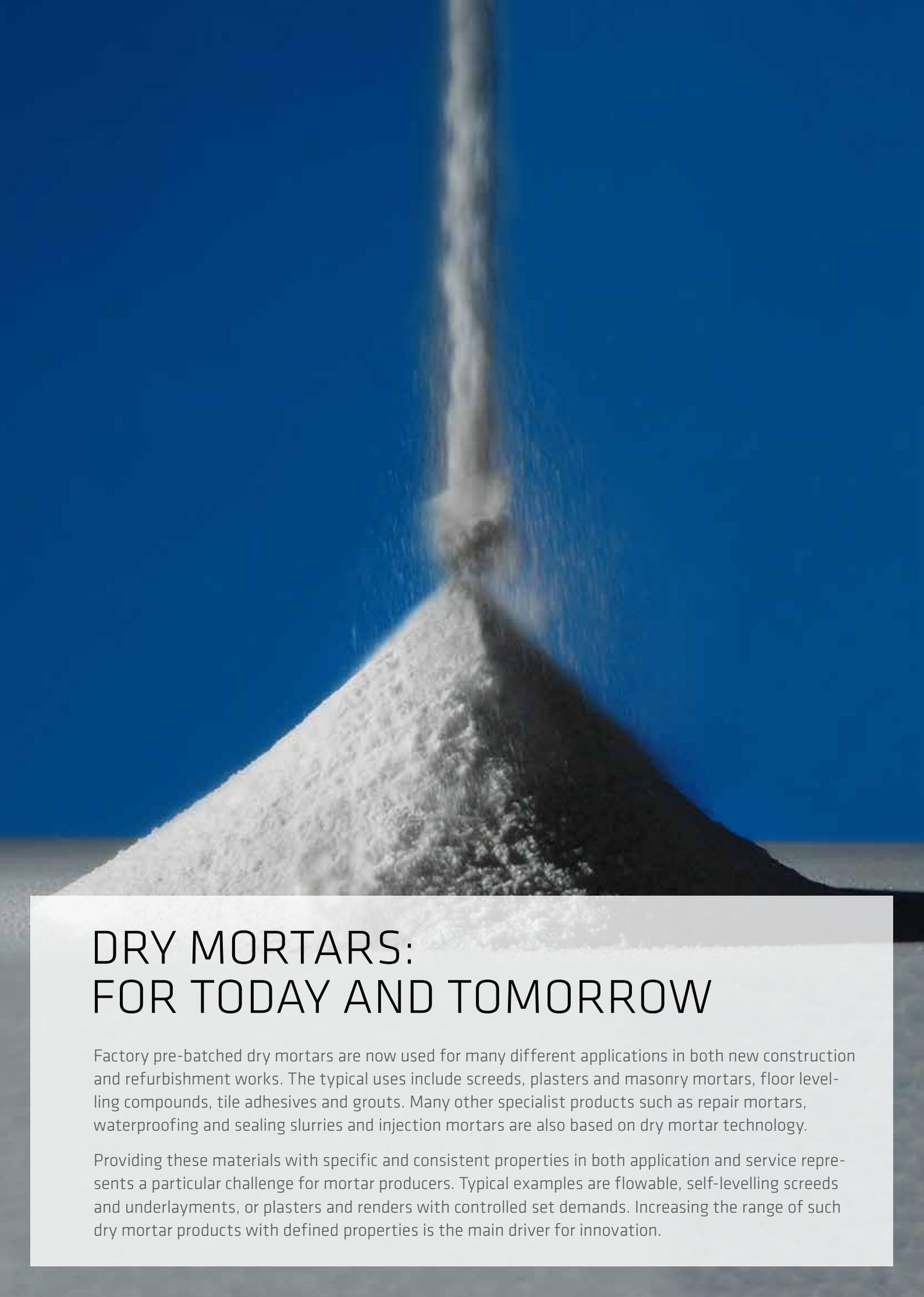




DRY MORTAR SIKA PERFORMANCE ADDITIVE TECHNOLOGIES

BUILDING TRUST





DRY MORTARS: FOR TODAY AND TOMORROW

Factory pre-batched dry mortars are now used for many different applications in both new construction and refurbishment works. The typical uses include screeds, plasters and masonry mortars, floor levelling compounds, tile adhesives and grouts. Many other specialist products such as repair mortars, waterproofing and sealing slurries and injection mortars are also based on dry mortar technology.

Providing these materials with specific and consistent properties in both application and service represents a particular challenge for mortar producers. Typical examples are flowable, self-levelling screeds and underlayments, or plasters and renders with controlled set demands. Increasing the range of such dry mortar products with defined properties is the main driver for innovation.

SIKA ADDS VALUE TO YOUR DRY MORTARS

IF THE PRODUCTION OF CONSISTENT, high performance, yet cost-effective dry mortar formulations is your goal, then Sika's performance powder additives are ideal. To ensure the desired application and service properties, today's dry mortars need to be balanced multi-component systems, in which each ingredient has to perform, and reliably. Individually developed formulations ensure high efficiency with maximum security of performance, and also allow the use of modern mixing and pumping equipment.

With more than 100-years' experience in concrete admixtures and mortars with liquid and powdered performance additives, Sika is a highly competent partner for your dry mortar business. We understand the challenges of cost and variable raw-materials, as well as the increasingly strict health and environmental legislation. Sika provides you with professional technical and commercial support, including timely delivery of high-quality products – all tailored to achieve your specific requirements and maximize your plant's profitability.

Our tailored customer solutions include

- Competent and specific product recommendations
- Preliminary tests in our own mortar laboratories
- Adaptation of your mix designs
- Tailoring specific additive blends
- Support in your laboratory, your plant and on site

SUSTAINABILITY AND COST OPTIMIZATION

Next to performance and cost saving, sustainable production is an ever-present topic today, and gaining increasing importance in the dry mortar industry.

Several proactive measures can be taken to save resources and also costs, including the implementation of optimized mix-designs using combinations of innovative additive technologies.

As is generally known, the production of Portland cement (OPC) – the major dry mortar component – generates a significant share of world-wide CO₂ emissions. Accordingly, the environmental sustainability, as well as the cost-performance of dry mortar formulations, can be improved by reducing the cement content and also by the replacement of some of the OPC with other materials. In addition to the potential to improve the performance and durability of a mortar, this can be a major measure to reduce the product's carbon footprint over its entire service. A key element of this is also reducing the water demand with innovative additive technologies such as Sika® ViscoCrete®. Additionally, by being free of formaldehyde, these solutions can meet or exceed the requirements of the latest health and safety standards.

As a result, Sika provides dry mortar producers with sustainable and cost optimized solutions to add increased value to their products.



SUPERPLASTICIZERS

SIKA® VISCOCRETE® POWDERS ARE extremely efficient liquefiers which are readily tailored for performance products such as self-levelling and pumpable screeds, as well as underlayments, non-shrink grouts, repair mortars and plasters.

Today Sika is a leading producer of PCE-based plasticizers, with our own network of Sika® ViscoCrete® production sites worldwide, and we have truly international dry mortar experience in numerous different applications.

Sika® ViscoCrete® technology is based on PCE, which was one of our own innovations in the late 1990's. 'PCE' stands for PolyCarboxylate Ether and describes a polymer which is actually similar to a comb in shape. The backbone of the comb consists of a polycarboxylic acid (polycarboxylate) and the teeth of the comb are made of polyether chains. In a comparable way to conventional plasticizers PCE molecules are adsorbed onto the surfaces of solid particles via the polycarboxylic acid in their backbone. However, the side chains are not adsorbed but extend into the aqueous solution and prevent the convergence of solid particles. This effect is known as dispersal through steric hindrance. By varying the specific PCE polymer structure, the properties of the resulting superplasticizing liquid or powder can be adjusted and modified to suit different requirements. The main parameters which are varied are the length and nature of the polycarboxylic acid backbone and the length, number and type of side chains used.

In these and other ways tailor-made solutions for many different applications and binder systems, including different cements, calcium sulfate and ternary binder systems can be provided. This in turn allows the additive and thereby the finished dry mortar products essential characteristics to be precisely tailored to their respective application and requirements, particularly in terms of:

- Polymer adsorption
- Liquefaction and water reducing capacity
- Stickiness/stability/viscosity/flow
- Workability and setting characteristics
- Strength development
- Robustness with respect to variations in water content, temperature and quality of raw materials



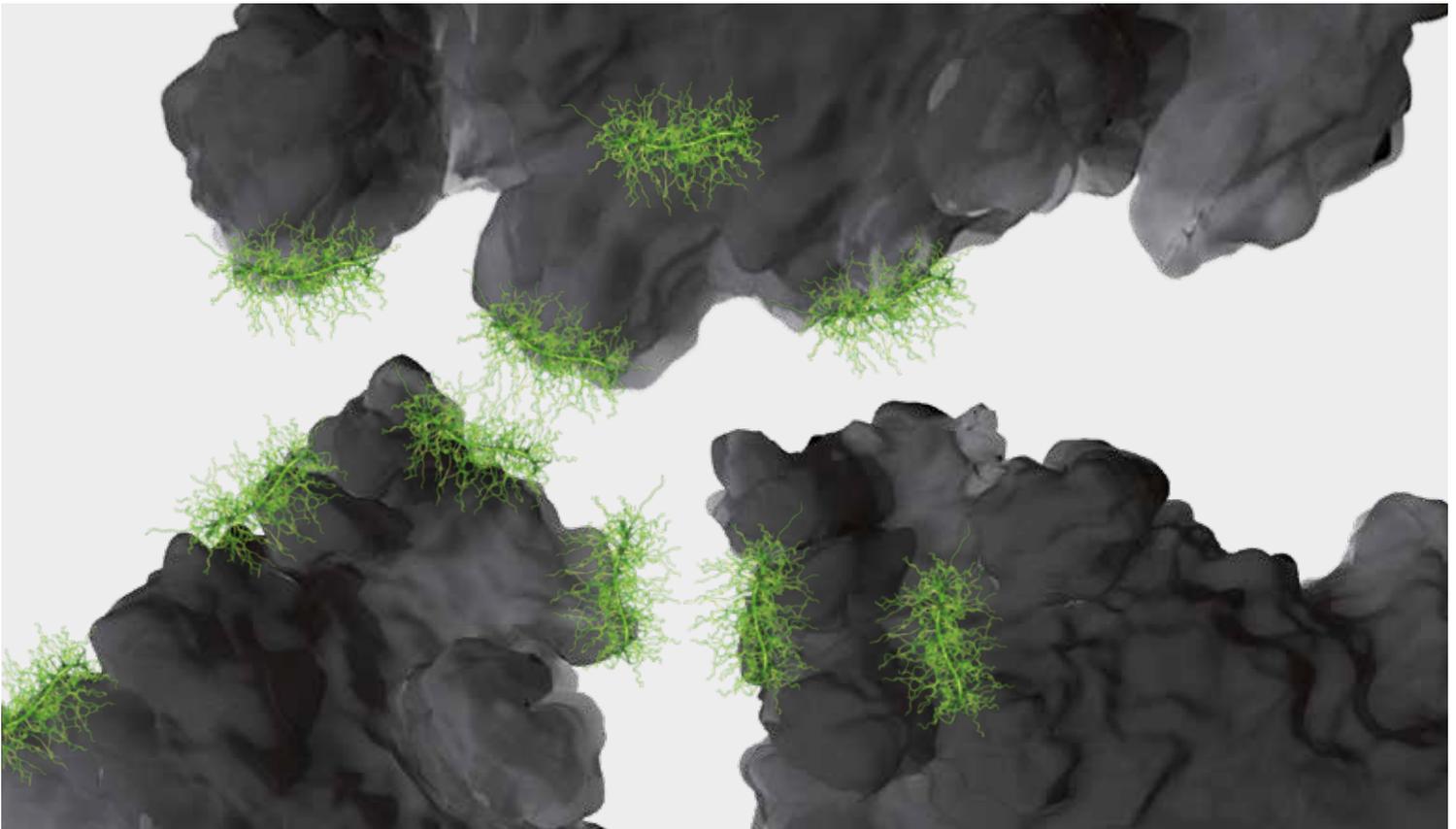
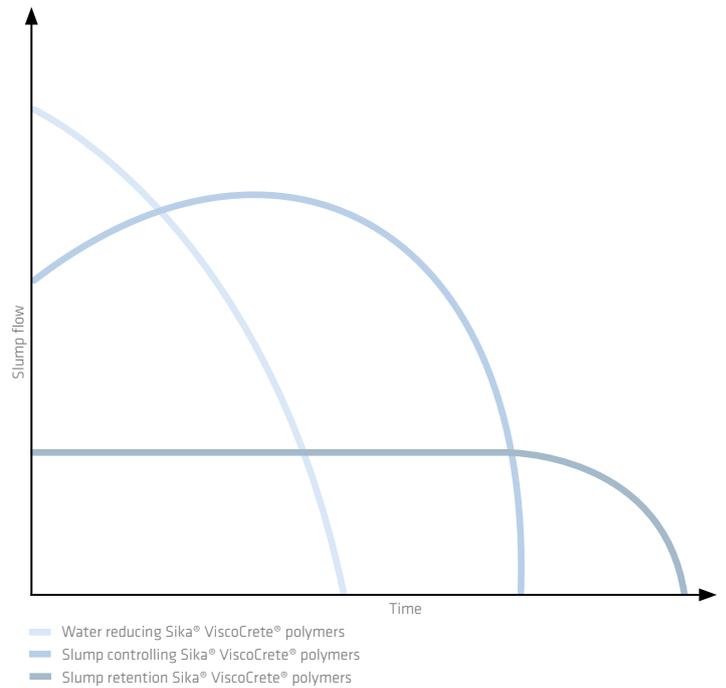
KEY FACTORS FOR THE SUCCESS OF THE SIKA PCE TECHNOLOGY

- Tailor made designs for specific requirements
- High water reduction
- High liquefaction
- Strength increase
- Shrinkage reduction
- No release of formaldehyde
- Improved cost performance

POWDERED OR LIQUID SUPERPLASTICIZERS?

For processing reasons, concrete admixtures are classically defined and produced as polymer dilutions in water, usually containing a defoaming agent to prevent or reduce possible aeration and 'foaming' during mixing and placing. Powdered superplasticizers for dry mortars and other applications do not typically contain defoamers (unless otherwise requested). This enables the adjustment of the air content of the mixed final mortar product to be made according to the application and performance requirements.

Principle consistency curves of PCEs



RETARDERS

RETARDERS ARE TYPICALLY USED to delay the onset of setting or to increase the setting time and thereby also to increase the available processing or production times of gypsum, cement and other mineral binder systems. The Sika Retardan® range includes very effective gypsum retarders that have been used very successfully in a wide range of dry mortars for many years.



Sika Retardan® TECHNOLOGY

Sika Retardan® products are very effective gypsum (calcium sulfate binder) retarders, characterized by low dosage and high retardation effects. They give excellent performance for the adjustment of the setting and workability time with a variety of different calcium sulfate binders. Sika Retardan® is compatible with typically used mix-design components including other set-controlling agents.

The mode of action of Sika Retardan® is based on targeted intervention in the process of gypsum crystallization. By adsorption on the gypsum crystal surfaces the further integration of calcium and sulfate ions is blocked. Thus gypsum crystal growth, and thereby setting and hardening, are retarded for a certain period of time (dependent on additive dosage).

Sika Retardan® additives are valued for their especially well-defined retardation effects:

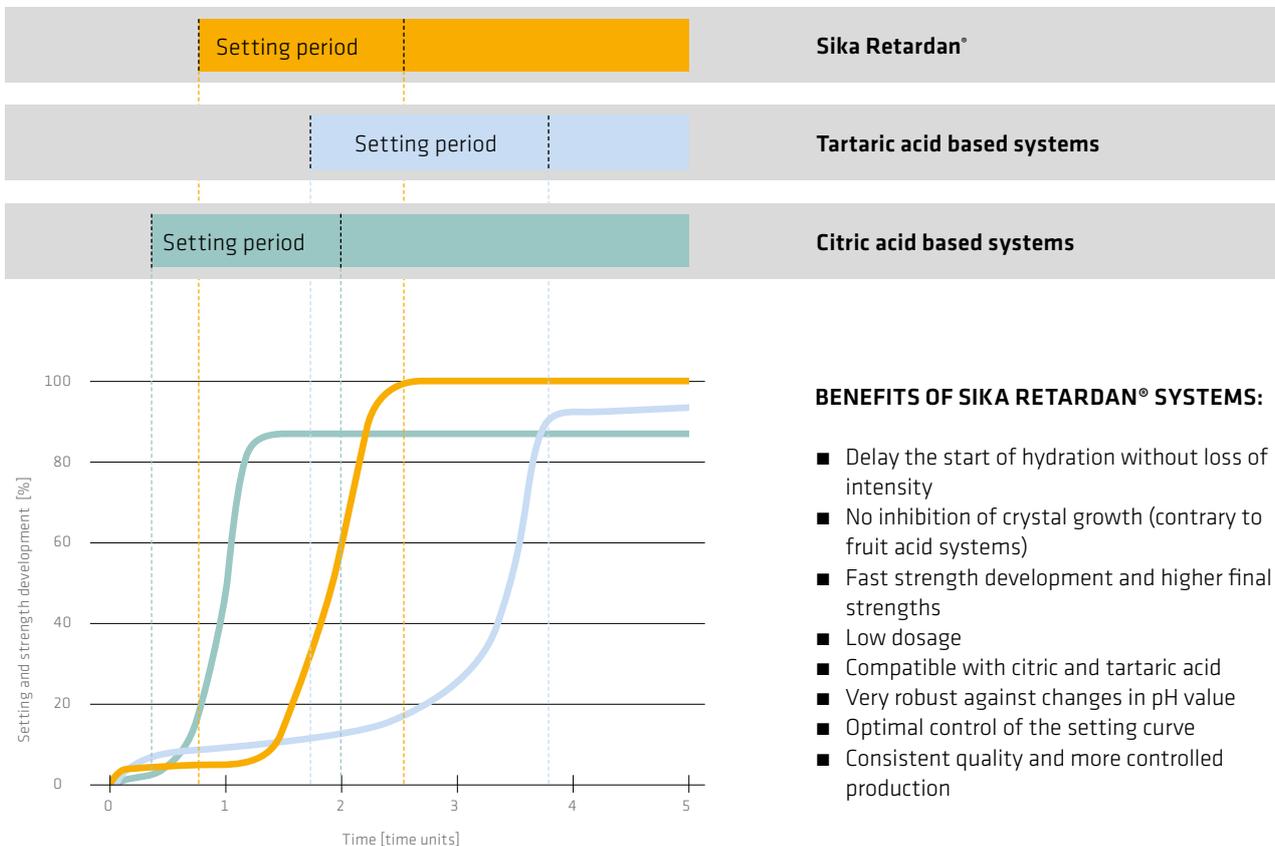
- Targeted delay of the beginning of the hydration reaction
- No reduction of hydration intensity for an early end of setting

Sika Retardan® does not show the typical side effects of other gypsum retarders, especially those based on fruit acids and their salts, such as extension of the setting period and ultimate strength loss.

The Sika Retardan® range has been developed with products in both liquid and powder form to suit all of your requirements.

In addition to retardation, the use of Sika Retardan® can also have a positive rheological influence: An early binder reaction during the mortar processing phase is typically accompanied by reduced mortar flow, but the addition of Sika Retardan® counterbalances this and still allows significant water reduction

Comparison of the setting characteristics of different retarders (Test conditions: Constant retarder dosage, alkaline environment)



BENEFITS OF SIKA RETARDAN® SYSTEMS:

- Delay the start of hydration without loss of intensity
- No inhibition of crystal growth (contrary to fruit acid systems)
- Fast strength development and higher final strengths
- Low dosage
- Compatible with citric and tartaric acid
- Very robust against changes in pH value
- Optimal control of the setting curve
- Consistent quality and more controlled production

APPLICATION EXAMPLE

LEVELLING FLOOR SCREED

Flowable floor screeds in Germany are already at about 25 % of the market and this is predicted to continue to increase in the future. Very simply, ease and speed of installation due to the almost self-levelling and compacting properties with even surfaces are the main advantages. Sika® ViscoCrete® based

technology gives excellent liquefying performance in floor levelling screeds, even at very low dosages. It is also compatible with other Sika performance additives for dry mortars including Sika Retardan® retarders.

Dry Mortar: Flowable anhydrite levelling screed

Customer Objective: Improved screed quality with optimized formulation costs

Sika Solution: Reduce w/b-value and set flow behavior by using Sika PCE Technology (Sika® ViscoCrete®-425 P); Increase in strength: +16%!

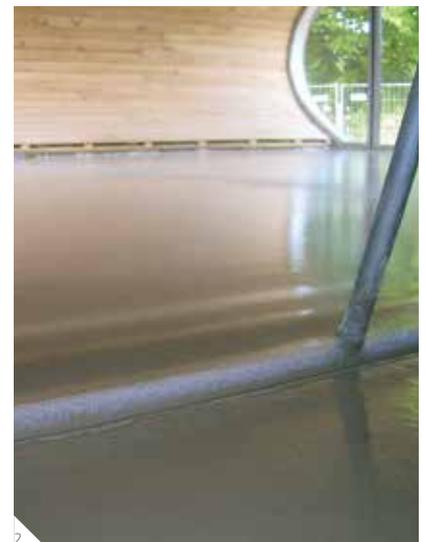
Mortar formulations and test results

	Reference System (PCE-based)	"Concrete" PCE	Sika® ViscoCrete®-425 P
Binder: Synthetic Anhydrite [g]	4,587	4,587	4,587
Sand: Norm sand 0-8mm (B8) [g]	10,000	10,000	10,000
PCE-based Superplasticizer (powder compound with inert filler) [g]	45.8 (1.0 binder %)	45.8 (1.0 binder %)	45.8 (1.0 binder %)
Water [ml]	1,930	2,030	1,800
w/b [-]	0.42	0.44	0.39
Initial flow [cm]	23.0	23.5	23.0
Workability time [-]	OK	OK	OK
Strength 3 d (FTS / CS) [N/mm ²]	2.7 / 22.9	2.5 / 19.1	3.1 / 26.4
Strength 7 d (FTS / CS) [N/mm ²]	4.3 / 29.6	4.8 / 27.9	4.4 / 34.0
Strength 28 d (FTS / CS) [N/mm ²]	7.1 / 36.7	6.0 / 30.8	7.1 / 42.4



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1 Convenient installation whilst standing up
2 Easy surface finishing



2

APPLICATION EXAMPLE GROUTING MORTAR

Poured and pumped grouting mortars are used for many different applications in both new construction and refurbishment works. They are often applied in safety related areas such as for the fixing of hand rails, bearing and mounting plates, plus for the filling of voids, connection of precast concrete units and grouting inside ducts and for foundations etc.

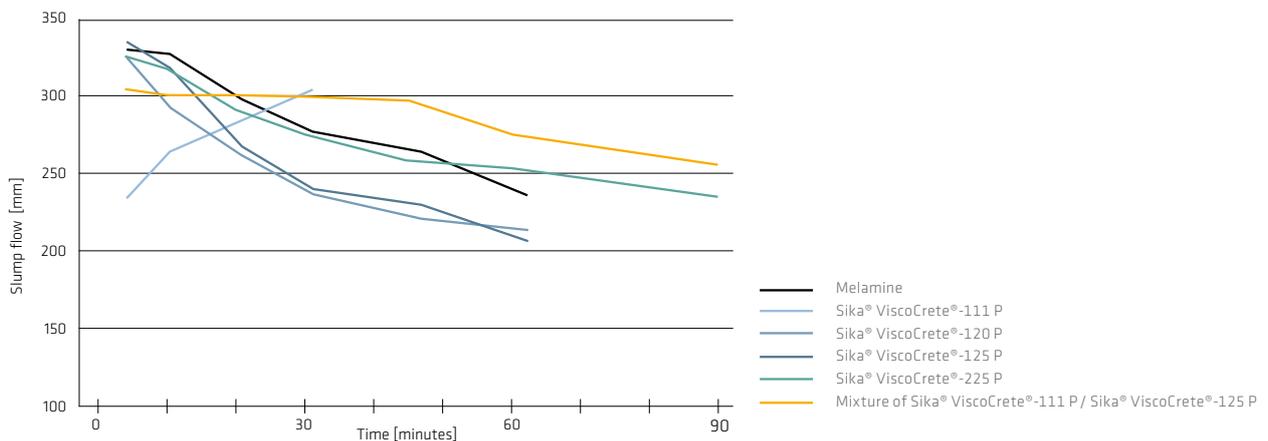
Due to the huge range of different applications, new and improved formulations are continuously required – including higher strengths and performance for structural applications. Different types and qualities of cement and the right additives are the major challenges for optimizing the right grouting mortar formulation.

Dry Mortar: Cementitious grout

Customer Objective: Superplasticizer optimization to a target flow value of 30 cm (Hägermann cone) over 45 min

Sika Solution: Optimization to the desired flow and performance using a blend of two Sika PCE-based superplasticizers

Slump development over time



None of the individual superplasticizers provided a constant slump-flow over the required mortar processing period of 45 min. It was only the mix of Sika® ViscoCrete®-111 P and Sika® ViscoCrete®-125 P that provided the desired slump retention effect.



1 Flow channel for grout testing

APPLICATION EXAMPLE SELF-LEVELLING UNDERLAYMENT

For the installation of modern floor coverings, a flat, uniformly absorbent substrate is required. Self-levelling dry mortar floor compounds are widely used to provide this. They must be tailored to the particular substrate and floor covering. Excellent flow properties and rapid drying to allow installation of the finished floor coverings without delay are the key arguments

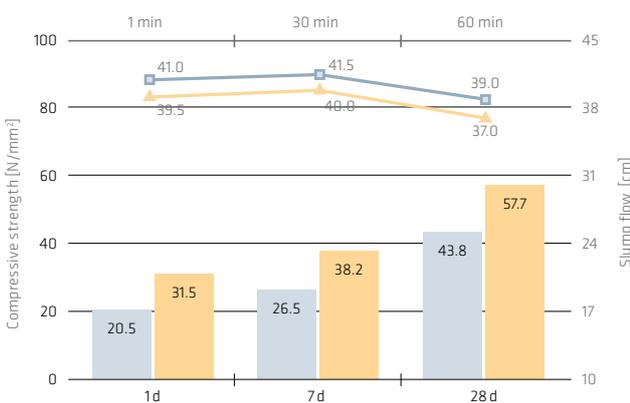
for floor layers. Special site mixing and pumping equipment is increasingly used by producers of floor levelling compounds and their customers. Sika® ViscoCrete® superplasticizers are excellent for these applications due to their outstanding liquefaction.

Dry Mortar: Ternary (mixed binder), self-levelling, flooring underlayment

Customer Objective: Replacement of traditional but problematic casein plasticizer whilst maintaining comparable flow and processing properties

Sika Solution: Adjusting the flow properties using Sika® ViscoCrete®-225 P, however, due to the significantly lower liquefier dosage requirements, the retarding effect and therewith the processing time was also correspondingly lower and so this was extended with another compatible retarder (tartaric acid based in this example).

Compressive strength and flow rate in comparison



Improved results achieved:

- High water reduction (from 24% to 20%)
- Comparable flow behaviour
- Very good surface aspect
- Increase in strength

Slump flow
 ■ Original with Casein
 ▲ New with Sika® ViscoCrete®
 Compressive strength
 ■ Original with Casein
 ■ New with Sika® ViscoCrete®

Corresponding dosage:
 Original with Casein 0,26 %
 New with Sika® ViscoCrete® 0,015 % and tartaric acid 0,08 %



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1 Flow test with Hägermann cone



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2 Optimized flow properties

APPLICATION EXAMPLE

GYPSUM PLASTER

Gypsum plaster, or gypsum and lime based plasters are the most commonly used interior finishing and lightweight decorative plasters. Easy application and a consistent setting behavior are critical to the success of the user.

Sika Retardan® retarders are particularly suitable for regulating the setting behaviour of these gypsum based or

modified materials.

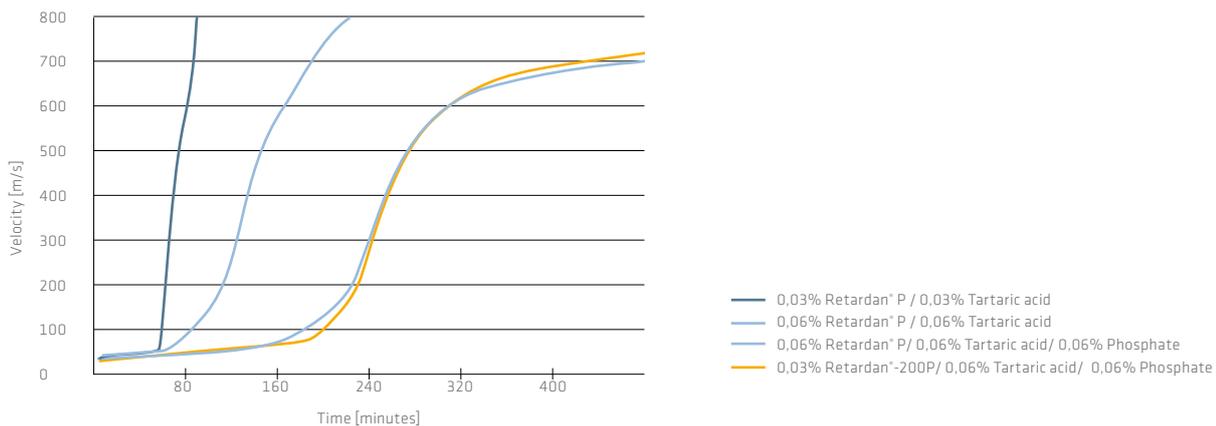
Due to their wide pH tolerance range, the Sika Retardan® systems can also be combined with other types of retarders e. g. fruit acids, in order to meet demands for even longer processing times / workability periods.

Dry Mortar: Gypsum modified, lime based, lightweight plaster, pH approx. 12,3 (mixed with 10 % water)

Customer Objective: Establish the desired setting profile and extended processing time

Sika Solution: The combination of Sika Retardan® with other retarders gives the ideal setting curve with extended workability

Combination of setting profile retarders by ultrasound



The ideal setting curve was reached by a combination of Sika Retardan®, tartaric acid and phosphate retarders. Shortly after spray application, the plaster is initially levelled with a metal straight edge, then once stiffening begins after about 90 minutes, any ridges and tracks can be pulled out. After about 3 hours, when the plaster has hardened sufficiently, the surface can be slightly wetted, felted and sponged as required. After another 30 to 60 minutes, once the surface is matt and dull, the final smoothing and finishing begins.

The whole of the setting profile of gypsum plasters can therefore be adapted to different requirements, conditions and differing regional working practices.



1 Wall and ceiling finished with gypsum plaster

GLOBAL BUT LOCAL PARTNERSHIP



FOR MORE INFORMATION:



WHO WE ARE

Sika AG, Switzerland, is a globally active specialty chemicals company. Sika supplies the building and construction industry as well as manufacturing industries (automotive, bus, truck, rail, solar and wind power plants, façades). Sika is a leader in processing materials used in sealing, bonding, damping, reinforcing and protecting loadbearing structures. Sika's product lines feature high quality concrete admixtures, specialty mortars, sealants and adhesives, damping and reinforcing materials, structural strengthening systems, industrial flooring as well as roofing and waterproofing systems.

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