



Sika® DRY MORTAR PERFORMANCE ADDITIVES

BUILDING TRUST



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Sika® DRY-MIX ADDITIVE TECHNOLOGIES

OVERVIEW

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DRY-MORTAR COMPONENTS

OVERVIEW AND POSITIONING OF Sika® TECHNOLOGIES

Binders

Cement (PC, CAC etc)
Quicklime, hydrated Lime
Calcium Sulfates / Anhydrite
Waterglass, Powdery Alkalisilicates
Polyvinyl Alcohol
Redispersible Powders

Aggregates

Hard Aggregates, Abrasives
Lightweight Aggregates
Heavyweight Aggregates

Fillers, Pozzolana

Microsilica
Fly Ash
Microspheres, **Microballoons**

SikaAer® Solid

Source: drymix.info

Additives

Fibers

SikaFiber®

Rheological Additives

Cellulose Ethers

Starch Ethers

Polyacrylamides

Thixotropic Agents (inorganic)

Guar Ethers

(Super)Plasticizers

**Sika® ViscoCrete®
/ Sikament®**

Stabilizers

Shrinkage-reducing Additives

Set-Retarders

Sika® Retardan® / SikaTard®

Set-Accelerators

Sigunit® / SikaRapid®

Air-entraining Agents

Pigments

Sika® Color

Hydrophobizing Agents

Defoamers

Expansive Additives

Sika® ViscoCrete® POWDERS

SUPERPLASTICIZERS / HIGH-RANGE WATER REDUCERS (HRWR)

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Sika® ViscoCrete® TECHNOLOGY

INTRODUCTION

Development of (Super)Plasticizers:

Year	Sika Product/Brand	Technology	Water reduction up to
~ 1930	Plastocrete	Lignosulfonates	10%
~ 1970	Sikament-NN	Naphthalene sulfonates	20%
~ 1980	Sikament-300	Melamine sulfonates	20%
~ 1990	Sikament-10	Vinyl copolymers	30%
~ 2000	Sika ViscoCrete	Polycarboxylates	40%



Sika's global footprint: 20 PCE production sites and >120 admixture blending plants (2014)

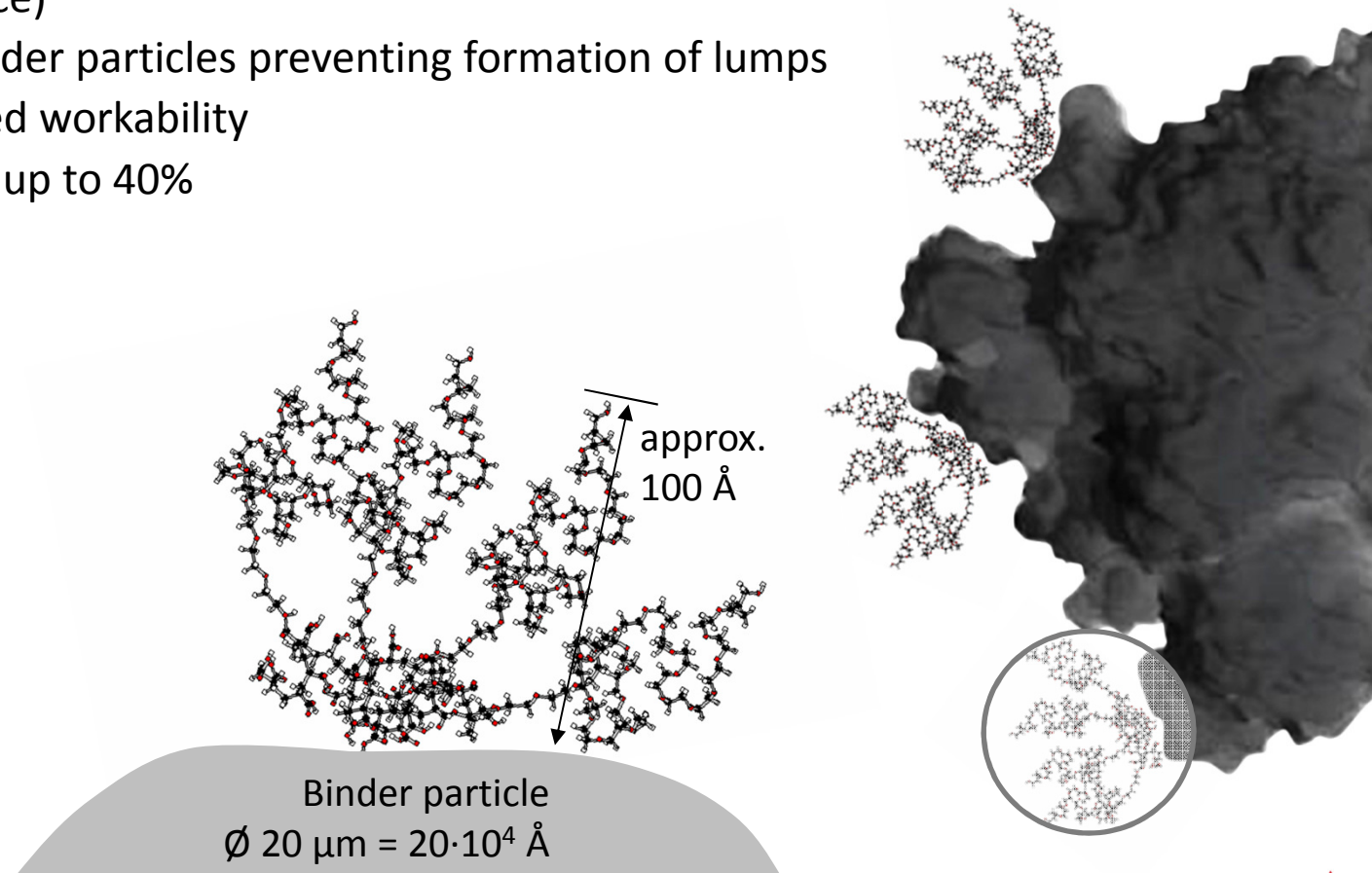
- Cost advantage due to Sika's unique, supply chain optimized production process
- Short lead times and continuously high product quality

Sika® ViscoCrete® TECHNOLOGY

HYPOTHESIZED WORKING MECHANISM

- Electrostatic inter particle repulsion
- Large molecules acting as a barrier between the binder particles (= steric hindrance)
- Dispersion of binder particles preventing formation of lumps
- Strongly improved workability
- Water reduction up to 40%

- Polycarboxylate molecules on a binder particle surface



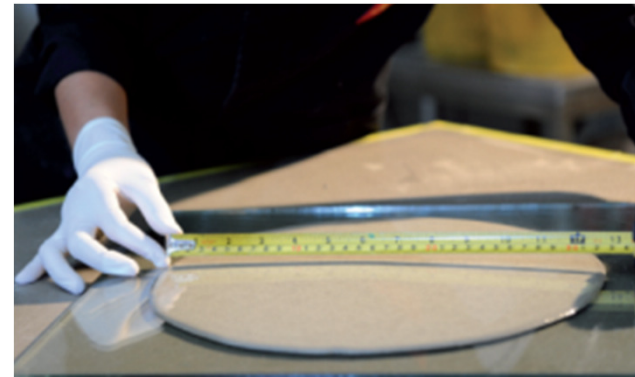
Sika® ViscoCrete® TECHNOLOGY

PCE STRUCTURE - PERFORMANCE RELATIONSHIP

- Backbone chemistry
- Backbone length
- Number of side chains
- Length of side chains
- Charge density
- etc.



- Adsorption speed
- Water reduction
- Rheology
- Workability
- Air entrainment
- etc.



PCEs are designed to achieve specific application-oriented properties

Sika® ViscoCrete® POWDERS

PRODUCT PORTFOLIO (APPLICATIONS)

Application system	Typical applications	Binder type	Sika® ViscoCrete®						
			111 P	125 P	150 P	225 P	430 P	510 P	520 P
Cementitious mortars	Self-compacting concrete (SCC), industrial floors	OPC / CEM I, R (rapid)	★	★	★★	★	★	★★	
		OPC / CEM I, N (normal)	★	★	★★	★	★	★★	★
		Blended cements / CEM II, S (slag)	★	★	★★	★★	★★	★★	
		Blended cements / CEM II, LL (limestone)	★	★	★★	★	★★	★★	★★
	Self-levelling underlayments (SLU), grouts	Ternary binder system, pH > 11.5			★★	★★		★★	★★
		Ternary binder system, pH < 11.5			★★	★★	★	★★	★★
Calcium sulfate / gypsum based mortars	Self-levelling screed (SLS)	Thermal anhydrite (FGD)					★	★★	★
		Synthetic anhydrite		★		★	★★	★★	★
		Natural anhydrite				★	★	★★	★
	Self-levelling screeds / underlayments (SLS/SLU), plasters	Alpha-hemihydrate, pH > 11.5				★★	★	★★	★★
		Alpha-hemihydrate, pH < 11.5				★★	★	★★	★★
		Beta-hemihydrate, FGD				★★	★	★★	★
		Beta-hemihydrate, natural				★★	★	★★	★

★★ recommended
★ suitable

Sika® ViscoCrete® POWDERS

PRODUCT PORTFOLIO (PERFORMANCE)

Performance	Sika® ViscoCrete®						
	111 P	125 P	150 P	225 P	430 P	510 P	520 P
High initial flow			✓	✓	✓	✓	✓
Long flow retention (open time)	✓	✓	✓	✓	✓	✓	
Low sulfate sensitivity			✓	✓	✓	✓	✓
Compatibility with retarders (fruit acids)			✓	✓	✓	✓	✓
Fast dispersing effect (short mixing)		✓	✓	✓	✓	✓	✓
Low set-retardation		✓	✓	✓		✓	✓
High early strength development		✓			✓	✓	✓
Low early shrinkage	✓	✓				✓	✓

Notes:

- All VC-Powders are pure polycarboxylate ethers (PCE). They do not contain a defoamer, which enables the adjustment of the air content of the final mortar composition, according to application and performance requirements.
- They are free of formaldehyde and ammonia.
- An additive compound may be targeting for your specific application. Please contact our Technical Service Department for more information and advice.

Sika® ViscoCrete® POWDERS

PRODUCT RECOMMENDATIONS

- **VC-150 P** has excellent performance in **OPC-based applications**
- **VC-430 P** first choice for **blended cements, thermic and synthetic anhydrite**
 - High initial flow and long flow retention (open time)
 - High robustness regarding changing sand qualities
- **VC-510 P** has excellent performance in the widest range of applications (**'All-rounder'**)
- **VC-520 P** first choice for **ternary binder systems** and **alpha-hemihydrate**
 - Good performance at low and high pH
 - Very low viscosity and good mortar stability
- **VC-510 P and VC-520 P** preferred options for **high-temperature conditions** (hot climate and/or transportation in big-bags and storage in additive silo)
 - Higher melting point and dilution option to reduce caking risk during storage and dosing

Sika® ViscoCrete® POWDERS

BENEFITS

- Tailor-made designs for specific requirements
- High water reduction / liquefaction
- Efficiency up to 10-times (typically 3...4-times) higher than melamine → Resulting in better cost-performance
- Quick adsorption → Allowing for short mixing times
- Strength increase → Allowing for Portland cement reduction / usage of new blended cements with reduced CO₂ footprint
- Shrinkage reduction → Allowing for damage-free construction
- No release of formaldehyde (unlike melamine) and ammonia (unlike casein) → Allowing for low emission recipes acc. to latest EHS regulations like REACH (EU)
- Odorless and colorless to slightly yellowish liquid; reducing the risk for discolorations
- Good compatibility and synergy with other additives
- Overall formulation cost reduction (additives & binders)



Sika® ViscoCrete® POWDERS

APPLICATION EXAMPLES

Sika® ViscoCrete® POWDERS

APPLICATION EXAMPLE 1: SELF-LEVELLING SCREED (SLS)

- **System:** Binder mix of natural and synthetic anhydrite
- **Mission:** Reformulation to a very low emission recipe by replacing melamine by PCE



Sika® ViscoCrete® POWDERS

APPLICATION EXAMPLE 1: SELF-LEVELLING SCREED (SLS)

	Reference (melamine)	PCE 1 (VC-225 P)	PCE 2 (VC-510 P)	PCE 2 (VC-510 P)
Basic screed drymix [g]	1997.00	1999.62	1999.62	1999.62
Superplasticizer dosage [g]	3.00	0.38	0.38	0.60
Water [ml]	320	320	320	300
Initial flow Hägermann 2 min [cm]	22.0	22.5	21.4	23.4
Initial flow Hägermann 30 min [cm]	19.8	19.8	20.2	22.9
Strength 7 d (F/C) [N/mm ²]	3.4 / 15.4	3.8 / 18.4	3.7 / 17.2	3.9 / 19.4
Strength 28 d (F/C) [N/mm ²]	3.9 / 20.2	4.3 / 20.8	4.2 / 20.5	4.5 / 22.6

Sika® ViscoCrete® POWDERS

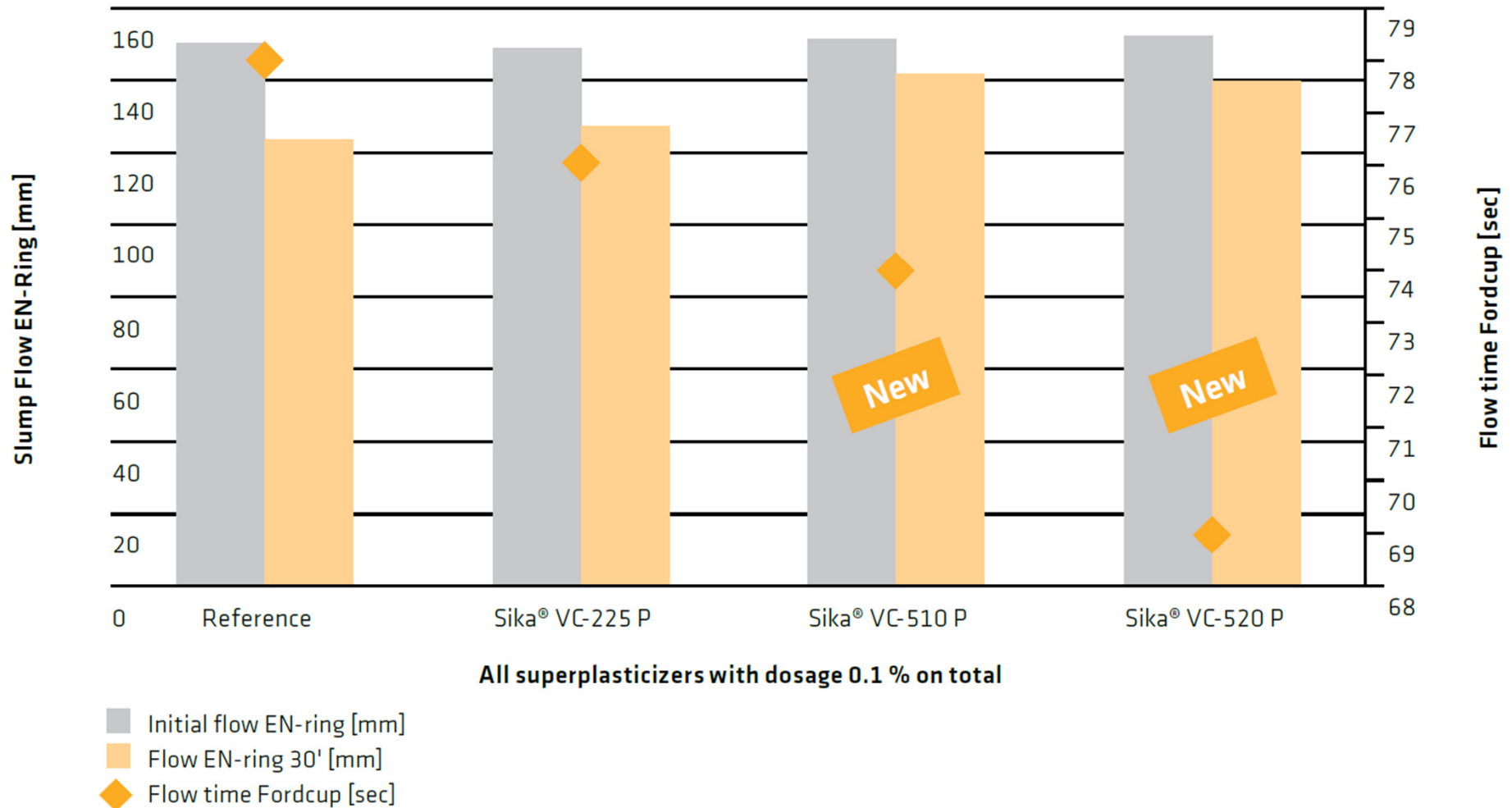
APPL. EXAMPLE 2: SELF-LEVELLING UNDERLAYMENT (SLU)

- **System:** Ternary binder (CAC-C $\$$ -OPC), CAC-rich floor levelling compound, pH <11.5
- **Mission:** Replacement of an existing PCE with comparable flow properties for mechanical mixing and conveying technology.



Sika® ViscoCrete® POWDERS

APPL. EXAMPLE 2: SELF-LEVELLING UNDERLAYMENT (SLU)



Sika® ViscoCrete® POWDERS

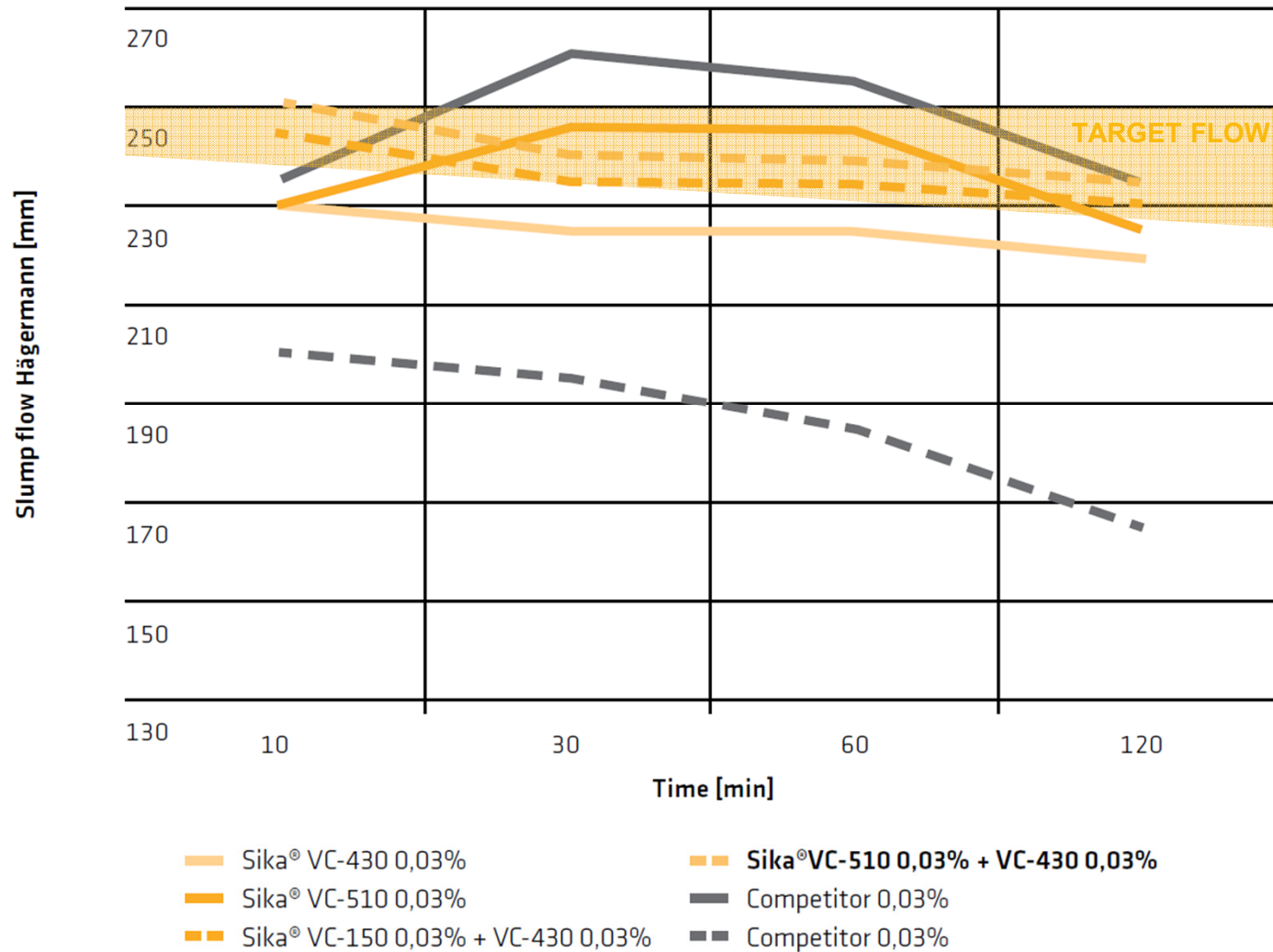
APPLICATION EXAMPLE 3: CEMENTITIOUS GROUT

- **System:** Highly dynamically stressed grout for wind power stations in offshore and onshore areas
- **Mission:** Optimize fresh mortar on a target value of 245 ± 5 mm Hägermann consistency drop after 2 hours $<10\%$. Fast adsorption to a high initial flow associated with a long slump keeping without additional liquefaction.



Sika® ViscoCrete® POWDERS

APPLICATION EXAMPLE 3: CEMENTITIOUS GROUT



Retardan® POWDERS

GYPSUM RETARDERS

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Retardan® TECHNOLOGY

INTRODUCTION

- Very effective gypsum retarders
- Typically applied to delay the setting of even accelerated binders, until the required processing is successfully completed
- Retardan® range includes products in both liquid and powder form
- Retardan® L and Retardan® P have been used very successfully in the gypsum and dry-mortar industry for many years
- Well-defined retardation effects of Retardan®:
 - Targeted delay of the beginning of the hydration reaction
 - No reduction of hydration intensity for an early end of setting



Retardan® TECHNOLOGY

NEW: Retardan®-200 L AND -200 P

- Sets a new standard in retarding efficiency
- Based on modified amino acid
- Available in liquid and powder form
- Characterized by low dosage and high retardation effects
- Allows for reduction of formulation costs
- Suitable for setting time control in the range of seconds (gypsum board production) to several hours (gypsum based dry-mixes)



Retardan®

APPLICATION DURING DRY-MIX PRODUCTION



- A variety of calcium sulfate-based dry-mixes exists based on alpha and beta-hemihydrate, various anhydrite binders and mixtures
- Many of them contain accelerators and/or activators to speed up the setting and hardening
- The use of **Retardan®** results in a delay of the beginning of setting for precise adjustment of the mortar processing time before the initial setting occurs

Retardan®

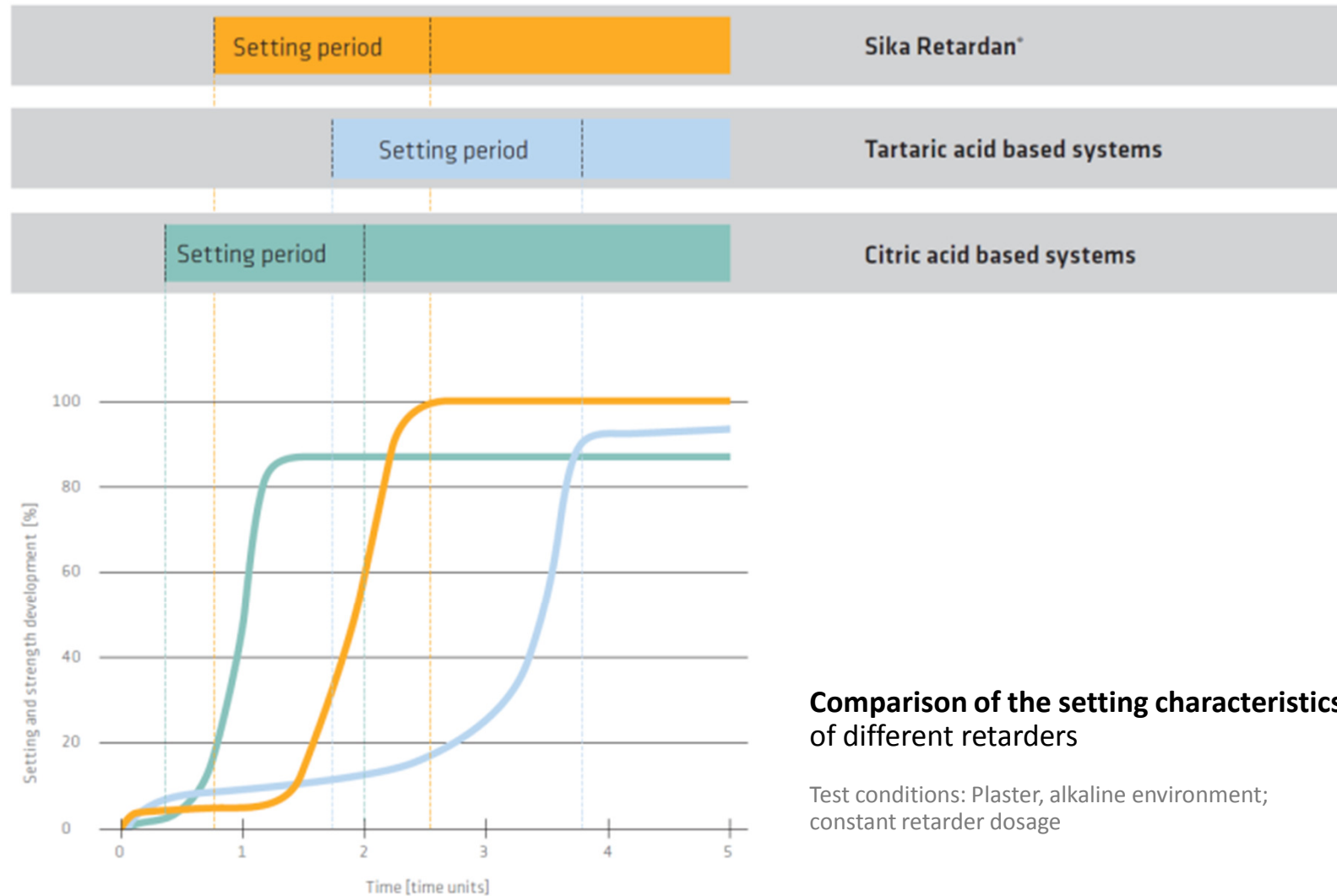
APPLICATION ADVANTAGES

- Precise adjustment of the mortar workability time
- Improved mortar flow capability
- No inhibition of crystal growth (contrary to fruit acid systems)
- Fast strength development and higher final strengths
- Suitable for all standard gypsum binders
- Robust against changes in pH value
- Compatible with citric and tartaric acid
- Consistent quality allows for more controlled mortar processing
- Low dosage enables formulation cost reduction



Retardan®

PERFORMANCE CHARACTERISTICS

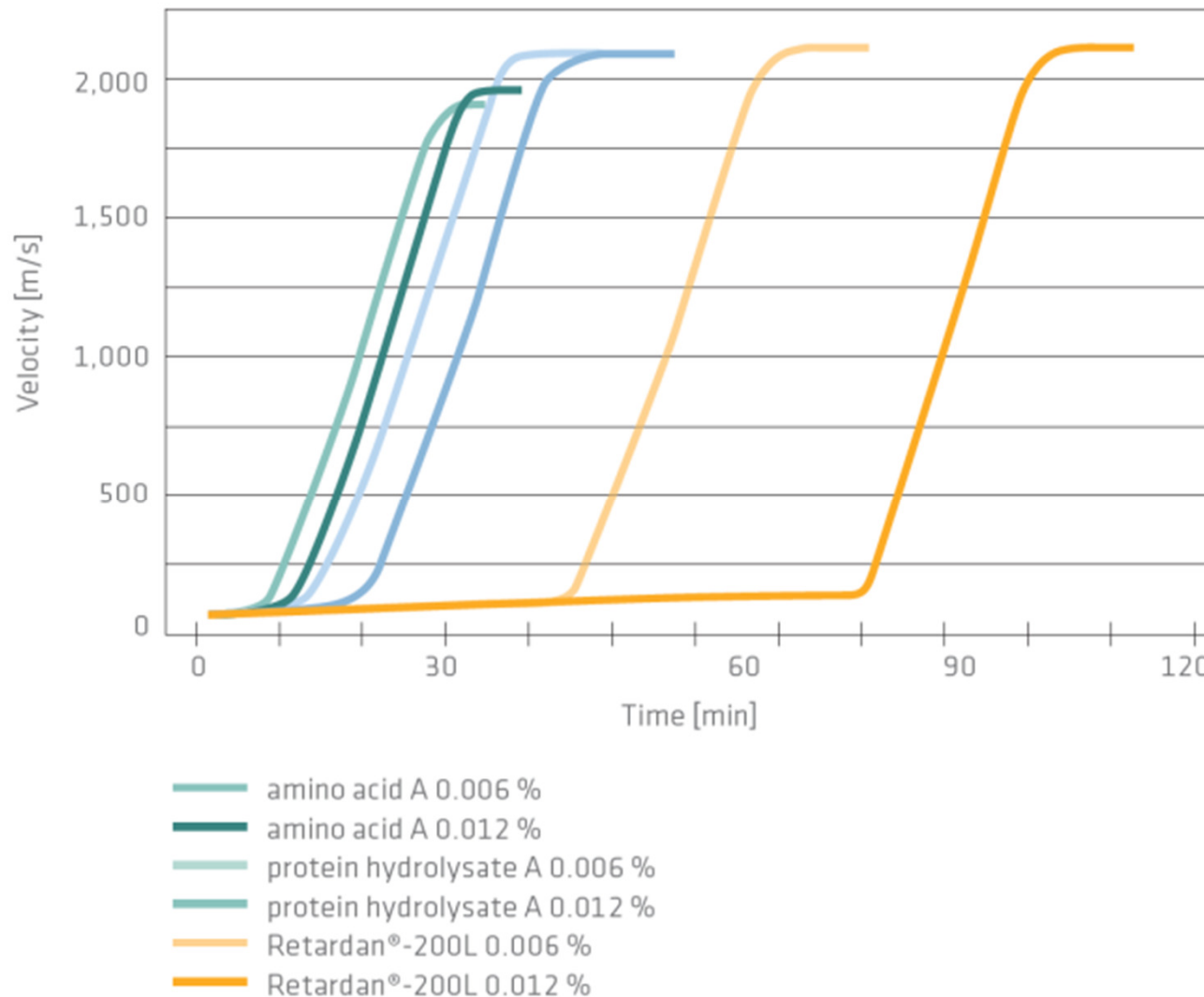


Comparison of the setting characteristics of different retarders

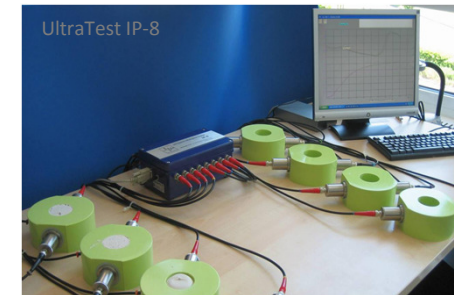
Test conditions: Plaster, alkaline environment;
constant retarder dosage

Retardan®

SET-RETARDER PERFORMANCE COMPARISON

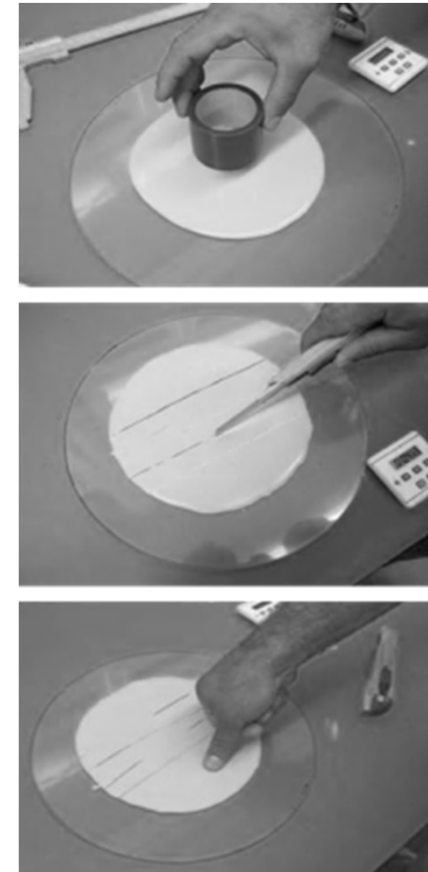
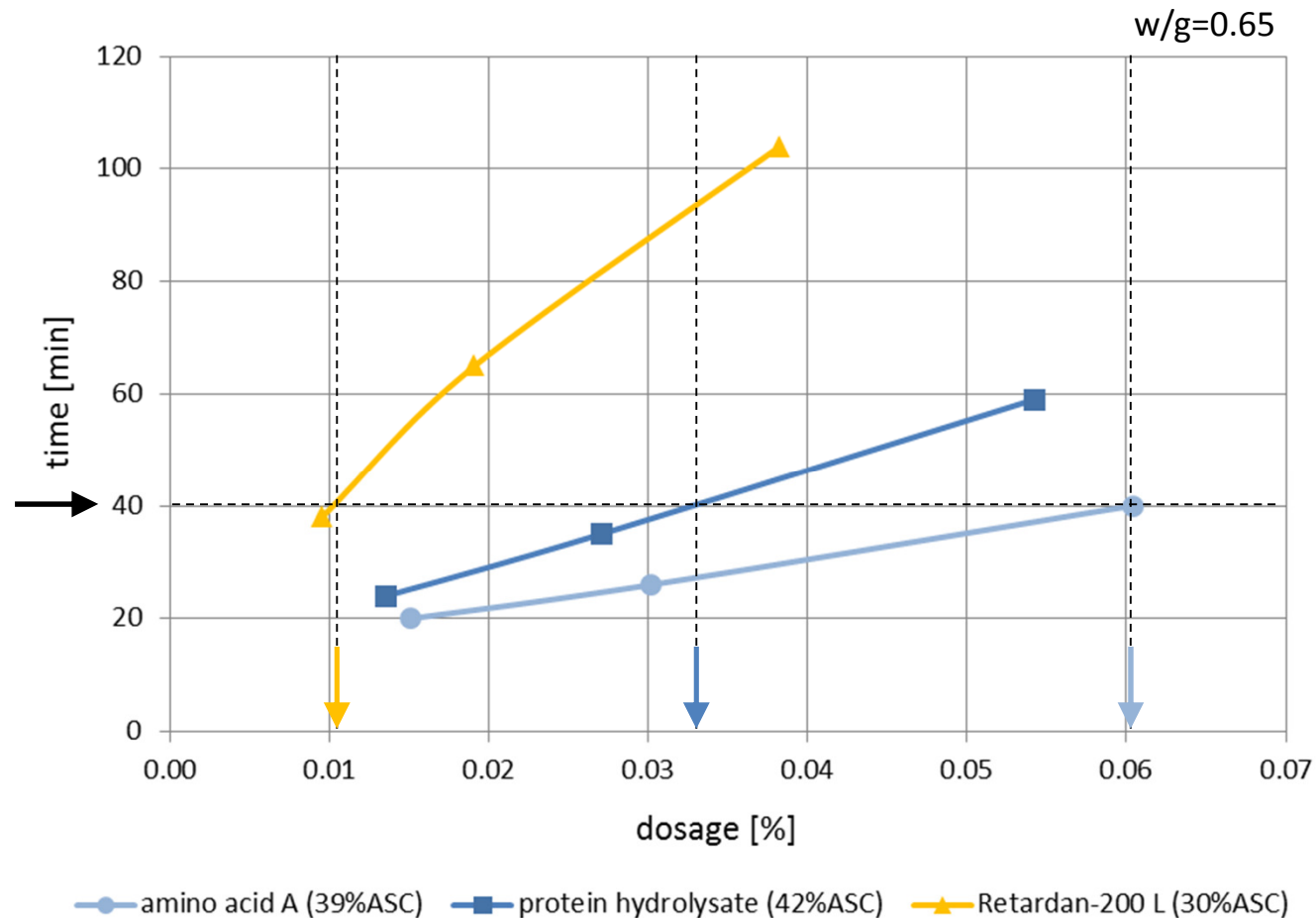


Performance of different retarders (by ultrasonic-testing)



Retardan®

SET-RETARDER EFFICIENCY COMPARISON



Retardan®

AWARD WINNER

British Gypsum (Saint-Gobain Group) Supplier Conference in November 2011:

- Sika wins “Supplier Innovation Value Opportunity 2011 Award” for “**Highest Scoring Cost Saving Idea**”
- See Media Release in February 2012



Steve Squire (Sika) receives award from Mike Chaldecott (M.D. British Gypsum)

Sigunit® POWDERS

ALKALI-FREE SETTING ACCELERATOR FOR SHOTCRETE

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Sigunit® TECHNOLOGY

ADVANTAGES OF 'ALKALI-FREE'



Properties	Alkaline	Alkali-free (Sigunit®)
Early strength	Increased	Increased
Final strength	Significant reduction (up to 40% at 5% dosage)	Comparable with un-accelerated reference
Spray dust	Increased alkali content	No additional entry
Rebound reduction	Noticeable	Clearly
Additional washing out alkalis	Yes	No
Increased sintering and blockage of drainage facilities	Yes	No
Additional risk to the mountain or ground water	Yes	No
Concrete impermeability	Low (soluble alkalis)	Unaffected
Caustic effect on skin	Amplified	Cement crucial

Sigunit® POWDERS

PRODUCT PORTFOLIO



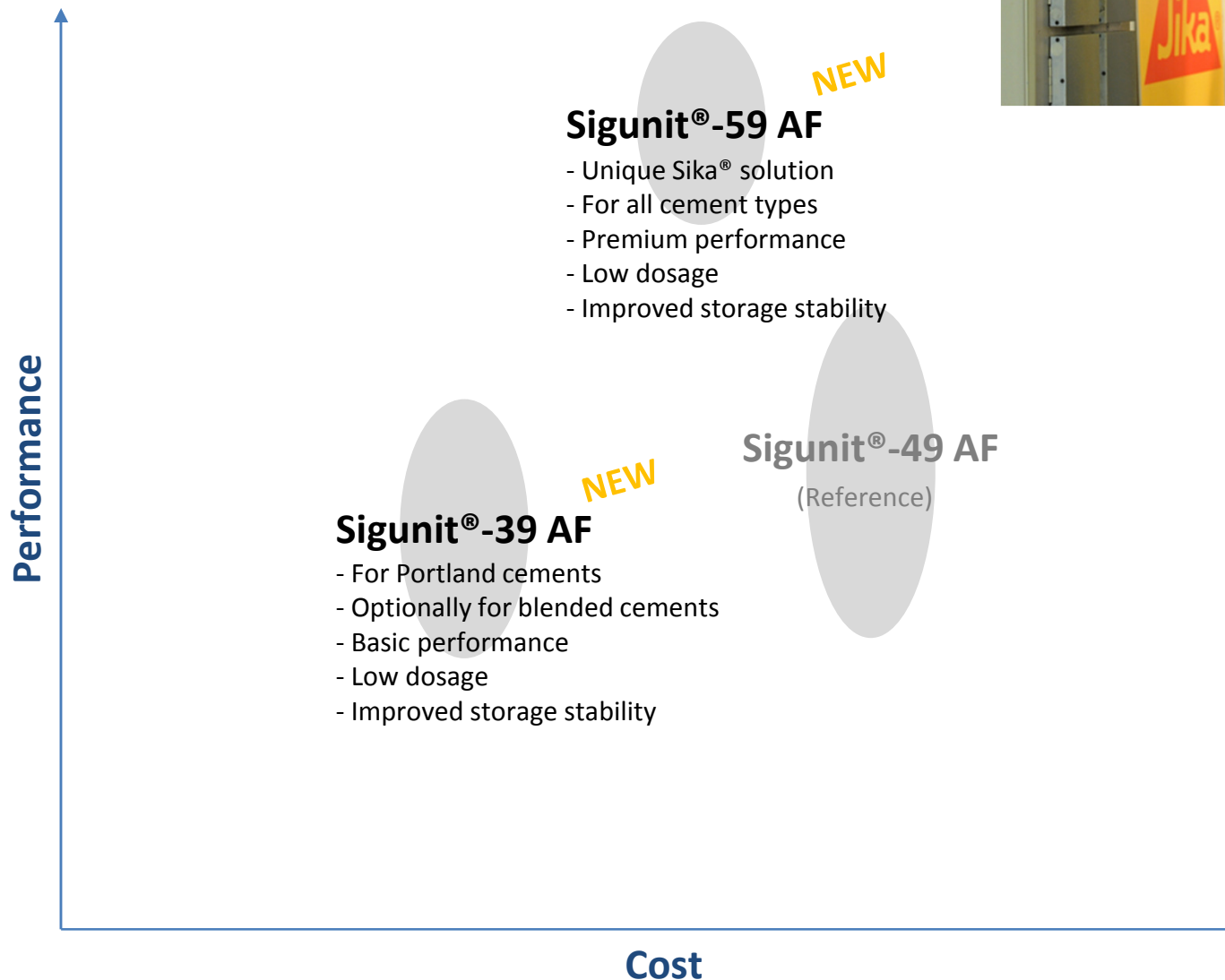
NEW

NEW

	Sigunit®-49 AF	Sigunit®-39 AF	Sigunit®-59 AF
Application system	OPC	OPC	OPC and blended cem.
Performance	medium-high	medium-high	high
Cement robustness	medium	medium to high	high
Dosage range (on binder weight)	4 to 7 %	2 to 6 %	2 to 6 %
Chemical base	mineral based mixture	aluminium sulphate	aluminium salts mixture
Occupational safety	alkali free	alkali free	alkali free
Shelf life	1 year	2 years	2 years
Price	high	medium	medium-high

Sigunit® POWDERS

POSITIONING OF THE PRODUCTS



Sigunit®-39 AF

APPLICATIONS AND BENEFITS



Applications

- Setting accelerator for shotcrete based on **Portland cement (OPC)**
- For applications like tunnel repairs, heading stabilization in tunneling, slope and trench stabilization etc.
- Addition to the dry mix in the drymix mortar plant or to the dry mortar/concrete premix at the construction site prior to feeding the spray equipment (rotor machine)
- Processing in thin-flow process

Benefits

- High early strength development of shotcrete and minimal final strength loss
- Significant rebound reduction
- Improved bond of shotcrete to rock and concrete, making overhead spraying easier
- Alkali-free, which eliminates any adverse effects from additional alkali in the spray dust
- No additional surface and ground water pollution by leached-out alkali
- Sigunit®-39 AF is non corrosive to steel reinforcement
- Extended shelf life (24 months)

Sigunit®-59 AF

APPLICATIONS AND BENEFITS

Applications

- Setting accelerator for shotcrete based on **Portland cement and 'green' blended cements, such as CEM II/B-M (S-T)**
- For applications like tunnel repairs, heading stabilization in tunneling, slope and trench stabilization etc.
- Addition to the dry mix in the drymix mortar plant or to the dry mortar/concrete premix at the construction site prior to feeding the spray equipment (rotor machine)
- Processing in thin-flow process



Benefits

- High early strength development of shotcrete and minimal final strength loss
- Significant rebound reduction
- Improved bond of shotcrete to rock and concrete, making overhead spraying easier
- Alkali-free, which eliminates any adverse effects from additional alkali in the spray dust
- No additional surface and ground water pollution by leached-out alkali
- Sigunit®-59 AF is non corrosive to steel reinforcement
- Extended shelf life (24 months)



THANK YOU FOR YOUR ATTENTION

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