Mixed to resist.

Additives and active agents for the concrete admixture industry

SITREN® SITREN AirVoid® TEGOSIVIN®

EVONIK
Leading Beyond Chemistry

CONTENTS

Evonik
Your first choice for specialty chemicals

Construction Chemicals | Interface & Performance

On the right track for future trends

What will tomorrow's world look like? What technologies can we expect and what possibilities will they offer? What challenges will the construction industry face in 10 and 20 years? Only those who raise these questions will be able to identify emerging trends and needs in good time, and develop future-proof solutions for their customers.

Construction Chemicals product line is part of Evonik's Interface & Performance business line, which strives to innovate, shape trends, and continuously improve and develop its product portfolio.

Interface & Performance, part of Evonik Operations, invests significantly in research and development to maintain and extend its advantage in key technologies.

In order to strengthen our position, our efforts are supported by five competence centers for manufacturing, applied technology, research and development and sales and marketing. These are located in Germany (Essen/Geesthacht), North America (Richmond, Virginia), China (Shanghai), Brazil (Americana) and India (Mumbai). Investment in our manufacturing sites ensures global security of supply.

Face-to-Face Performance

Consulting, development and cooperation on an equal footing

We develop tailor-made solutions, and use our proven skills to support our customers with their specific tasks.

Our willingness to meet unique customer requirements is shaped by:

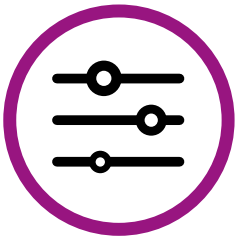
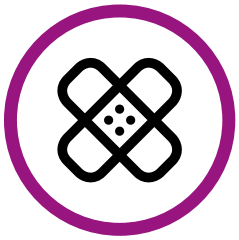
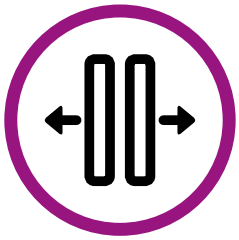
- An in-depth knowledge of each market's technical requirements
- An understanding of customer challenges and the corresponding tasks
- The ability to develop customer-specific products

Experienced technical specialists and sales managers are available to assist and advise our customers throughout the world. In addition, we have regional laboratories and competence centers that enable us to deliver effective support at all times and in all locations. This gives us the ability to develop and deliver solutions specifically designed for the needs of each market.

Our management systems for the concrete admixture industry

At a glance.

Process and Performance Additives
for the concrete admixture industry

AirVoid® Management	**Protection** Management	**Curing** Management	**Release** Management	**Formulation** Management
				
Air entrainers Defoamers	Water repellents	Shrinkage reducing agents	Mold release agents	Wetting agents Dispersants Process defoamers

SITREN® SITREN AirVoid® TEGOSIVIN®

All five management systems and their associated activities and products address the two following application areas:

- **Admixtures**, liquid additives for the concrete admixture industry
- **Industrial building materials**, additives for the building materials supply industry, e.g. insulating materials and fillers

We understand our customers' challenges, including their manufacturing processes and the requirements their products have to meet. In addition, we offer a broad product portfolio, extensive experience and specialized technical expertise, plus our in-depth knowledge of applications and markets.

At the same time, we are dedicated to protecting the environment, and to sustainable socioeconomic development. With more than thirty years' experience in product design, we continuously improve and evolve our products. As a result, our solutions set new standards in terms of efficiency and performance.

A solid base for construction

Our product portfolio for concrete admixtures

New and highly sophisticated design options make ever-increasing demands on the properties of concrete. Many of these challenges can be overcome with the help of chemical admixtures for the construction industry.

In the future, the construction industry will be increasingly affected by **megatrends** such as **scarcity of resources** and **climate change**.

The latest chemical methods are accordingly being applied to develop and to test chemical compounds for the construction industry to achieve an optimal interaction between diverse mineral substrates. **These new active ingredients and additives are constantly improving the ways in which materials can be used to adapt to the changing conditions by mega trends.**

The focus is shifting to new objectives:

- sustainable socio-economic development (e. g. energy efficiency)
- architectural structures with extended lifespans
- cost controls and faster construction
- addressing changing climatic and environmental conditions

This development increases the demand for new high-performance additives and process aids. **Our goal is to support our customers in the development of high-performance materials.**

Construction chemistry has developed numerous admixtures through which the properties of concrete can be individually influenced. After water, concrete is the most widely used substance on the planet.

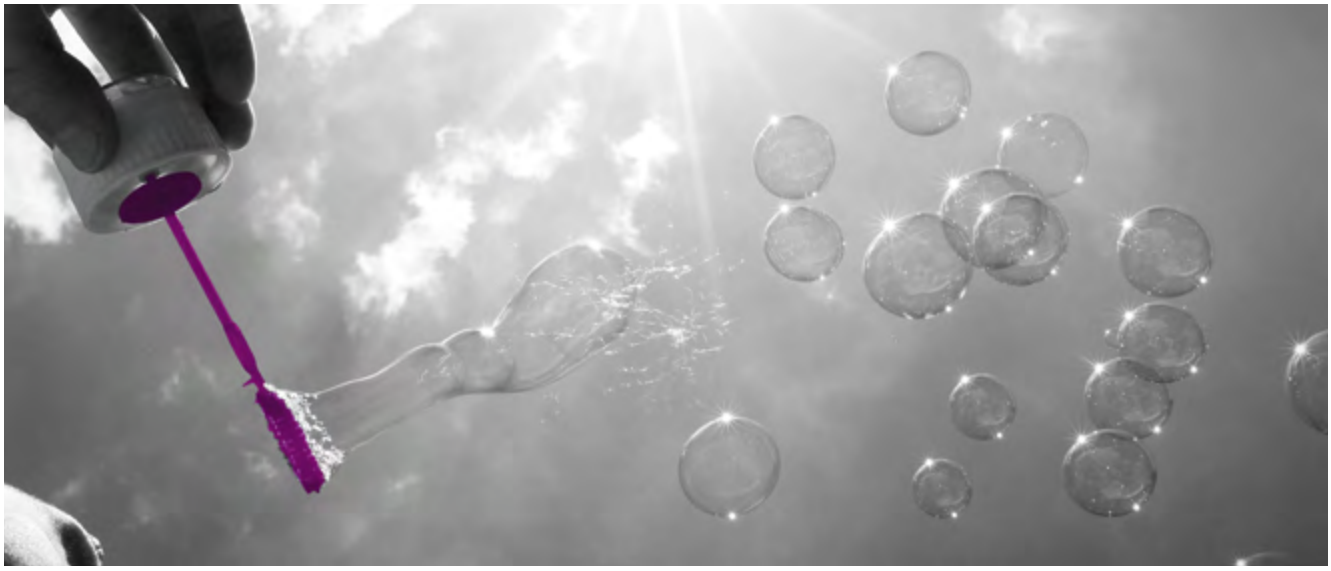
With our concrete admixtures product portfolio, we do not only offer solutions for market requirements, but also understand the entire process of development, production and processing of concrete, as well as its different levels of quality – from standard concrete mixed on the job site up to ultra-high-performance concrete.

Our five unique management systems offer our customers a **targeted and effective product solution** to meet their individual challenges.

THE FIVE MANAGEMENT SYSTEMS:

AirVoid Management

Air entrainers
Defoamers



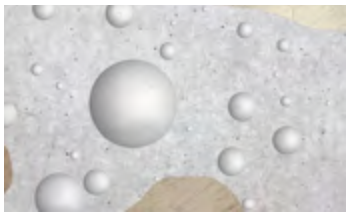
Air has a significant impact on the performance of concrete – in both positive and negative terms. The manufacturing process of concrete generally requires mixing with water. The application of shear force combined with surfactant components in the concrete mix leads to the distribution and stabilization of air in the fresh concrete.

Air in the right quantity and in the right form is essential for the end properties of cement based materials and has a direct impact on the

- **workability**
- **mechanical properties**
- **durability**
- **aesthetics**
- **slump properties**
- **insulation properties**
- **and density**

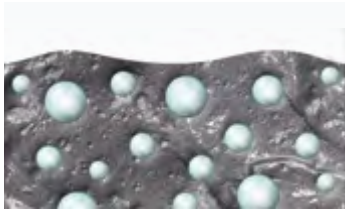
AIR ENTRAINERS AND DEFOAMERS IN USE – AIRVOID MANAGEMENT

Concrete without additives



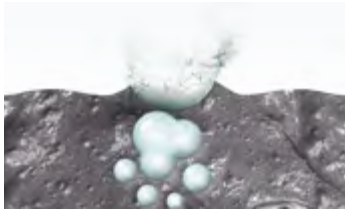
Total porosity:
- gel pores
- capillary pores
- **air voids**

Air entrainer

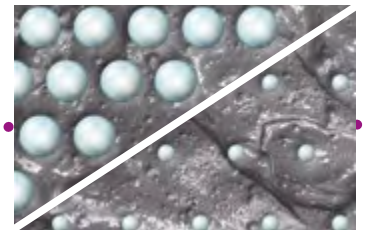


Total air volume
Air void size
Air void distribution
Air stability over time

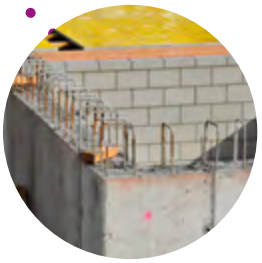
Defoamer



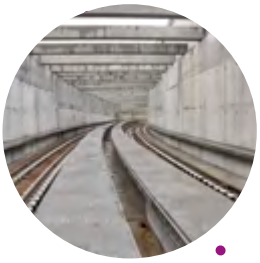
Concrete with special properties



- freeze-thaw resistance
- processability
- density



- impermeability
- durability
- strength



AIRVOID MANAGEMENT

Air entrainers

Our air entrainers create stable and homogeneously distributed air voids. Their main purpose is to stabilize the air entrained with the water during mixing.

Depending on the requirements, our portfolio of air-stabilizing additives can optimize the size, content and distribution of the air voids.

Influencing factors

Contrary to what the current name indicates, the function of air entrainers is not to generate air voids but to stabilize the mechanically entrained air during mixing. Therefore, the air content depends highly on the mixing process itself, and can vary depending on the mixing device, mixing duration, time of mixing, temperature and the additives used.

While the air void content is controlled under more or less defined conditions during the mixing process in a prefab concrete plant, the situation is different if the concrete is transported from the concrete plant to a construction site by truck.

The transport of the concrete to the construction site is a factor which is difficult to control, as transport time and ambient temperature can vary. If the concrete is not mixed long enough during the production process or if the air entrainer concentration is too high, the concrete can contain unreacted air-entraining agents. As these are activated by the mixing energy during transportation, the air void content (post-activation) can increase.

Conversely, the air void content may decrease due to extended and intensive mixing, or increasing temperatures.

Application areas

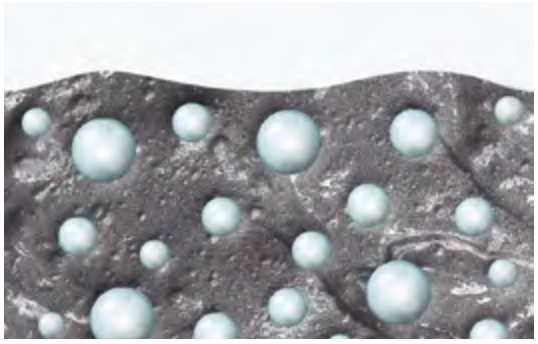
- Onsite and ready-mixed concrete (incl. lightweight and special concrete)
- Road paving concrete
- Concrete products (such as paving stones and concrete blocks)
- Screed concrete
- Air-entrained concrete
- Reinforced concrete
- Self-compacting concrete

Building on fresh air

Air voids for more efficient construction

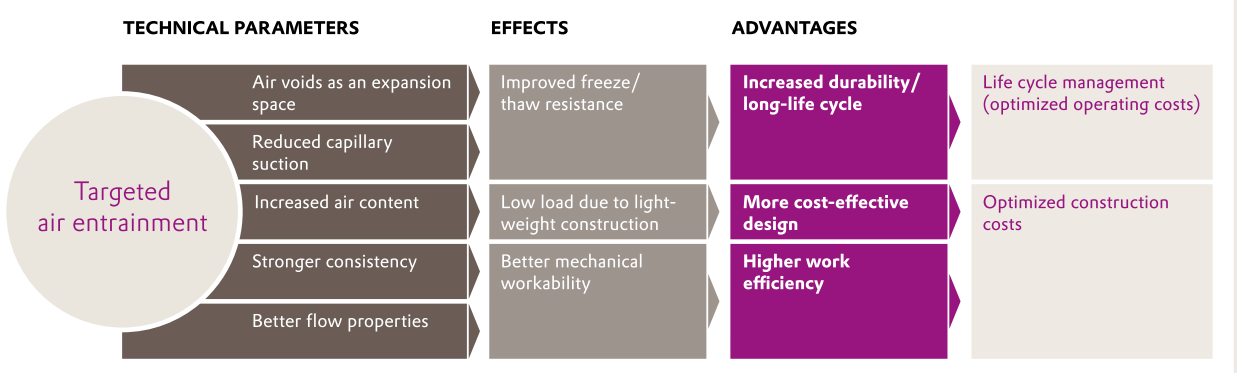
Advantages of synthetically produced air entrainers

There are a variety of different air-entraining agents on the market, based on natural active ingredients, synthetic surfactants and mixtures thereof. **Our synthetically produced air entrainers do not suffer from quality fluctuations associated with natural active ingredients.** They offer **consistent quality**, are **more stable** and therefore **more reliable**. Synthetic air entrainers are characterized by the fact that dosage and entrained air correlate. Air entrainers based on natural active ingredients, increase the air content at high dosages disproportionally. The increase in efficiency of synthetic air entrainers ensures **optimized construction costs and resource efficiency**.



Stabilization of air voids

AIR ENTRAINERS – **AT A GLANCE**



Increased durability

Ideally buildings are built to last forever. However, many buildings frequently require maintenance after only a few years.

Frost and **de-icing salts** have a decisive effect on the durability of concrete. Water and salt penetrate the structure of the building and destroy the microstructure of the building material. The crystallization of de-icing salts and the increase in volume of the frozen water lead to an internal explosive effect – and often result in severe spalling of the concrete's surface.

Air voids play a major role in situations like this. On the one hand, the additional air voids change the pore structure and reduce the capillary suction effect, means less water and reduced amounts of harmful salts penetrate the structure. On the other hand, the air voids act as expansion space, ensuring that the internal pressure of the freezing water and crystallizing salts is absorbed.

Maintenance can quite often become a significant cost factor during the lifetime of many buildings. If conscious planning is carried out for the total usage period of a building, the priorities often shift from a budget-bound solution to a durable, long-term and consequently cost-optimized solution.

Air entrainers from the **SITREN AirVoid®** range provide increased durability and the option of efficient lightweight construction and improved processing, thus optimizing construction costs and the entire life cycle management of a building. Ideal for the manufacture and processing of air-entrained concrete, in accordance with EN 1992 EC2.

Learn more about our air entrainers:

https://www.evonik.com/admixtures-air-entrainers

SITREN AirVoid® Air entrainers

Standards play a crucial role in ensuring the stability of performance characteristics during the planning, production and processing of concrete. DIN 1045-2 is one of the standards which applies to freeze-thaw resistance.

SITREN AirVoid® 601 is a highly effective air entrainer particularly suitable for concrete formulations, targeting high freeze thaw and de-icing salt resistance. Even under difficult conditions, the capillary suction and the water absorption are reduced.

Stabilized air void

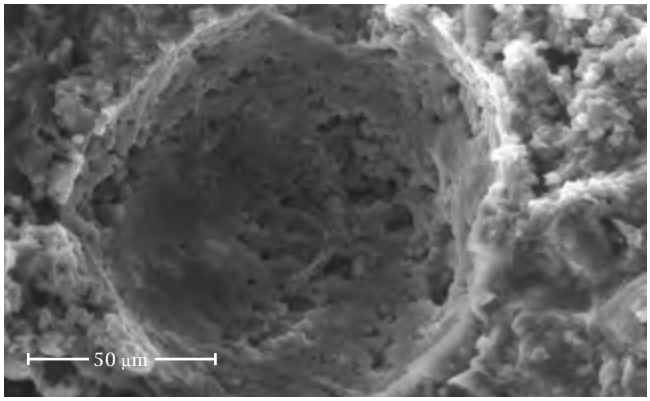


Image of a stabilized air void as seen through a scanning electron microscope

Determination of the air void parameters in hardened concrete in accordance with DIN EN 480-11

	AIR CONTENT [%]	MICROPORE CONTENT [%]	SPACING FACTOR [mm]
Setpoints	≥ 4.00	≥ 1.8	≥ 0.2
Concrete with SITREN AirVoid® 601	6.46	3.99	0.12

SITREN AirVoid® 601 allows the formulation of concrete in accordance with DIN EN 480-11.

Air content [%]:
Percentage of the air voids' volume (chord length up to 4 mm) compared to the total volume of the concrete.

Micro air void content A_{300}:
Content of micro air voids with a diameter of up to 0.3 mm (300 microns).

Spacing factor [mm]:
Calculated characteristic value of the greatest distance of any point in the hardened cement paste from the periphery of an air void (measured through the cement paste).

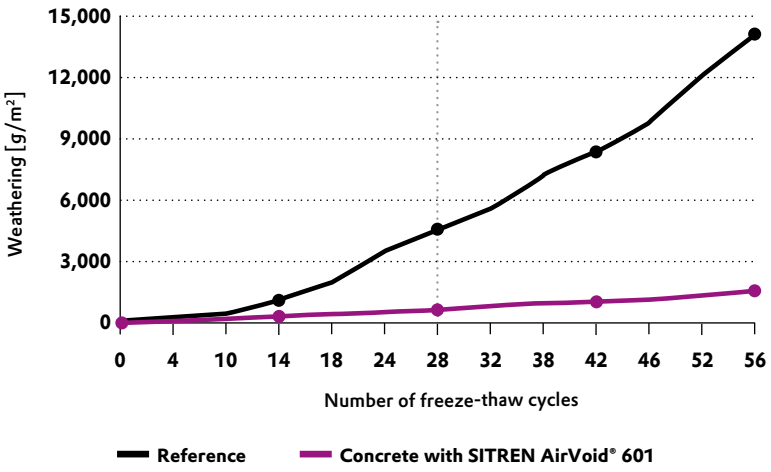
Formulation

Cement (CEM I 52.5 R):	350 kg/m³
Water (w/c: 0.55):	192 kg/m³
Aggregates	
Stone dust:	5 kg/m³
0–2 mm:	407 kg/m³
2–8 mm:	531 kg/m³
8–16 mm:	423 kg/m³
16–32 mm:	317 kg/m³
SITREN AirVoid® 601:	0.035 kg/m³

Verifiable freeze-thaw/de-icing salt resistance

DURABILITY OF CONCRETE WITH SITREN AIRVOID® 601 SUBJECTED TO FREEZE-THAW/DE-ICING SALT

CDF Test (Capillary suction of De-icing solution and Freeze thaw test)



Formulation

Cement (CEM I 42.5 N):	421 kg/m³
Water (w/c: 0.42):	177 kg/m³
Aggregates grading curve:	A/B 8
Aggregates (0–2 mm):	488 kg/m³
Aggregates (2–8 mm):	1181 kg/m³
SITREN AirVoid® 601:	0.0421 kg/m³

Concretes modified with **SITREN AirVoid® 601** belong to **the highest resistance class** (exposure class XF4) after being subjected to frost/de-icing salt. Weathering amounts to less than 1,000 g/m² after 28 freeze-thaw cycles.

Our modern air entrainers from the **SITREN AirVoid®** series for the construction industry chemicals sector consist of a **combination of highly effective specialty surfactants.**

Product overview

More information about air entrainers and additional products is available in our product overview or on request.

PRODUCT	CHEMICAL CHARACTERIZATION	ACTIVE INGREDIENT CONTENT [%]	RECOMMENDED DOSAGE* [%]
SITREN AirVoid® 601	Mixture of anionic surfactants	35	0.01–0.5

* based on cement

SITREN AirVoid® 601 enables an targeted and stable air entrainment into concrete mixes. SITREN AirVoid® 601 generates an air void system in the concrete that meets micro air void volume and spacing factor requirements. Very small distributed air voids are formed that allow freezing water to expand, making SITREN AirVoid® 601 ideal for formulations that are in accordance with exposure classes XF3 and XF4 (frost attack with and without de-icing agents).

AIRVOID MANAGEMENT

Defoamers

AIRVOID MANAGEMENT – Defoamers

The entrainment of uncontrolled air into cement based building materials is unavoidable and inevitably leads to a loss of quality in high performance concrete. Undesired air voids weaken the system resulting in lower mechanical strength and abrasion resistance. Air voids on the surface allow the penetration of harmful substances and can lead to surface defects.

Defoamers are preferably used for the prevention and removal of large air inclusions at the concrete surface and for rapid foam collapse in aqueous formulations. If it is necessary to remove finely distributed air from a system, deaerators are the preferred alternative. However, practice has shown that a clear differentiation between defoamers and deaerators is usually not possible. Most defoamers also have a deaerating effect to some extent and vice versa.

Application areas:
Defoamers are added to plasticizers and hybrid systems (on a chemical basis of lignosulphonates, naphthalenes, melamines or PCE's) for the production of:

- Onsite and ready-mix concrete (incl. lightweight and special concrete)
- Precast concrete elements
- Concrete products (e. g. paving stones and concrete blocks)
- Screed concrete
- Special concrete (e. g. HPC/UHPC)
- Architectural concrete
- Reinforced concrete
- Self-compacting concrete

Alternatively, defoamers can be used as a stand-alone concrete additive.

By direct addition to the concrete mix, surfaces can be optimized with regard to cavity clearance and other properties relevant for the exposed concrete, especially architectural concrete.

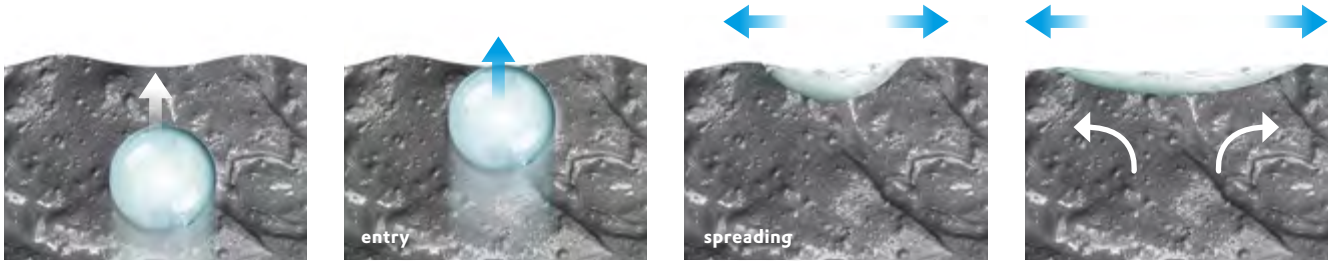
Not just hot air

Stay strong with our defoamers

How defoamers work can be best explained in the images below. Defoamers and deaerators are active at the air/water interface; they cause the stabilized structure of air voids to rupture in a liquid medium, thus allowing air to escape.

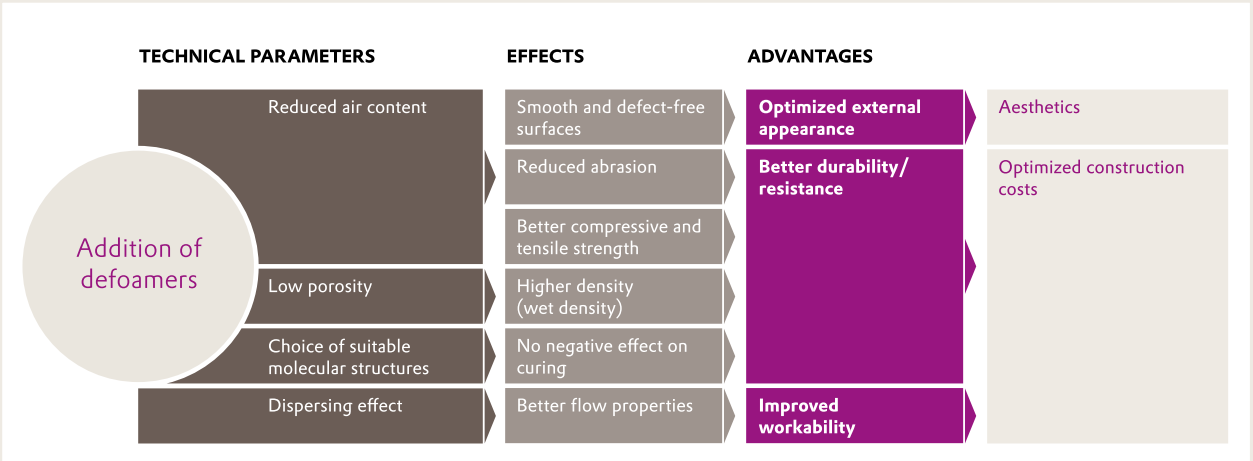
Defoamers are characterized by:

- **a low surface tension**
- **insolubility in the formulation to be defoamed**
- **a positive spreading coefficient**
- **a positive penetration coefficient**



The working mechanism of a defoamer is a three-step process. First, a defoamer droplet enters the foam lamellae. Second, it spreads and destabilizes the surfactant. Third, the foam lamellae becomes less elastic and finally ruptures.

DEFOAMERS – **AT A GLANCE**



Higher mechanical strength

Mechanical strength and resilience play a crucial role nowadays, with architecture being more sophisticated and creative than ever and the trend towards more streamlined building components constantly growing.

Our AirVoid Management defoamers give fresh concrete a higher bulk density. The reduction in air content results in higher flexural, tensile and compressive strengths and improved abrasion resistance of hardened concrete.
The selection of the correct molecular chemistry ensures that neither cement hydration nor the early strength of the concrete are adversely affected.

Thanks to our in-depth knowledge in the field of interfacial technology, we can influence the interplay between air entrainers and defoamers in a targeted way and are able to manage the strength of concrete.

With the **SITREN AirVoid®** brand, we offer high-quality defoamers that allow air voids to be selectively removed from the system. This results in higher mechanical strengths, an optimization of the surface appearance and easier workability, thus meeting the highest demand of aesthetics and durability. Our defoamers can be dosed easily. They can either be added to the plasticizers or directly to the concrete.

Learn more about our defoamers:

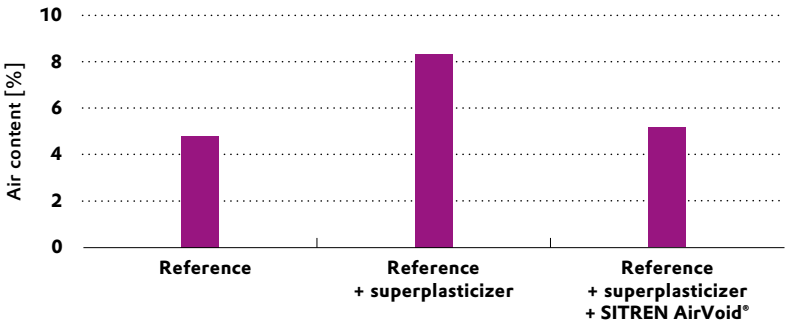
https://www.evonik.com/admixtures-defoamers

SITREN AirVoid® defoamers

Plasticizers and superplasticizers offer numerous advantages, but also increase the air content in the concrete and thus lead to a certain loss of strength. Our SITREN AirVoid® defoamers are based on a broad range of modified anionic surfactants and organo-modified siloxanes, which make the air content in the concrete controllable. In addition, they provide excellent compatibility in aqueous polymer solutions. Our defoamers can also be used in combination with our air entrainer SITREN AirVoid® 601 to achieve a more targeted control of the air void size and the air void size distribution.

SIGNIFICANT REDUCTION OF AIR CONTENT WITH SITREN AIRVOID® DEFOAMERS

Air content in fresh mortar

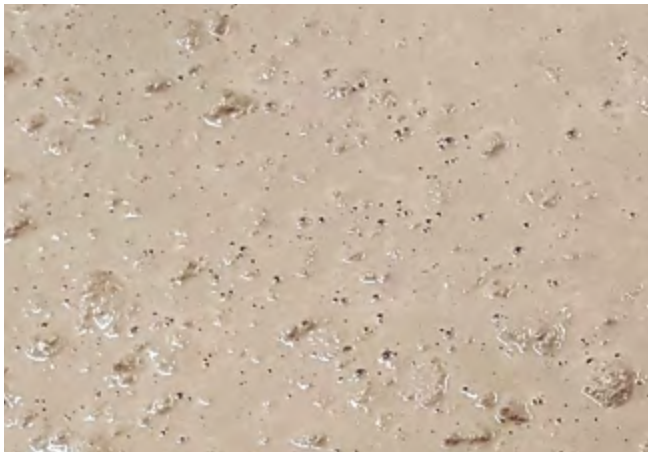


Formulation

Standard mortar according to DIN EN 196	
Cement (CEM I 42.5 R):	450 g
Standard sand:	1350 g
Water (w/c: 0.5):	225 g
Superplasticizer:	4.5 g
SITREN AirVoid® 305/320: (based on superplasticizer)	0.2 %

Dispersing effect

Our defoamers are characterized by an additional dispersing effect which ensures the optimal distribution of solid substances within a liquid matrix, guaranteeing excellent workability.



SITREN AirVoid® defoamers guarantee good workability properties even at low w/c ratios.

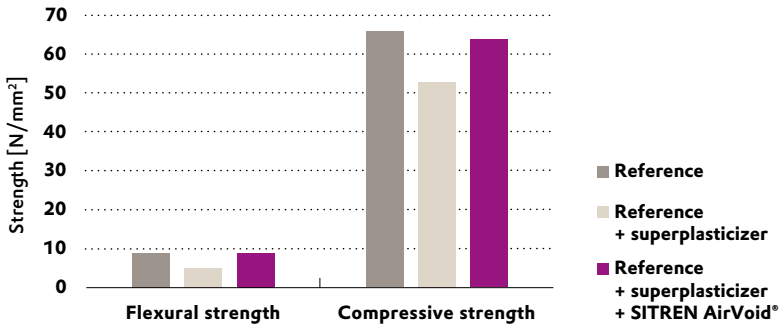
SITREN AirVoid® 3015 and 320 – Excellent compatibility in aqueous polymer solutions

The **excellent compatibility** of SITREN AirVoid® defoamers **in aqueous polymer solutions** ensures reliable and consistent protection against increased air entrainment that results from the use of plasticizers and superplasticizers in concrete.

Image left: Superplasticizer with SITREN AirVoid® 305 - no sign of turbidity or separation
Image right: Superplasticizer with commercial defoamer - heavy creaming and turbidity.

IMPROVED FLEXURAL AND COMPRESSIVE STRENGTH WITH SITREN AIRVOID® DEFOAMERS

Flexural and compressive strength after 28 days



Formulation

Standard mortar according to DIN EN 196	
Cement (CEM I 42.5 R):	450 g
Standard sand:	1350 g
Water (w/c: 0.5):	225 g
Superplasticizer:	4.5 g
SITREN AirVoid® 305/320: (based on superplasticizer)	0.2 %

Product overview

Information about additional defoamers and products is available in our product overview or on request.

	SITREN AirVoid® 320	SITREN AirVoid® 305
CHEMICAL CHARACTERIZATION	Nonionic surfactant	Nonionic surfactant
ACTIVE INGREDIENT CONTENT [%]	100	100
RECOMMENDED DOSAGE* [%]	0.1–1.0	0.1–1.0
COMPATIBILITY	★★★★★	★★★★★
DEFOAMING	★★★★★	★★★★★
APPLICATION IN	Polycarboxylate ethers	Lignosulphonates, Melamine sulphonates

*based on plasticizer/superplasticizer ★★★★★ = good ★★★★★ = superior

THE FIVE MANAGEMENT SYSTEMS:

Protection Management

Water repellents

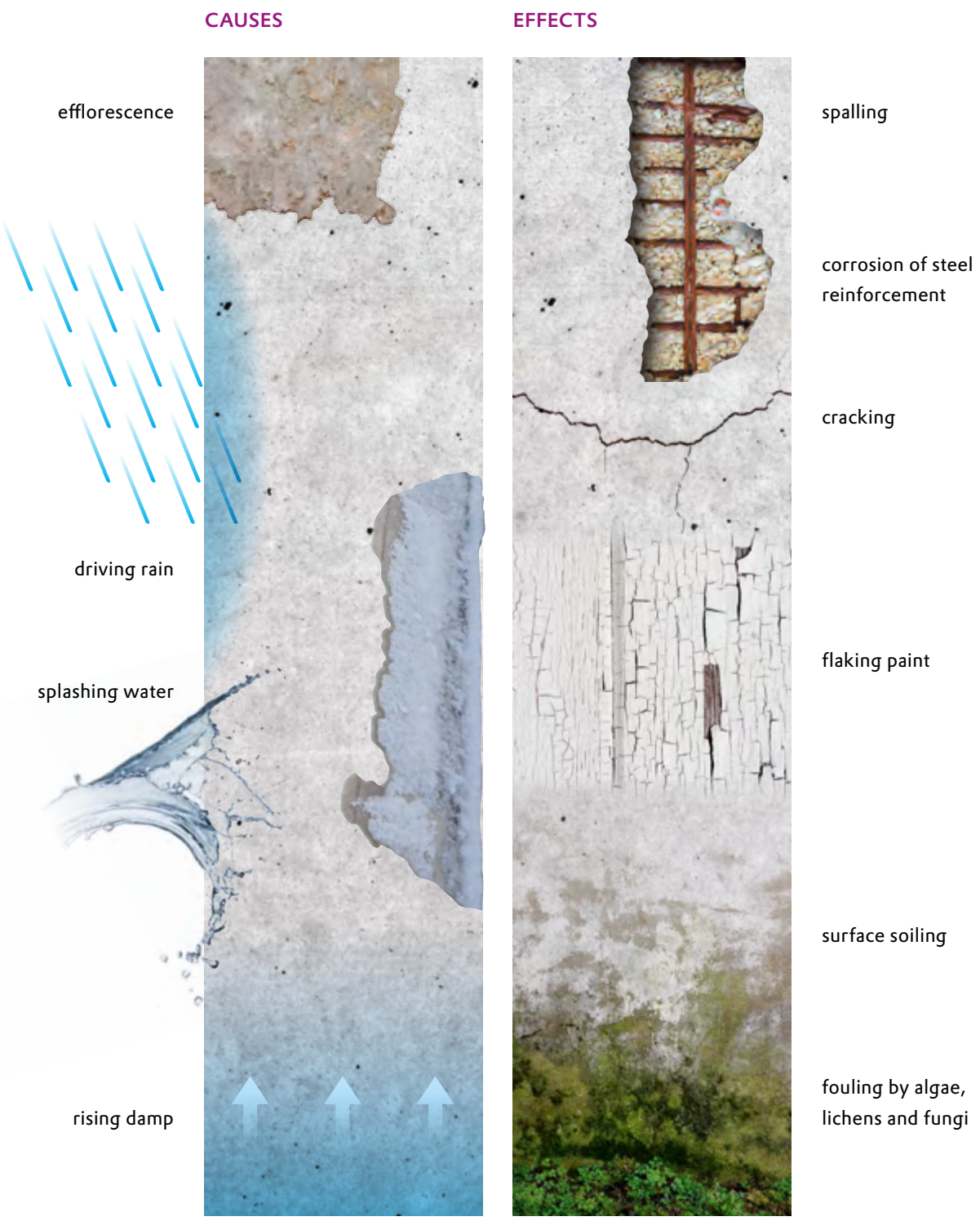
Water and moisture that infiltrate facades, buildings, roads, tunnels and bridges every year causing high maintenance costs every year.

Water infiltrates building structures in different ways and can trigger a variety of different processes that have a **considerable influence** on the **functionality,** the **appearance** and the **durability** of structures.

In nature even hard rocks can turn into sand. One prominent example is the formation of the Grand Canyon through erosion/surface abrasion in combination with the force of the water.

Therefore, it is crucial to understand the different mechanisms of water absorption and to control moisture effectively, thus preventing water induced damage.

POTENTIAL CAUSES AND EFFECTS OF EXTERNAL INFLUENCES ON CONCRETE



Potential damage – cracking, spalling, efflorescence, biological fouling by algae, lichens and fungi, corrosion of steel reinforcment, deteriorated insulation of exterior walls, surface soiling and flaking paint.

Water repellents

Water is a valuable natural resource – but water infiltration can cause major issues for concrete. Polluatants and dirt solved in the water as well as freezing water can cause considerable damage. Our **water repellents provide effective protection against these adverse effects.**

Typical reasons for the penetration of water and moisture into buildings are:

- **technical and manual application errors, which can cause cracks**
- **hygroscopic water absorption, i.e. moisture absorption through salts and minerals**
- **driving rain (with wind speeds of up to 150 km/h)**
- **leaking or missing horizontal barriers, facilitating the absorption of groundwater.**

Wetting angle of a water droplet on a hydrophobic surface:

One unit of measurement for the hydrophobic effect on a surface is the contact or wetting angle, a method for measuring the wettability of a surface. This is determined by means of water droplets applied to the surface. Surfaces with a wetting angle of > 90 ° are classified as being hydrophobic. If the contact angle is < 90 °, the surface is described as being hydrophilic.

Application areas:

- Onsite and ready-mixed concrete
- Precast concrete elements
- Concrete products (e. g. paving stones and concrete blocks)
- Screed concrete
- Special concrete (e. g. HPC/UHPC)
- Air-entrained concrete
- Reinforced concrete
- Self-compacting concrete

No entry!

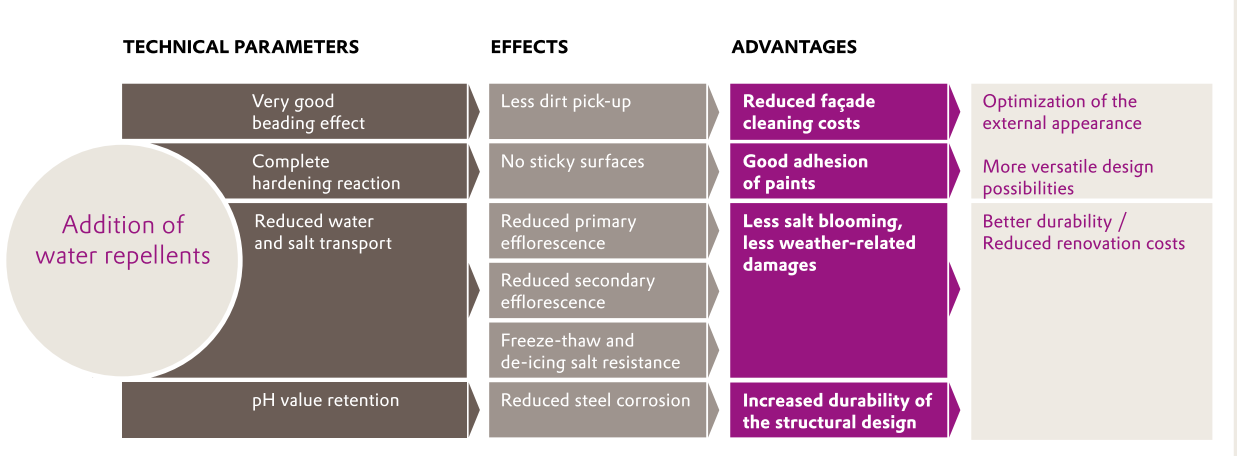
No room for water or moisture with our water repellents

Water repellents are used to provide buildings and roads with durable protection against water and moisture. Our silicone-based water repellents **minimize the infiltration of water** and dissolved pollutants, while maintaining the **water vapor permeability at the same time.**

Important requirements for water repellents:

- **High degree of alkaline stability**
- **Permeability to gas and water vapor**
- **Low surface tension**
- **No sticky surfaces**
- **Deep penetration depth**

WATER REPELLENTS – **AT A GLANCE**



Improved protection from efflorescence and increased freeze-thaw (salt) resistance

Flawless building surfaces are an important feature of high quality aesthetic architecture. Unsightly crystalline efflorescence can often appear on the surface of structures.

Hydrophobing agents reduce water and salt transport in building materials and minimize primary and secondary efflorescence. Reduced water transport also has a positive effect on limiting water uptake and minimizing frost damage. During the phase transition from liquid to ice, the volume of water increases by up to 10 %.
This volume is inevitably absorbed by the concrete structure or transported to the surface. If there is not enough expansion space, pressure and tensions are created, which can cause the material structure to fail.

Water repellents prevent the penetration of water and increase the resistance to freeze-thaw damage means they allow a significant reduction of maintenance costs.

Other water induced damage mechanisms include:

- **Steel corrosion**
- **Carbonation**
- **Alkali-silica reaction**

Our **TEGOSIVIN®** brand consists of powerful water repellents, which significantly reduce water absorption and provide outstanding beading properties. This optimizes the external appearance of a building and offers more design freedom; it also guarantees a significant improvement in durability, which in turn leads to lower maintenance costs.

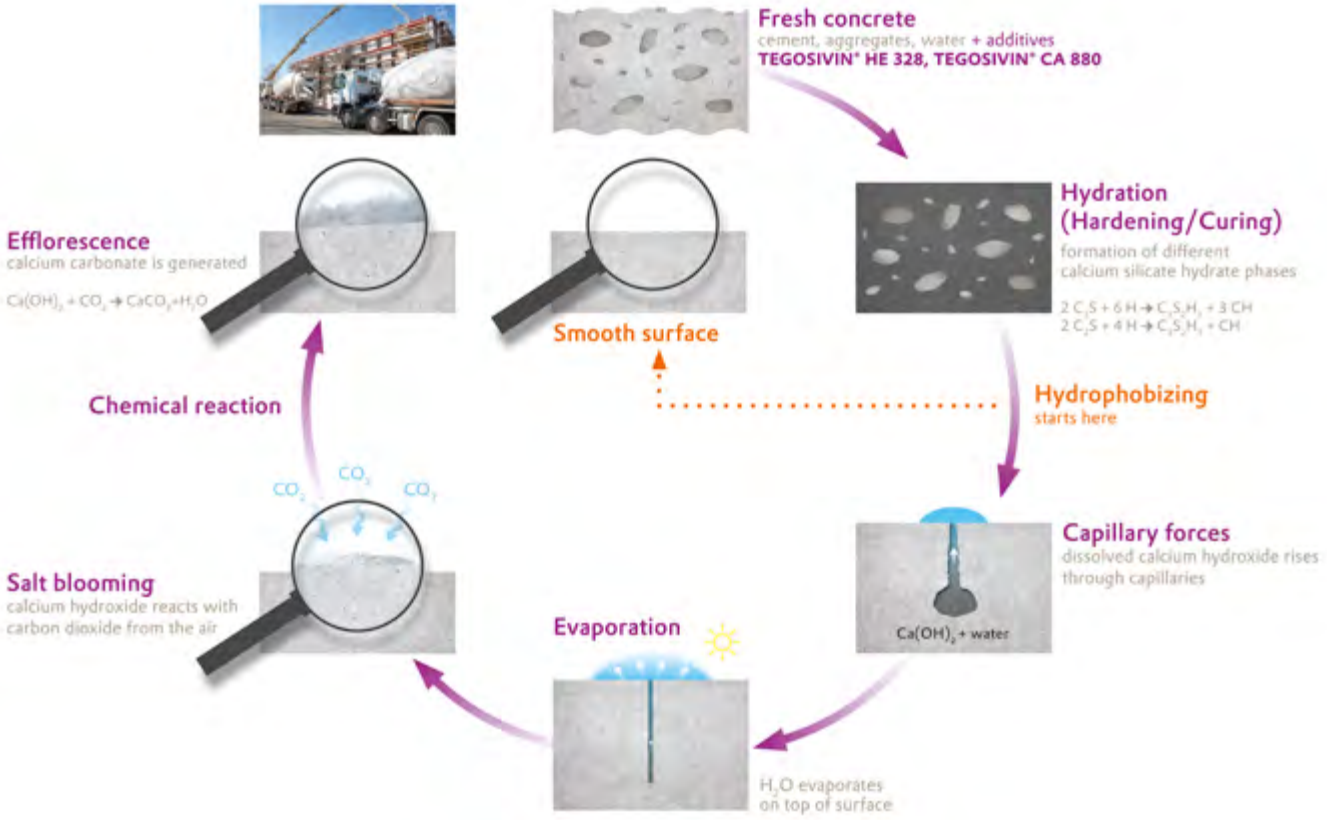
Learn mor about our water repellents:

https://www.evonik.com/admixtures-water-repellents

TEGOSIVIN® water repellents

TEGOSIVIN® water repellents for the concrete admixture sector are based on alkoxy silanes and siloxanes, a technology that has been used for many years with great success to improve the sustainability and durability of concrete.

Efflorescence



Primary efflorescence

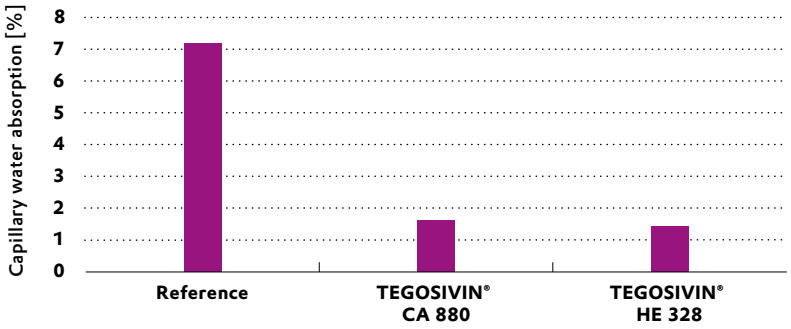
Dosages lower than 0.1 % of TEGOSIVIN® referred to cement can **significantly reduce primary efflorescence.**

Secondary efflorescence

A dosage of 0.5 % TEGOSIVIN® referred to cement ensures **long-term protection**. In contrast, unprotected objects, depending on the climatic conditions can exhibit efflorescence after just a few weeks.

Besides preventing efflorescence, **TEGOSIVIN® water repellents** also contribute to the **reduction of water absorption**.

SIGNIFICANTLY REDUCED CAPILLARY WATER ABSORPTION WITH TEGOSIVIN®



Formulation

Standard mortar according to DIN EN 196

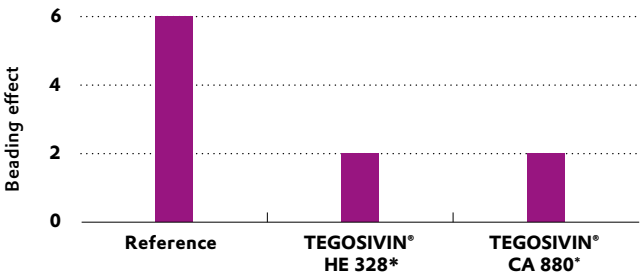
Cement CEM II A-LL 42.5 R:	900 g
Sand:	2,700 g
Water (w/c: 0.5):	450 g
Hydrophobing agent:	4.5 g

Cost-effective dosages of 0.5 % based on cement allow a **reduction of capillary water absorption by more than 80 % after 24 hours.**

Environmental influences such as fine dust and general air pollution have a significant impact on the appearance of structural surfaces and can cause high cleaning costs.

TEGOSIVIN® products counteract these influences – and thanks to their excellent beading properties, they are not only stain-resistant, they also facilitate the cleaning of soiled surfaces.

Beading effect



Beading effect: 1 = excellent ... 6 = no beading
*__Dosage water repellent:__ 0.5 % based on cement

Product overview

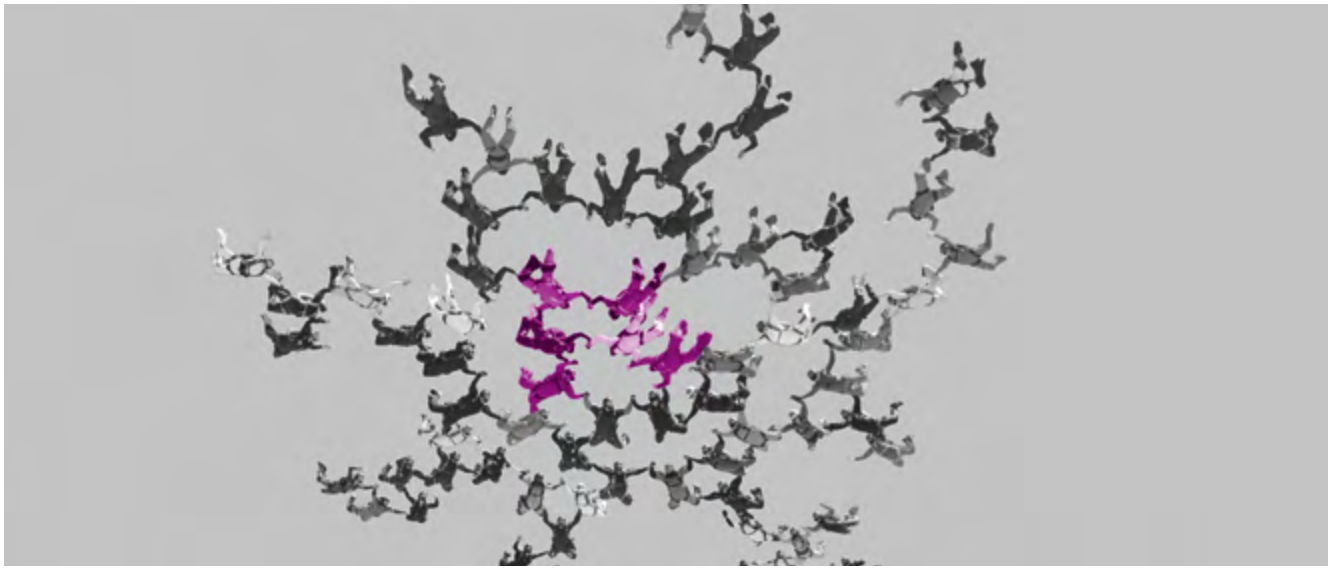
More information about water repellents and other products is available in our product overview or on request.

	TEGOSIVIN® CA 880	TEGOSIVIN® HE 328
CHEMICAL CHARACTERIZATION	Alkoxy silane emulsion	Alkoxy silane/Siloxane emulsion
ACTIVE INGREDIENT CONTENT [%]	60	50
RECOMMENDED DOSAGE* [%]	0.1–1.0	0.1–1.0
INTERNAL HYDROPHOBISING	★★★★☆	★★★★★
EFFLORESCENCE CONTROL	★★★☆☆	★★★★☆

* based on cement ★☆☆☆☆ = good ★★★★★ = superior

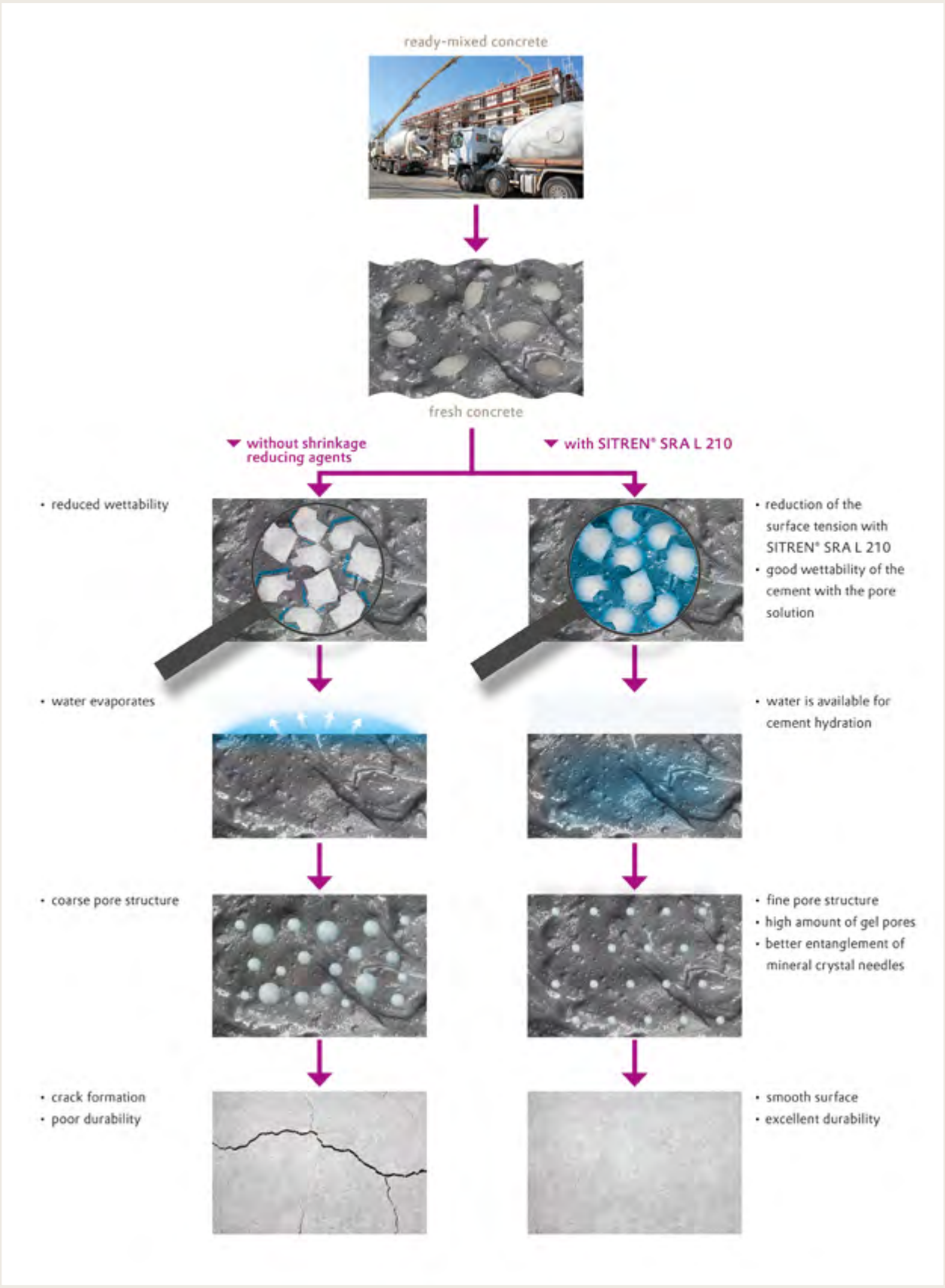
Curing Management

Shrinkage reducing agents



The final properties of concrete structures are strongly determined by controlling the water content. **Mistakes made at the beginning cannot be controlled later.** A lack of water prevents the cement from fully hydrating which may result in loss of compressive strength, reduced frost resistance and increased susceptibility to chemical attack which can all have adverse effects on the concrete durability. Concrete shrinkage properties during curing and drying are one area of major concern to the industry.

SHRINKAGE REDUCING AGENTS IN USE



Shrinkage reducing agents

Shrinkage describes a volume reduction of cement-based products due to a change in the water balance.

In addition to **ambient weather conditions** and **internal drying, chemical/mineral reactions** also play an important role. This volume reduction can affect both the shape of the concrete element as well as its bearing points. Restriction of the free shrinkage results in the build-up of **internal forces and tensions**, which can lead to deformation and **crack** formation.

Factors influencing shrinkage

The most important factors that affect shrinkage include low humidity, wind, solar radiation, unfavorable temperatures, but also the individual concrete composition and component dimensions.

Application areas:

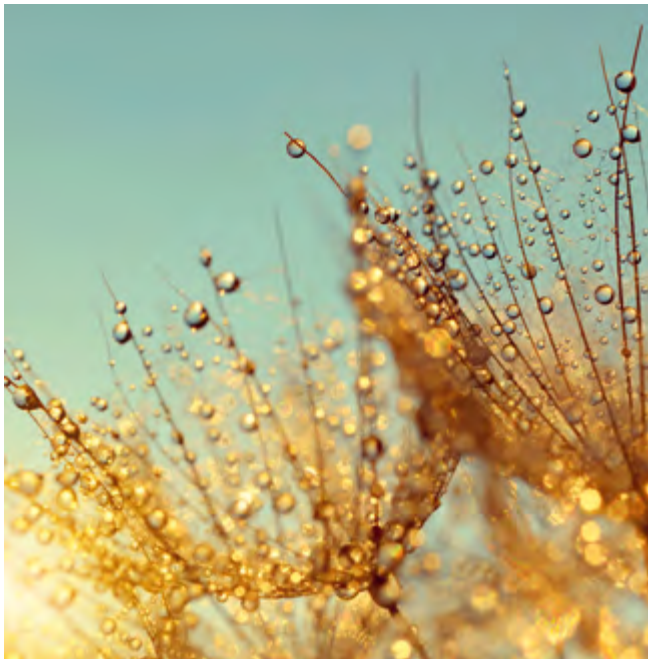
- In-situ und ready-mixed concrete
- Prefabricated concrete
- Concrete products
  (e. g. paving stones and concrete blocks)
- Concrete screeds
- Special concrete (e. g. HPC and UHPC)
- Architectural concrete
- Reinforced concrete
- Self-compacting concrete

Stay true to form!

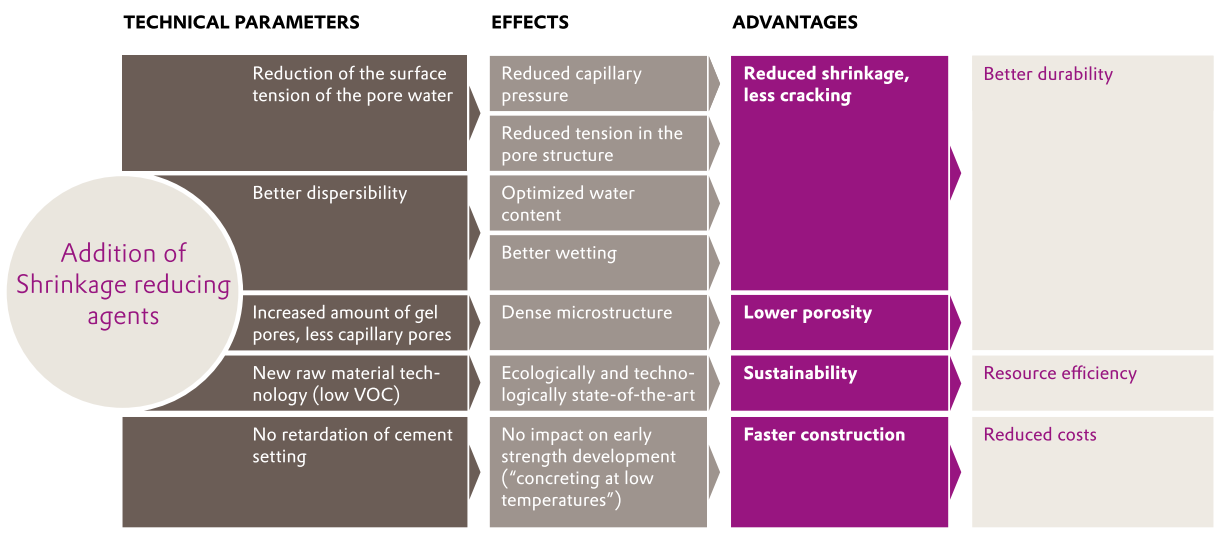
Better stability with our shrinkage reducing agents.

Evonik recognizes that **sustainability** is of utmost importance for all our futures. As a result, our product development focuses on high-performance products that are friendly to the environment.

With this in mind, Evonik has developed a new generation of **SITREN® shrinkage reducing agents**. Thanks to their **extremely low VOC content**, SITREN® shrinkage reducing agents are able to meet the most **stringent eco label requirements** such as **EMICODE EC1 PLUS** – without any dosage restrictions.



SHRINKAGE REDUCING AGENTS – **AT A GLANCE**



Minimize shrinkage – increase durability

Nowadays technical and aesthetic demands for building materials are higher than ever before. Lack of shrinkage control has a strong impact on the use and durability of concrete materials.

The **setting characteristics of cement based building materials** have a considerable influence **on the final concrete properties**. The hardening of mineral building materials results from a large number of complex processes. It is especially important to **minimize shrinkage and to avoid cracking.**

Our new generation of shrinkage reducing agents frequently out-perform other commercially available products. They can reduce drying shrinkage as well as plastic shrinkage. They also **enhance the workability** of the cementitious system whilst having **no effect on the setting process**. A significantly reduced number of capillary pores with simultaneously increased micro pore content leads to lower porosity and thus, to a more dense microstructure.

Our SITREN® shrinkage reducing agents, developed in close cooperation with the admixture industry, stand out for both ecological and technical reasons. The reduction in the capillary pressure and the stress in the pore structure, results in markedly reduced shrinkage and thus in the prevention of crack formation. The cement setting and the concrete early strength are not affected. In combination with an optimized water content, our new generation of shrinkage reducing agents also ensure improved durability.

Learn more about our shrinkage reducing agents:
https://www.evonik.com/admixtures-shrinkage-reducing

SITREN® shrinkage reducing agents

Shrinkage refers to the volume reduction of cementitious products over time. The water balance plays a central role, since the shrinkage processes or the subsequent drying of these materials are promoted by the chemical reaction of the binders with water.

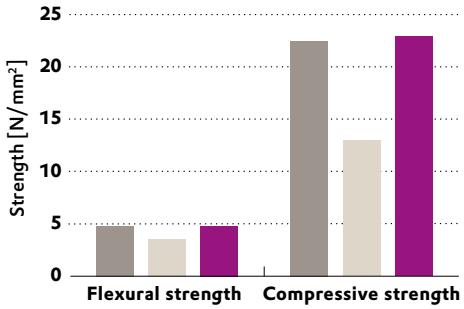
There are basically three types of shrinkage:

1. **Chemical or autogenous shrinkage** – through water removal in the chemical reaction between water and cement.
2. **Plastic shrinkage** – resulting from the evaporation of the excess water as long as the cement-based building material can still be processed.
3. **Long-term shrinkage or drying shrinkage** – as a result of the drying out of cement based building material over time.

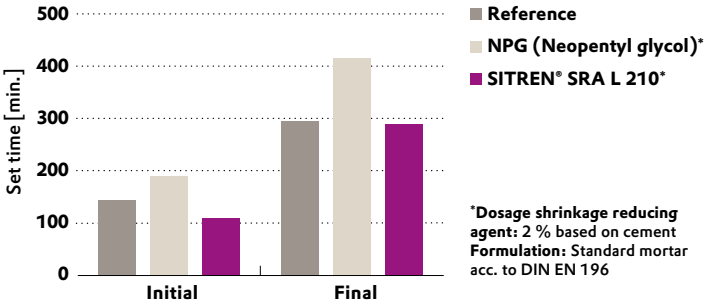
Our novel shrinkage reducing admixtures are based on the latest raw material technologies and significantly influence the process of plastic and drying shrinkage. SITREN® SRA L 210 is a liquid shrinkage reducing agent based on modified polyethers to prevent cracking of cement based building materials.

SITREN® SRA L 210 HAS ALMOST NO IMPACT ON THE SETTING BEHAVIOUR

Flexural/Compressive strength after 1 day



Vicat setting test



*Dosage shrinkage reducing agent: 2 % based on cement
Formulation: Standard mortar acc. to DIN EN 196

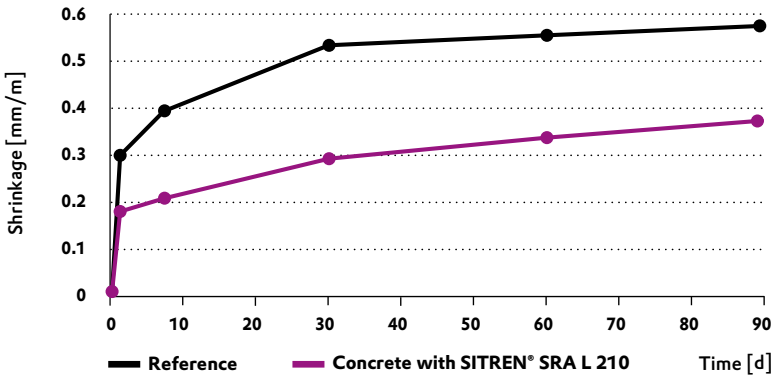
The use of **SITREN® SRA** has almost **no impact on early strength or set times** compared to neopentyl glycol.

Cracking of concrete surface without shrinkage reducing agent

Crack prevention in concrete by using SITREN® SRA L 210

SITREN® SRA L 210 REDUCES DRYING SHRINKAGE OF CONCRETE

Shrinkage up to 90 days



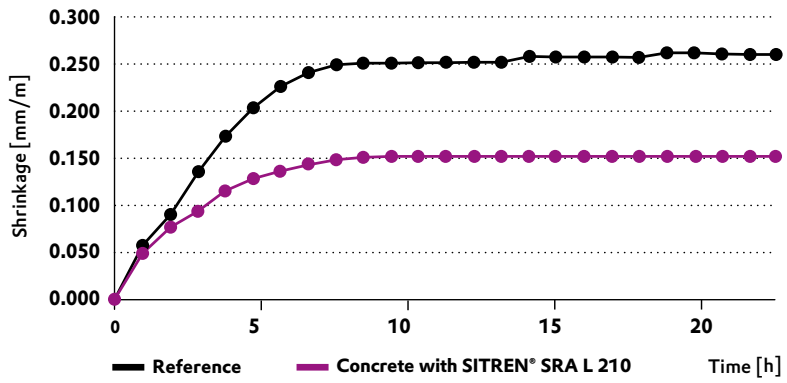
Formulation

Cement (CEM I 42.5 N):	375 kg/m³
Water (w/c: 0.45):	169 kg/m³
Aggregates (0–2 mm):	570 kg/m³
Aggregates (2–8 mm):	679 kg/m³
Aggregates (8–16 mm):	587 kg/m³
SITREN® SRA L 210:	7.5 kg/m³
PCE plasticizer:	1.9 kg/m³

SITREN® SRA L 210 not only significantly **reduces drying shrinkage**, also known as capillary shrinkage, but also **plastic shrinkage** within the first 24 hours.

SIGNIFICANT REDUCTION OF PLASTIC SHRINKAGE BY USING SITREN® SRA L 210

Shrinkage over a period of 24 hours



Product overview

Additional shrinkage reducing agents and further information are available in our product overview or on request.

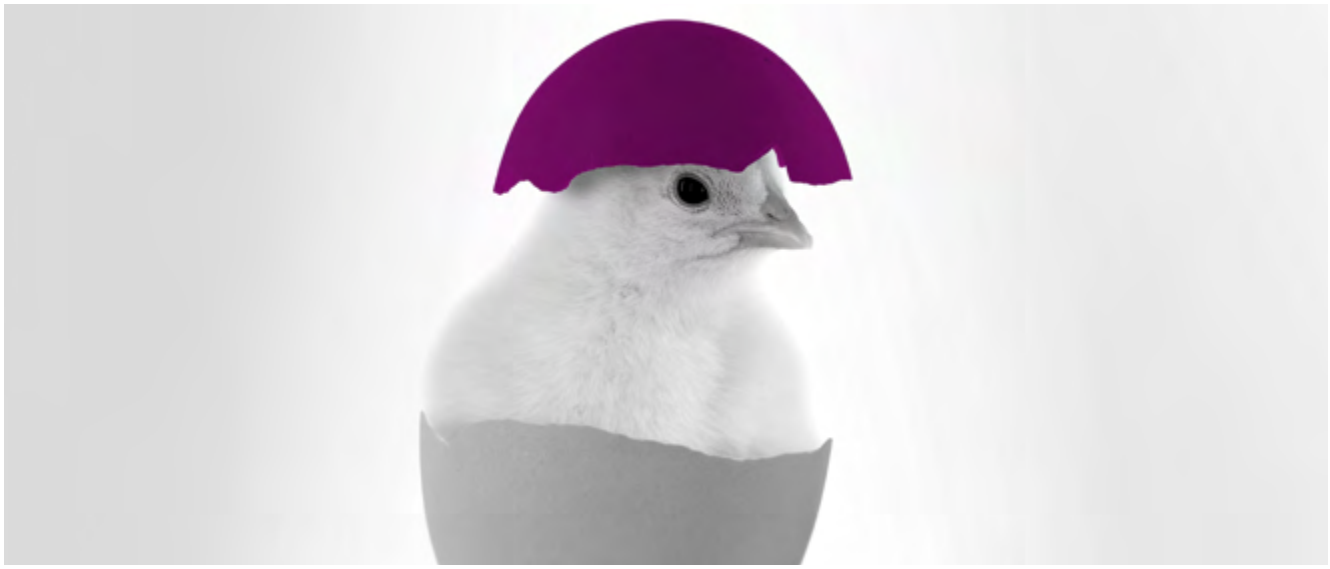
PRODUCT	CHEMICAL CHARACTERIZATION	ACTIVE INGREDIENT CONTENT [%]	RECOMMENDED DOSAGE* [%]
SITREN® SRA L 210	Modified polyether	100	0.5 – 3.0

* based on cement

THE FIVE MANAGEMENT SYSTEMS:

Release Management

Mold release agents



The demolding process and the associated use of mold release agents is becoming increasingly important due to the aesthetic demands on concrete structures. Smooth, defect-free and thus visually attractive concrete surfaces are seen today as hallmarks of quality in manufactured building components.

The mold and mold release agents

After the concrete has cured the demolding process has to be undertaken with care to avoid damaging the concrete surfaces, especially for visible surfaces, but also in sensitive areas, such as corners, edges and recesses.

To ensure a smooth and efficient process, the release procedure between the mold and the concrete must be safe and reliable. Our mold release agents form a protective film at the interface between the mold surface and the fresh concrete to avoid unwanted bonding and build-up.

Influencing factors

Selecting the right mold release agent depends not only on the temperature, the type of concrete, the load and the type of mold but also on the condition of the mold. A distinction is made between absorbent molds (timber) and non-absorbent molds (coated timber, steel and plastic). **The correct interaction of all the components not only affects the quality of the concrete surface, but also protects metal molds against corrosion.** Therefore, a mold protected with SITREN® MR products can be used more frequently.

RELEASE MANAGEMENT

Mold release agents

RELEASE MANAGEMENT – Mold release agents

Our mold release agents are used in almost all molding processes. Depending on the application, the requirements for release agents are different. Appropriate systems that match the general and working conditions should be selected; this will lead to a reliable and safe mold release procedure.

Protect the environment – protect health

In today's society, the demand for environmental protection is growing significantly. Our environmentally friendly mold release agents exceed all requirements in terms of environmental aspects of modern release agents.

Our products are readily biodegradable in accordance with OECD 301 F/28d and offer an environmentally friendly alternative to mineral-oil-based systems. Our solvent-free products set the highest standards in the areas of health protection and work safety.

Application areas:

- Onsite and ready-mix concrete (incl. lightweight and special concrete)
- Precast concrete elements
- Concrete products (e. g. paving stones and concrete blocks)
- Special concrete (e. g. HPC/UHPC)
- Architectural concrete
- Air-entrained concrete
- Reinforced concrete
- Prestressed concrete
- Self-compacting concrete

A marriage doesn't have to be permanent

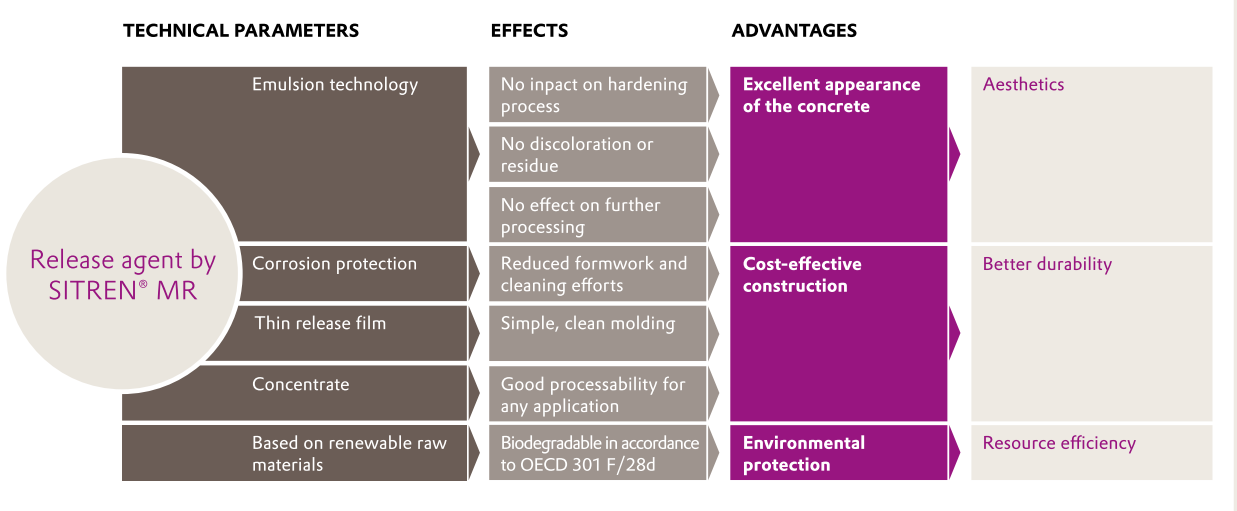
Letting go is easy with our mold release.

Whether on the construction site, the precast plant or in the building materials industry: shaping and molding manufacturing processes are everywhere – and choosing the right mold release agent plays a decisive role.

High aesthetic standards for concrete surfaces often play a part in pre-planning procedures designed to avoid visible defects. Therefore mold release agents must not impair the curing process of the fresh concrete. After mold stripping the concrete surface has to be smooth and visually perfect.

Mold release agents from our SITREN MR product range deliver outstanding release performance. In addition, they prevent concrete discoloration, surface residues and corrosion of metal molds that can also impact the further processing of the concrete element (paints, plasters and other coatings).

MOLD RELEASE AGENTS – **AT A GLANCE**



Processing and economy in the spotlight

In molding processes, the processing timeframe always goes hand-in-hand with economic efficiency. The concrete and the mold have to be separate easily and cleanly, without damaging either the concrete surface or the mold itself. At the same time, the mold surface has to be protected from weather influences and dirt buildups to **minimize molding and cleaning costs.**

Our emulsions not only meet these requirements, they also possess **excellent corrosion protection properties for metal molds**. The high active content of our emulsion concentrates enables **simple dilutions and a thin-layered and efficient coating**. Our mold release agents are produced using cutting-edge technology and have excellent storage stability.

SITREN® mold release agents guarantee visually excellent concrete surfaces, they also generate enormous cost efficiency thanks to optimized working and usage times. Our products ensure easy demolding processes and are readily biodegradable.

Learn more about our mold release agents:

https://evonik.com/admixtures-release-management

SITREN® mold release agents

Our **SITREN® MR** range of concentrated mold release agents are based on renewable raw materials. These concentrated mold-releasing agents make preparation of handling concrete molds a simple task – just add water and employ easy stirring techniques. Depending on the degree of dilution, mold release agents can be formulated with different release properties and for different types of molds.

Application areas

FORMWORK TYPE	SITREN® MR 870	SITREN® MR 871
METAL	★★★☆☆	★★★★★
PLASTIC	★★★★★	★★★★★
WOOD	★★★★★	★★★★★
RUBBER	★★★★★	★★★★★

★☆☆☆☆ = improper ★★★★★ = extremely suitable

Product overview

	SITREN® MR 870	SITREN® MR 871
CHEMICAL CHARACTERIZATION	Vegetable oil based emulsion concentrate	Vegetable oil based emulsion concentrate
ACTIVE INGREDIENT CONTENT [%]	58	58
APPLIED QUANTITY [ml/m²]	10–18	10–18
CORROSION PROTECTION	★★★★★	★★★★★

★★★★★ = average ★★★★★ = excellent

Reference: without corrosion protection

with SITREN® MR 871

- Metal plates treated with mold release agents
- 30 minutes storage at room temperature
- Additional storage in water for more than 24 hours

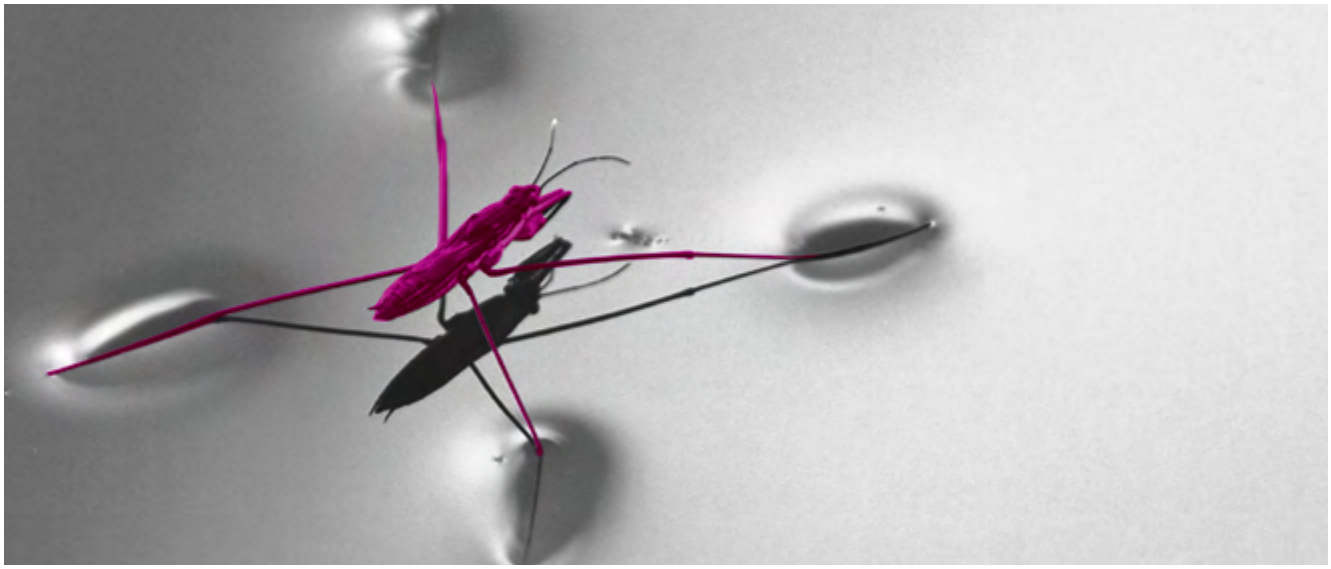
Very effective separation effect with SITREN® MR-based concrete release agents even in the most demanding applications

More information about mold release agents and other products is available in our product overview or on request.

THE FIVE MANAGEMENT SYSTEMS:

Formulation Management

Wetting agents, Dispersants, Process defoamers



Today's **formulations** for the construction industry often consist of a **complex combination of a wide range of different raw materials, admixtures and additives**. To meet technical and economic demands placed on modern building products, **all components have to complement each other,** enabling all the „wheels", no matter how small, to engage with one another accurately and reliably. Process or performance additives – perform a wide range of critical functions during manufacture, processing or final product finishing.

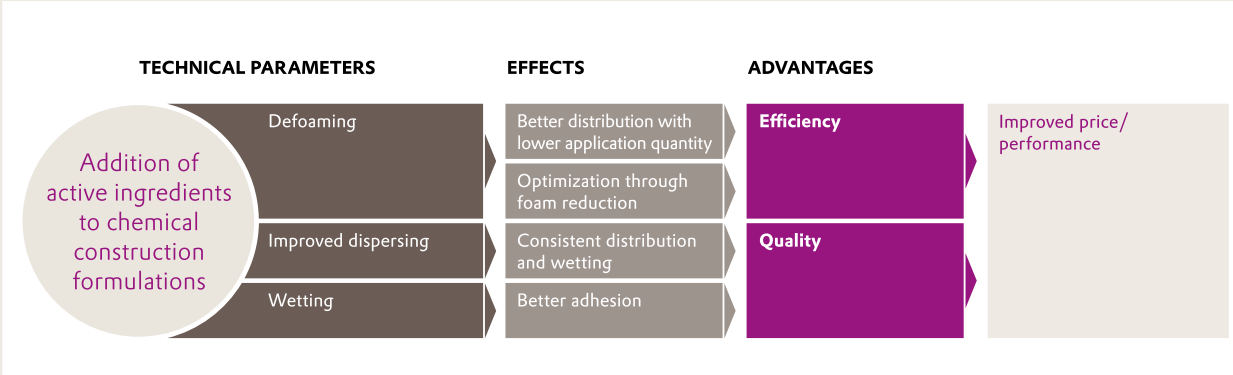
The fundamentals of formulation management is the foundation of our extensive product portfolio and our expertise in surface-active substances.

Our additives influence the interaction of the different components within chemical formulations used in the construction industry and as a result improve the efficiency and performance of these systems. Evonik's product range offers a wide range of additives that enable our customers to achieve numerous objectives including:

- **increased efficiency and compatibility of compounding ingredients**
- **optimized mixing and processing procedures**
- **improved adhesion properties**
- **increased storage stability**

Properties can be adapted within a formulation through the direct addition of additives such as wetting or dispersing agents; alternatively, individual formulation ingredients such as fillers or pigments can be pre-modified by means of surface treatment, providing them with an optimized property profile within the formulation.

WETTING AGENTS / DISPERSING AGENTS / PROCESS DEFOAMERS – **AT A GLANCE**



Interaction of surface-active substances

In addition to the results reported here, our broad chemical portfolio of organically modified siloxanes, oleochemicals, polyethers, polyacrylates, nonionic amphoteric and cationic surfactants enables us to offer our customers innovative, tailor-made and solution-oriented products and concepts created through our targeted molecular design.

Regardless of the specific objective, our product portfolio aims to achieve solutions of the highest quality and optimal efficiency.

Modified surface properties

Additives can also specifically change surface properties, modifying the performance profile to match the desired application. Surface tension, for example, can be modified to match the application.

The wettability of the surface is one of the typical property profiles that are changed in this way. Here, the interfaces can be modified from heavily hydrophobic or lipophilic to particulary hydrophilic and lipophobic. Our additives thus enable wettability, essentially affecting the bonding properties of surfaces.

Our solution-oriented process and performance additives increase both the efficiency of industrial production processes significantly as well as enhancing the performance characteristics of the materials used within the construction industry.

Learn more about our wetting agents, dispersants and process defoamers:

https://evonik.com/admixtures-formulation-management

Inv.-Nr.: 09-2022

https://www.evonik.com/construction-chemicals

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