



CONSTRUCTION & INFRASTRUCTURE | SILANES & SILICONE SILOXANES



CONCRETE SURFACE PROTECTION FOR CONCRETE ADVANTAGES

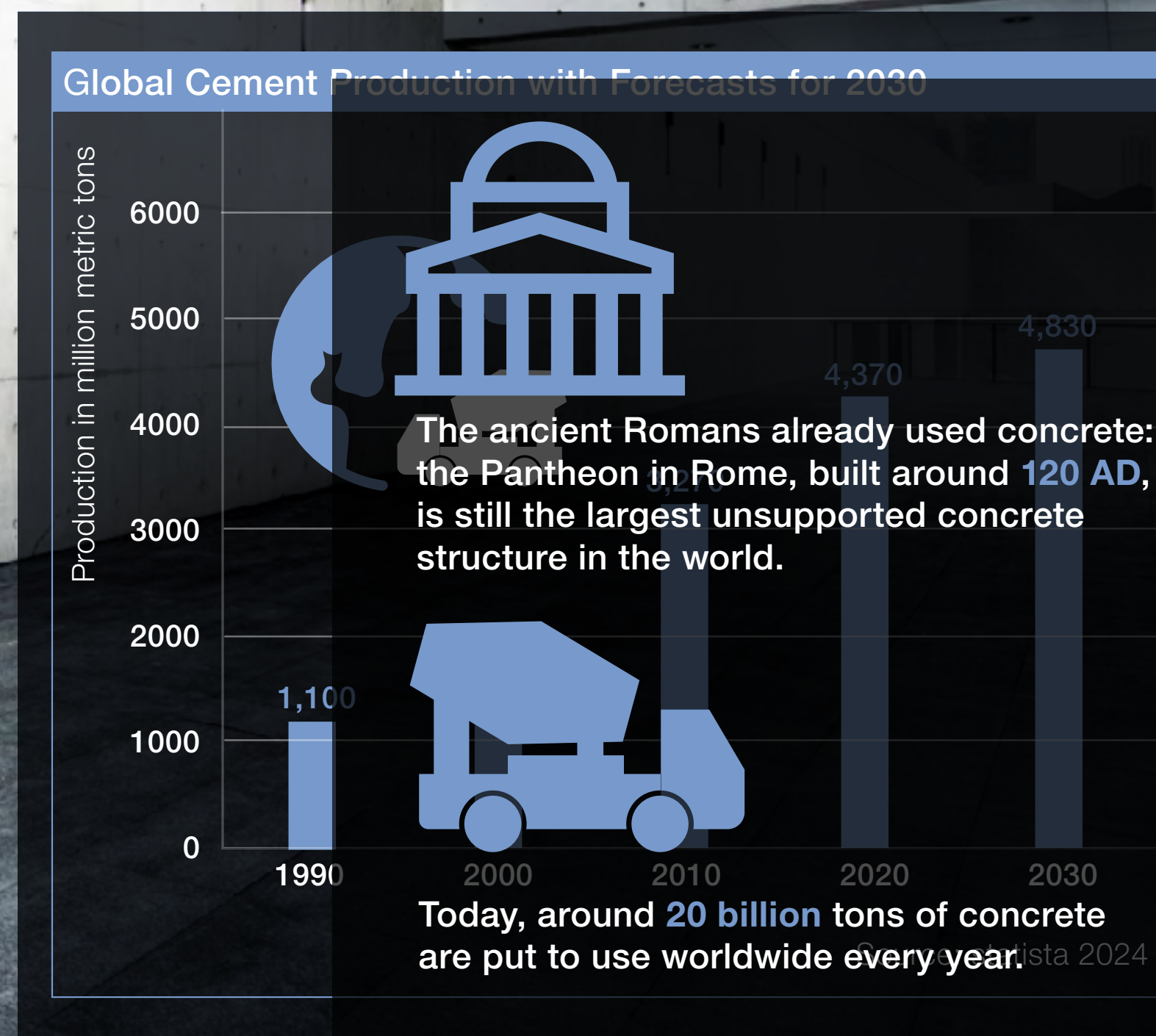


CONCRETE: NO. 1 BUILDING MATERIAL TODAY AND TOMORROW

Concrete has significantly changed construction. The reasons are manifold: while it is widely appreciated for its excellent mechanical and physical properties, cost-effectiveness and durability, concrete also offers unprecedented versatility.

Roads and bridges, skyscrapers and industrial buildings: our modern infrastructure is based on concrete, often in combination with steel. As a highly versatile material, concrete provides architects and engineers with the opportunity to shape buildings in new and unprecedented ways – matching today's motto "bigger, higher, wider".

Impressive Facts about Concrete 
Global Demand for Concrete 



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CONCRETE AND MOISTURE: A HARMFUL COMBINATION

Other Typical Damage Caused By Water

- Chemical corrosion, e.g. binder transformation by acidic gases (SO₂, NO₂, CO₂)
- Cracks by swelling and shrinkage
- Frost damage and freeze/thaw damage due to salt ingress
- Efflorescence and salt damage caused by hydration and crystallization
- Lime leaching
- Rust stains
- Dirt pick-up and stains
- Fungal, moss, lichen and algal growth

However durable concrete may seem, it is also quite vulnerable – especially when it comes to moisture. Penetrating water can cause serious damage that endangers a building's existence.

Especially reinforced concrete is at risk: Harmful substances such as chloride ions from road salt or seawater that penetrate the concrete with water can cause the steel reinforcement to rust. But even without steel, concrete is highly susceptible to water damage.

The Destructive Power of Water

Steel and Concrete

A strong connectionReinforced concrete combines the compressive strength of concrete with the tensile strength of steel. The high alkalinity of the fresh concrete passivates the steel.

Moisture Penetrates

Dissolved salts in water such as chlorides penetrate into the concrete, reduces the alkalinity and causing the steel's passivating layer (protective layer) to dissolve.

Damage Begins Under the Surface

Under the influence of oxygen and moisture, the steel begins to rust and pitting corrosion starts to occur. The damage is invisible from the outside.

The Damage Becomes Visible

Since the iron's corrosion process involves a drastic volume expansion (bursting force), the concrete layer above the reinforcement spalls, resulting in serious damage of the building structure.

Other Typical Damage Caused By Water



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CONCRETE NEEDS LONG-LASTING PROTECTION

Much of the damage caused by moisture can be prevented, or at least reduced or kept at bay for longer, by means of hydrophobic impregnation. At WACKER, we have been developing and enhancing particularly longlasting and cost-efficient concrete protection agents for decades.

Hydrophobic impregnation reduces capillary water uptake **i** by at least 80 %. Low capillary water uptake is the most efficient protection against rain and humidity. As opposed to film-forming coatings, hydrophobic impregnation does not affect the water-vapor permeability of the concrete, keeping its original breathability unchanged.

The Benefits of Hydrophobic Impregnation

- Reduction in water uptake
- Formation of a chloride barrier and thus protection against reinforcement corrosion
- Retention of high water-vapor permeability
- Extensive penetration
- High UV resistance
- Surfaces are not rendered shiny or tacky, or caused to yellow
- Adequate resistance to alkalis
- Safe use

Capillary Water Absorption

Mineral construction materials such as concrete are open-pored. Contact with water produces the capillary effect. Large volumes of water can therefore penetrate into the concrete within a short time.

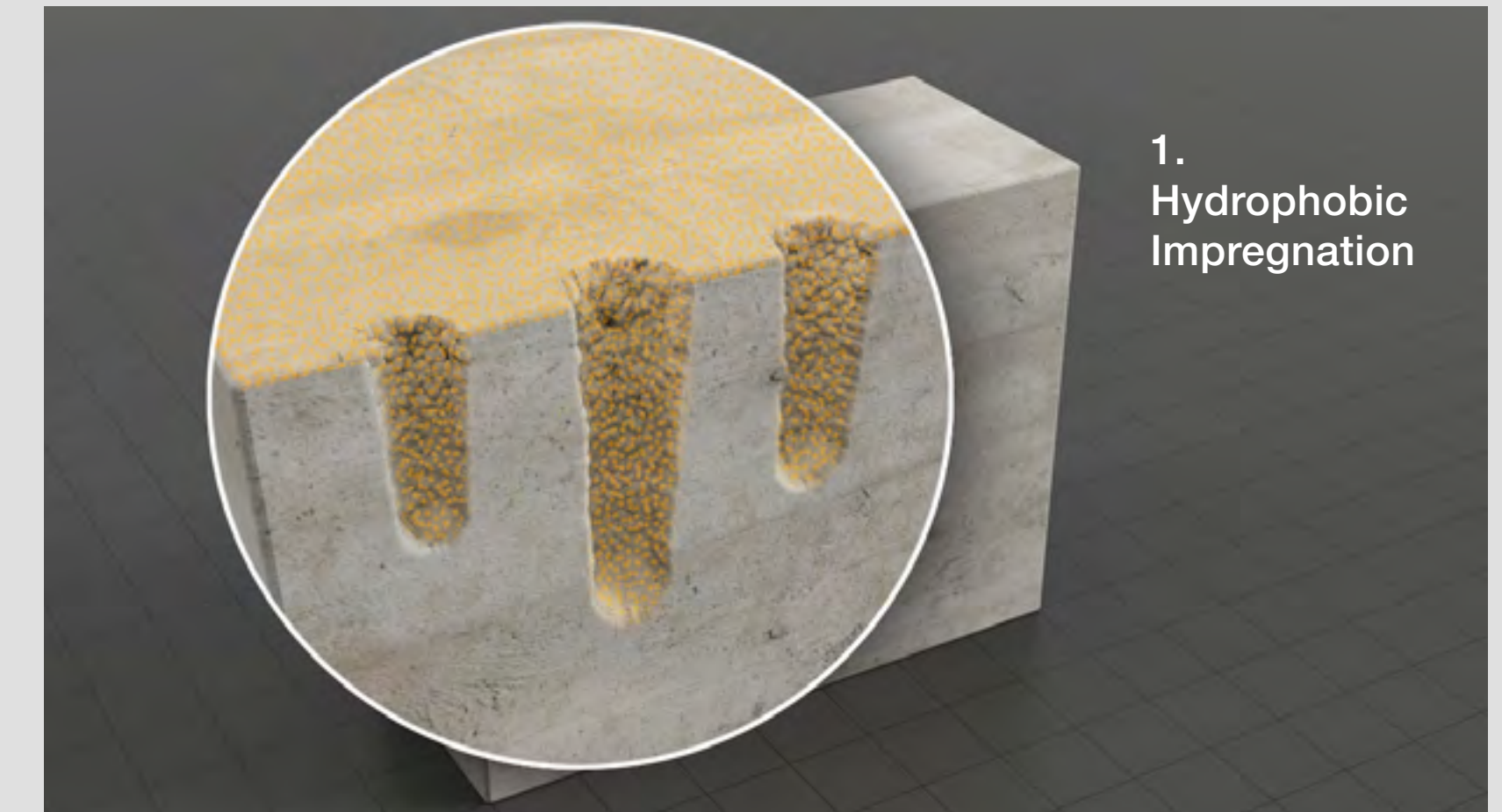


The untreated substrate absorbs water.



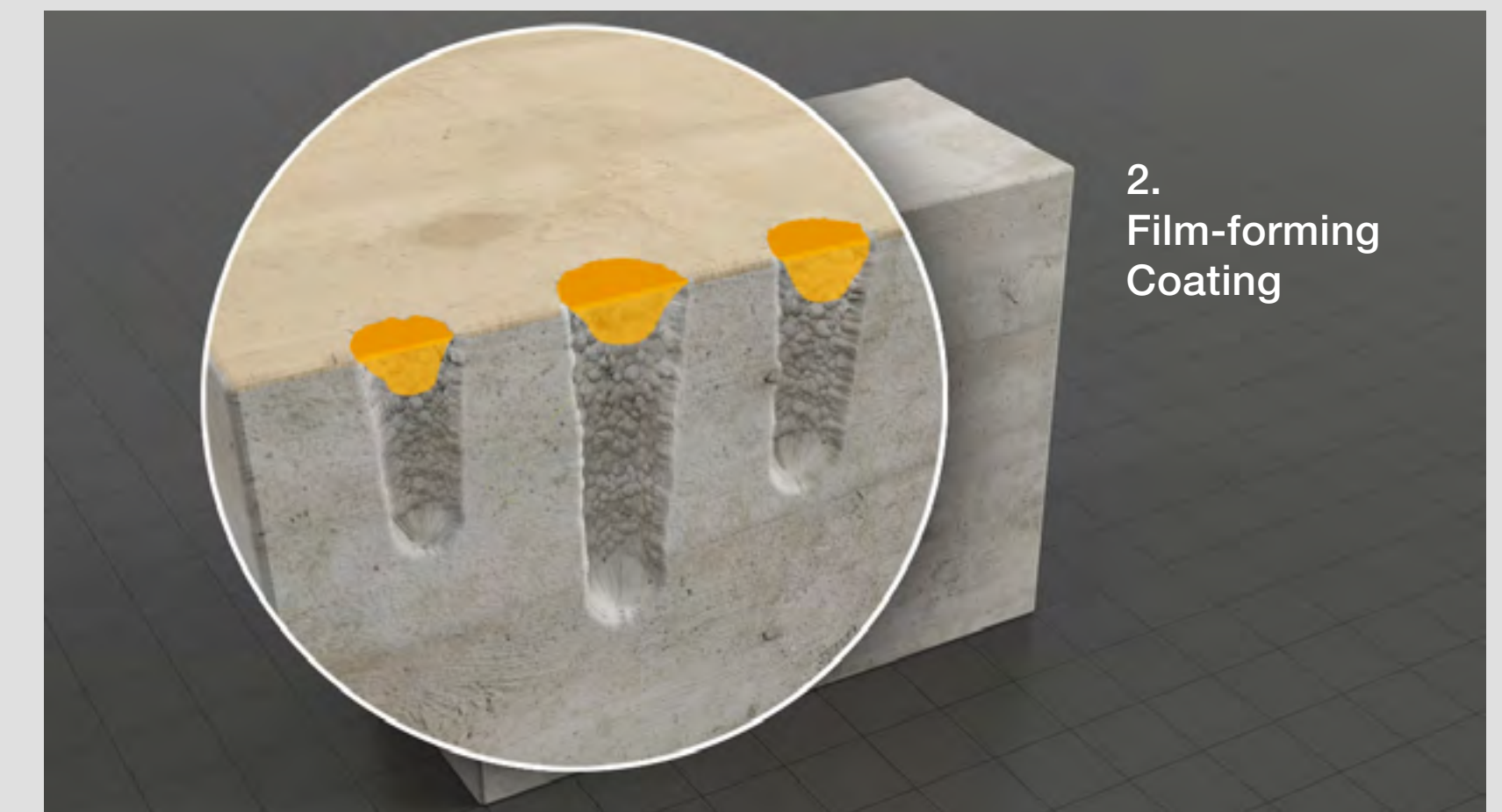
When a hydrophobic impregnation is applied, the water beads off.

Two Methods of Concrete Protection



1. Hydrophobic Impregnation

The concrete's capillaries remain open, so that water vapor is not measurably influenced. Even when the surface cracks it remains protected.



2. Film-forming Coating

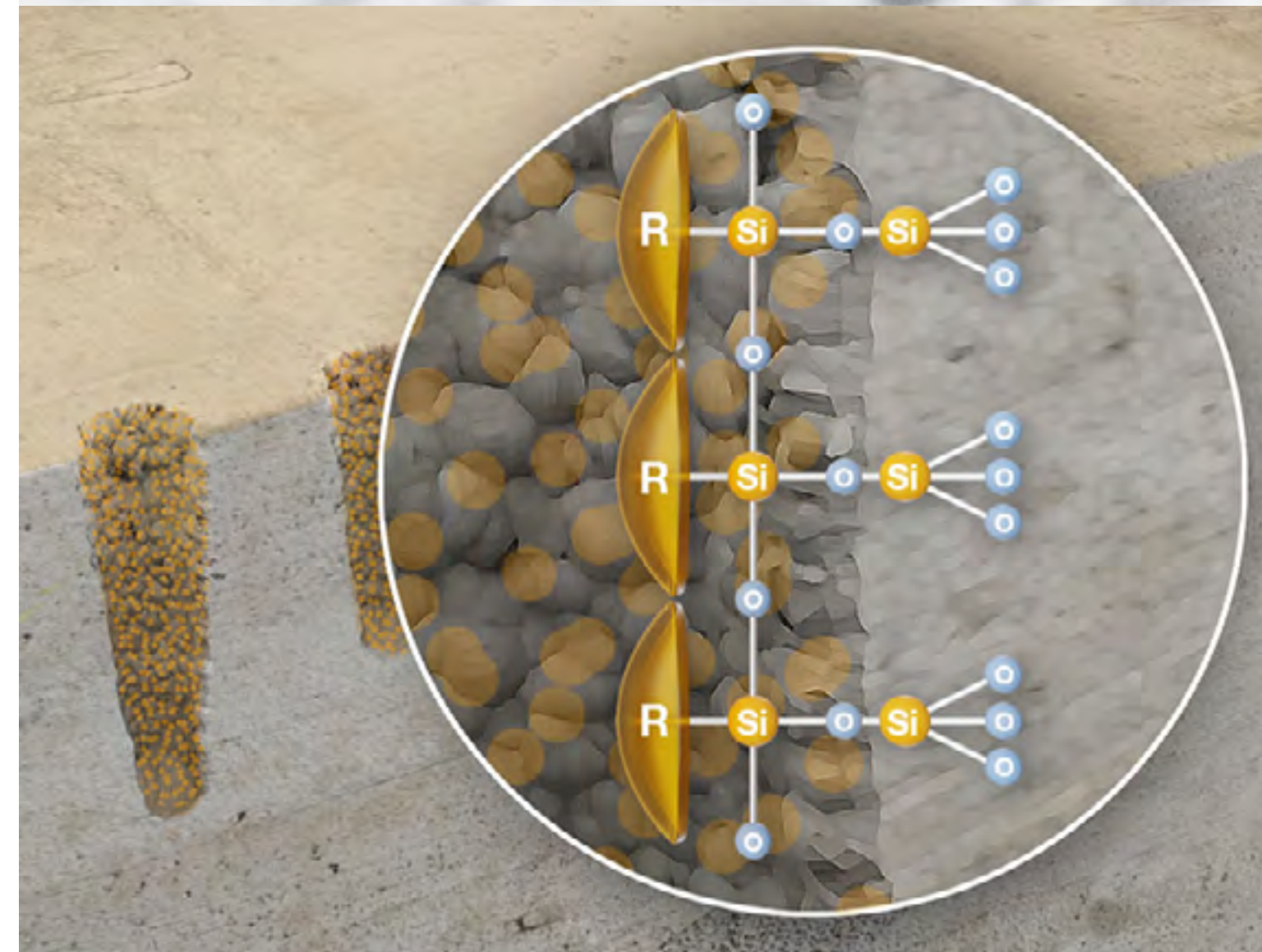
The capillaries are sealed, water vapor cannot pass out. A damaged protective film quickly leads to further concrete damage, as water and aggressive substances can then easily penetrate.



SILANES AS IDEAL WATER-REPELLENT AGENTS

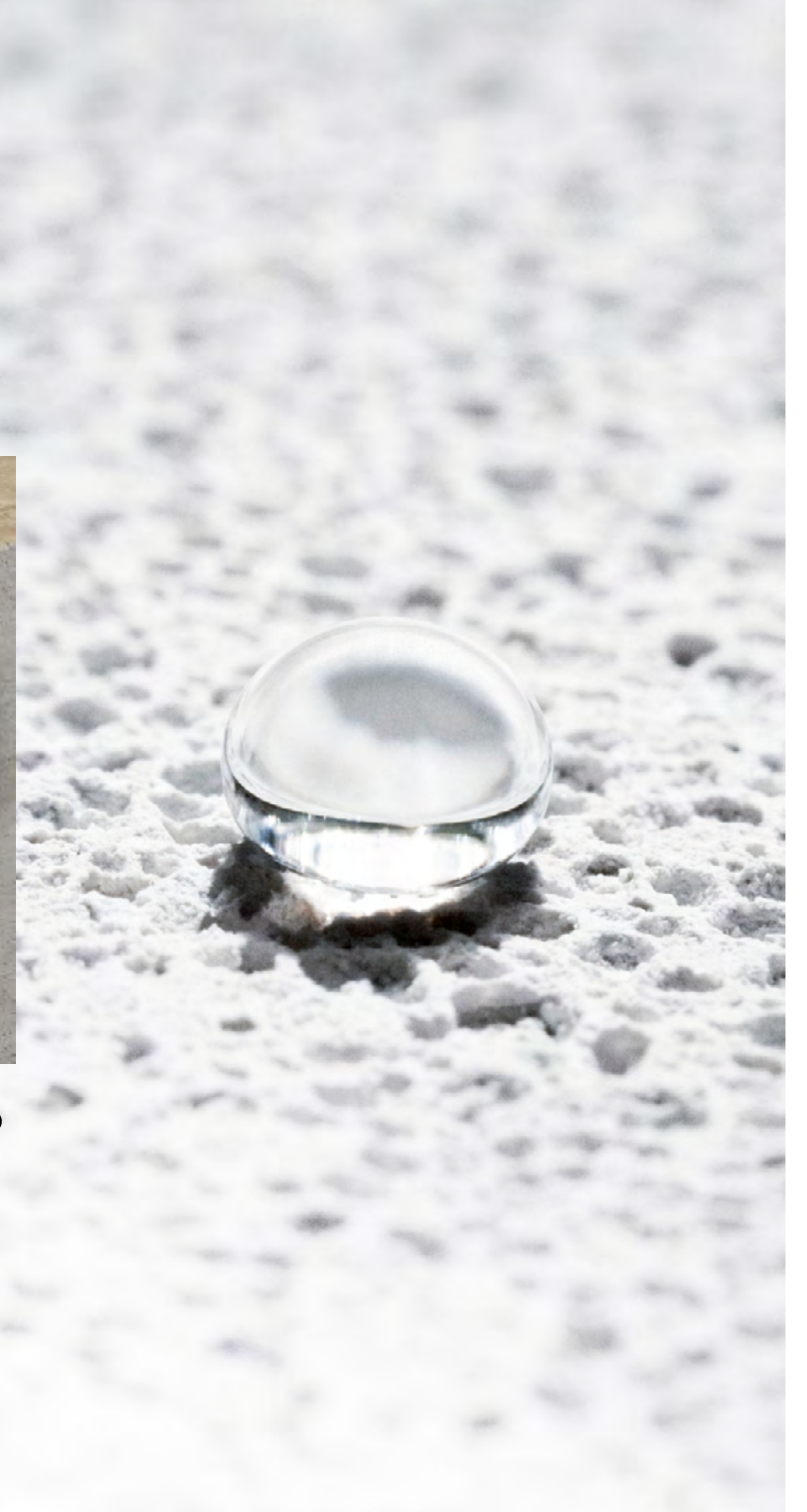
The past decades have shown that silanes with long alkyl chains (e.g. octyl) are the ideal product class for concrete protection. They combine outstanding water-repellency with durability and outperform rival product classes in their resistance to physical, chemical and microbiological attack.

Silanes for water-repellent treatment of concrete must penetrate well into the relatively dense concrete and resist degradation by the high alkalinity found especially in fresh concrete. Applied as a colorless, non-film-forming agent, they prevent capillary uptake of water. Since the capillaries remain open, the substrate retains its vapor permeability, keeping its original breathability unchanged.



The Silane Reacts with the Concrete to Develop the Long-Lasting Water-Repellent Effect

The silane forms extremely stable covalent bonds with the silicate matrix of the pores and capillary walls in the concrete.




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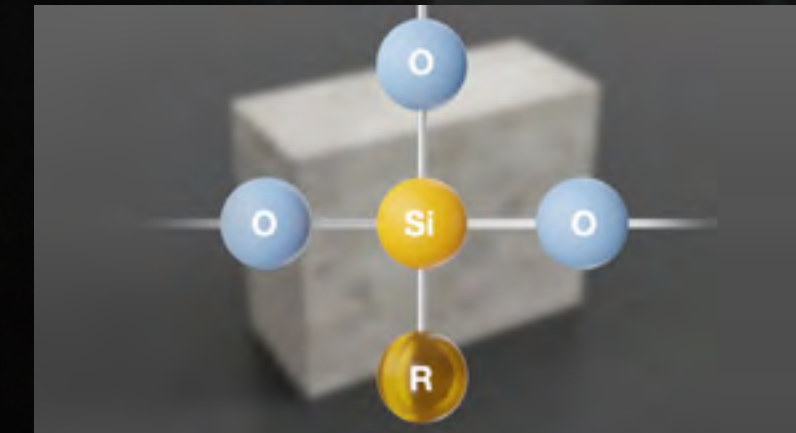
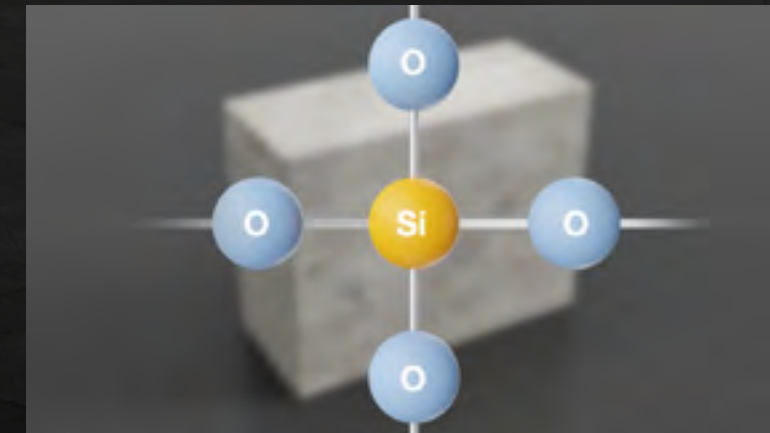
SILANES – RELIABLE VEHICLES OF HYDROPHOBIC IMPREGNATION

Fully cured silane's close structural resemblance to quartz is the reason for its high affinity for silicate building materials, and for the exceptional durability of the hydrophobic impregnation.

Organosilicon compounds work by binding strongly to the building material to form extremely stable Si-O-Si structures , similar to silicone resin. A comparison of the molecular structure of a fully reacted silane with that of natural quartz shows their close similarity.

Stable Si-O-Si Structures

The fully reacted silane is simply a quartz modified with organic groups. This close structural resemblance is the reason for the high affinity of silicone resins for silicate building materials, and for the exceptional durability of the water-repellent treatment. The organic group R makes the silane treated construction material outstandingly water repellent. Since it is, moreover, extremely resistant to many chemical, physical and biological influences, the hydrophobic effect lasts for decades.



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SILANES & SILOXANES PIONEERS IN HYDROPHOBIC IMPREGNATION

Today, alkylalkoxysilanes such as octyltriethoxysilane set the standard in terms of highly efficient penetration and excellent resistance to high alkalinity. They are colorless, low-molecular (and thus low-viscosity), highly penetrating liquids that are generally applied to concrete in undiluted form.

Silanes and siloxanes react with moisture, liberating alcohol, and form extremely stable bonds with the pores and capillary walls of the concrete. After the reaction, the iso-octyl group juts out into the center of the capillaries and pores, which is the reason behind hydrophobic impregnation's high effectiveness.

How to Reach Optimum Silane Efficiency 

How to Reach Optimum Silane Efficiency

- Liquid water repellents must be applied in several coats to achieve the required active concentration and penetration depth
- On vertical and overhead surfaces, products with higher viscosity such as SILRES® BS Creme C are ideal for attaining an adequate contact time



SILANE AND SILOXANE EXPERTISE FOR CONCRETE PROTECTION

We have been a leader in masonry protection with silicones for decades. Our broad series of masonry protection agents covers an extensive range of applications, from preservation of historic buildings to concrete protection. Ongoing product development ensures that our products are continually adapted to meet market requirements.

Our Products for Concrete Protection

- SILRES® BS Creme C – the expert
- SILRES® BS 1701 and GENIOSIL® NOTE CE – the allrounders

Product Characteristics and Benefits:

SILRES® BS Creme C – the Expert

- Certified to EN 1504-2
- Water-repellent cream
- Aqueous
- Solvent-free
- Silane-based
- For concrete and reinforced concrete
- Use undiluted

SILRES® BS 1701 and GENIOSIL® NOTE CE – the Allrounders

- Certified to EN 1504-2
- Liquid water repellent
- Monomeric silanes
- For concrete and reinforced concrete
- Use undiluted



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Characteristics of SILRES® BS Creme C:

- Excellent penetration
- Solvent-free, aqueous and environmentally compatible
- Low volatility
- Optimum resistance to alkalis
- Thixotropic and may be applied without loss of material
- One step application possible

Properties of Treated Concrete:

- Reduced chloride and water absorption
- No loss in breathability
- Improved durability against freeze-thaw de-icing salt stress
- Good paint adhesion


Suitable for:

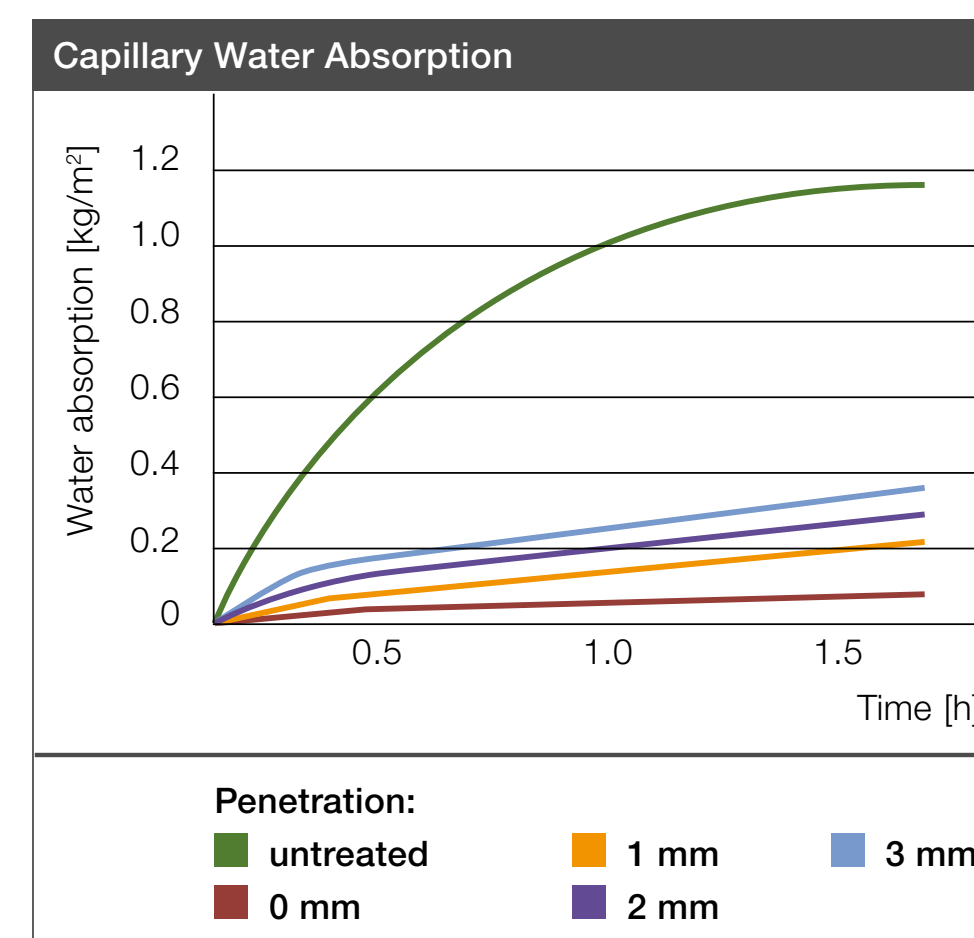
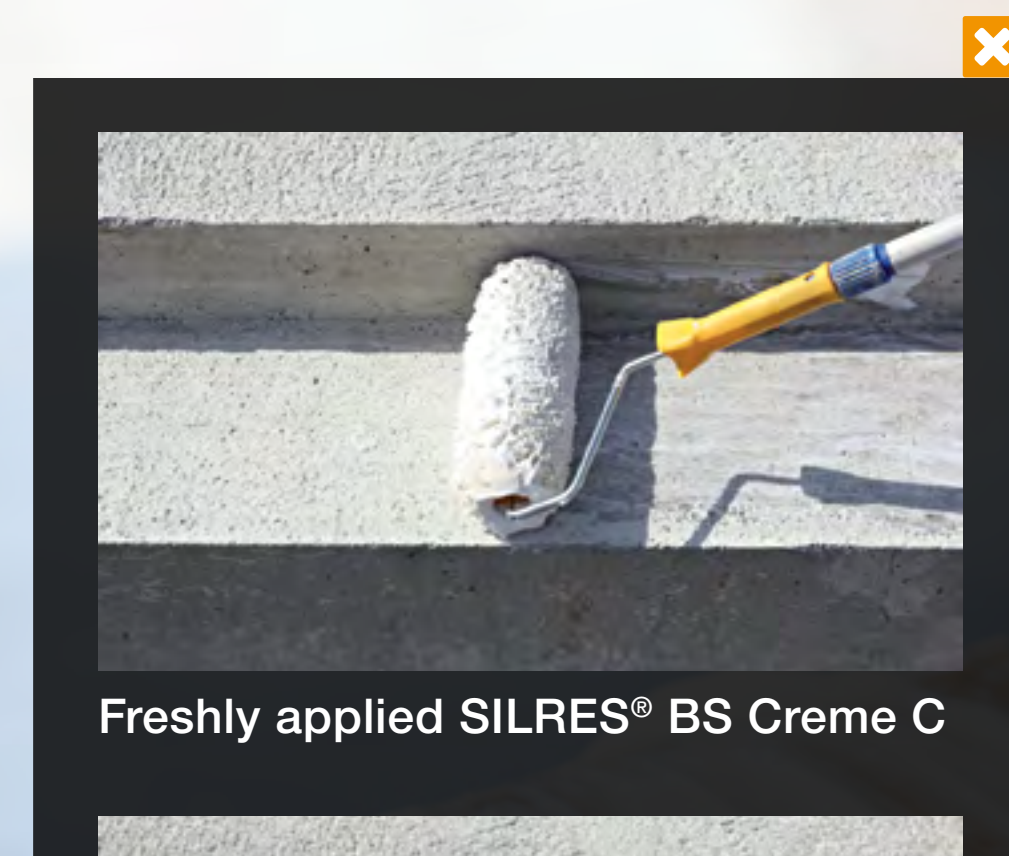
- Hydrophobic impregnation and priming of concrete and reinforced concrete in road, bridge and building construction
- Alkaline substrates that were conventionally treated with concentrated or undiluted water repellents such as alkoxysilanes

Effect on Capillary Water Absorption

SILRES® BS CREME C: THE EXPERT IN HYDROPHOBIC IMPREGNATION

SILRES® BS Creme C is an aqueous, solvent-free, water-repellent cream based on silane and siloxane. It's a high-quality specialty product for the hydrophobic impregnation of concrete and reinforced concrete and especially suited for vertical and overhead surfaces. SILRES® BS Creme C is certified to EN 1504-2.

SILRES® BS Creme C's thixotropic consistency is unique among water repellents. Unlike conventional liquid products, SILRES® BS Creme C can be applied to the required extent in just one or sometimes two steps. Depending on porosity and thus concrete quality, the active ingredient penetrates deeply into the substrate within a short period of time (30 minutes to a couple of hours). The creamy layer that was initially white disappears completely. 



Capillary water uptake of drill cores taken from the Fürstenland bridge in St. Gallen, Switzerland, at varying depths (1-mm thick slices are cut off and inspected). Source: LPM report 17'160-2 of May 28, 1997



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SILRES® BS 1701 AND GENIOSIL® NOTE CE: THE ALLROUNDERS

SILRES® BS 1701 is a mixture of isomeric octyl-triethoxysilanes with iso-octyltriethoxysilane as the main component. GENIOSIL® NOTE CE is an n-octyltriethoxysilane. Both silane types are certified to EN 1504-2 and used in undiluted form for the hydrophobic priming and impregnation of concrete and reinforced concrete.

After application to the concrete, SILRES® BS 1701 and GENIOSIL® NOTE CE react initially with atmospheric moisture or the building material's pore water. In the zone where the hydrophobic impregnating agent has penetrated, the active agent greatly reduces the concrete's absorption, but without blocking the concrete's pores and capillaries. The building material retains its water-vapor permeability.

Characteristics of SILRES® BS 1701 and GENIOSIL® NOTE CE:

- Excellent penetration
- Solvent-free and environmentally compatible
- Low volatility
- Optimum resistance to alkalis

Properties of Treated Concrete:

- Reduced chloride and water absorption
- No loss in breathability
- Improved durability against freeze-thaw de-icing salt stress
- Good paint adhesion

Suitable for:

- Hydrophobic impregnation and priming of concrete and reinforced concrete in road, bridge and building construction



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PREVENTIVE CONCRETE SURFACE PROTECTION: THE PERFECT PRODUCT FOR EVERY APPLICATION

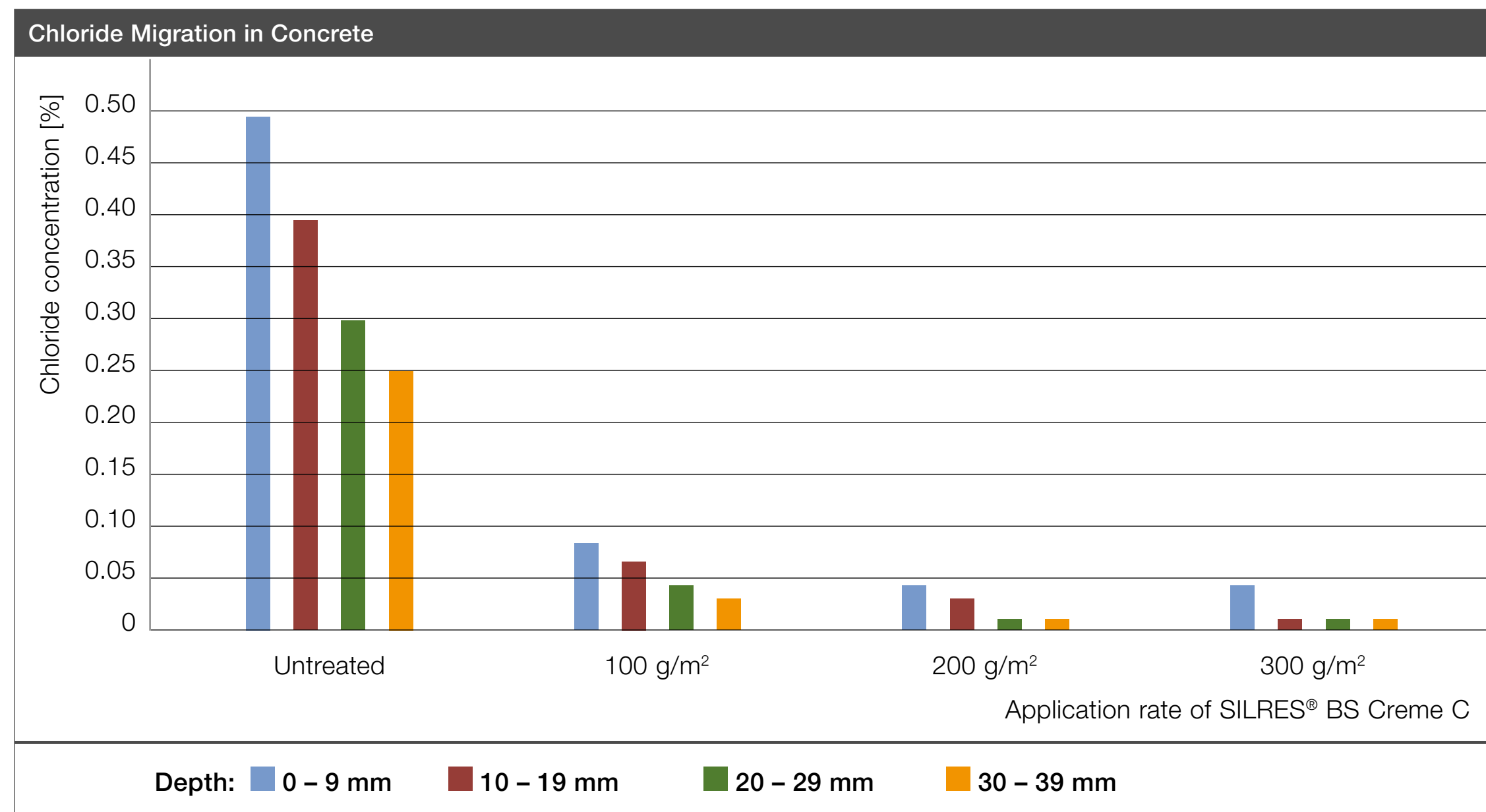
Hydrophobic Impregnation Agents – Test Results – DIN EN 1504-2

Applications

| Drying rate coefficient | Absorption ratio | Absorption rate after exposure to alkali | Freeze-thaw salt stress test | Depth of penetration |
|-------------------------|------------------|--|------------------------------|----------------------|
| DIN EN 13579 | DIN EN 13580 | DIN EN 13580 | DIN EN 13581 | DIN EN 14630 |
| Class I: > 30% | | | | Class I: < 10 mm |

| | Actives | Type |
|--------------------|---------|--------|
| SILRES® BS Creme C | 80% | Silane |
| SILRES® BS 1701 | > 98% | Silane |
| GENIOSIL® NOTE CE | > 96% | Silane |

Chloride Migration in Concrete



Chloride migration in concrete (strength class C35/45). Untreated specimens and those treated with SILRES® BS Creme C. Specimens conditioned for 10 days in 10% NaCl solution.

Cycles treated vs. control

Class II: ≥ 10 mm

> 20 Class II

> 20 Class II

> 20 Class II

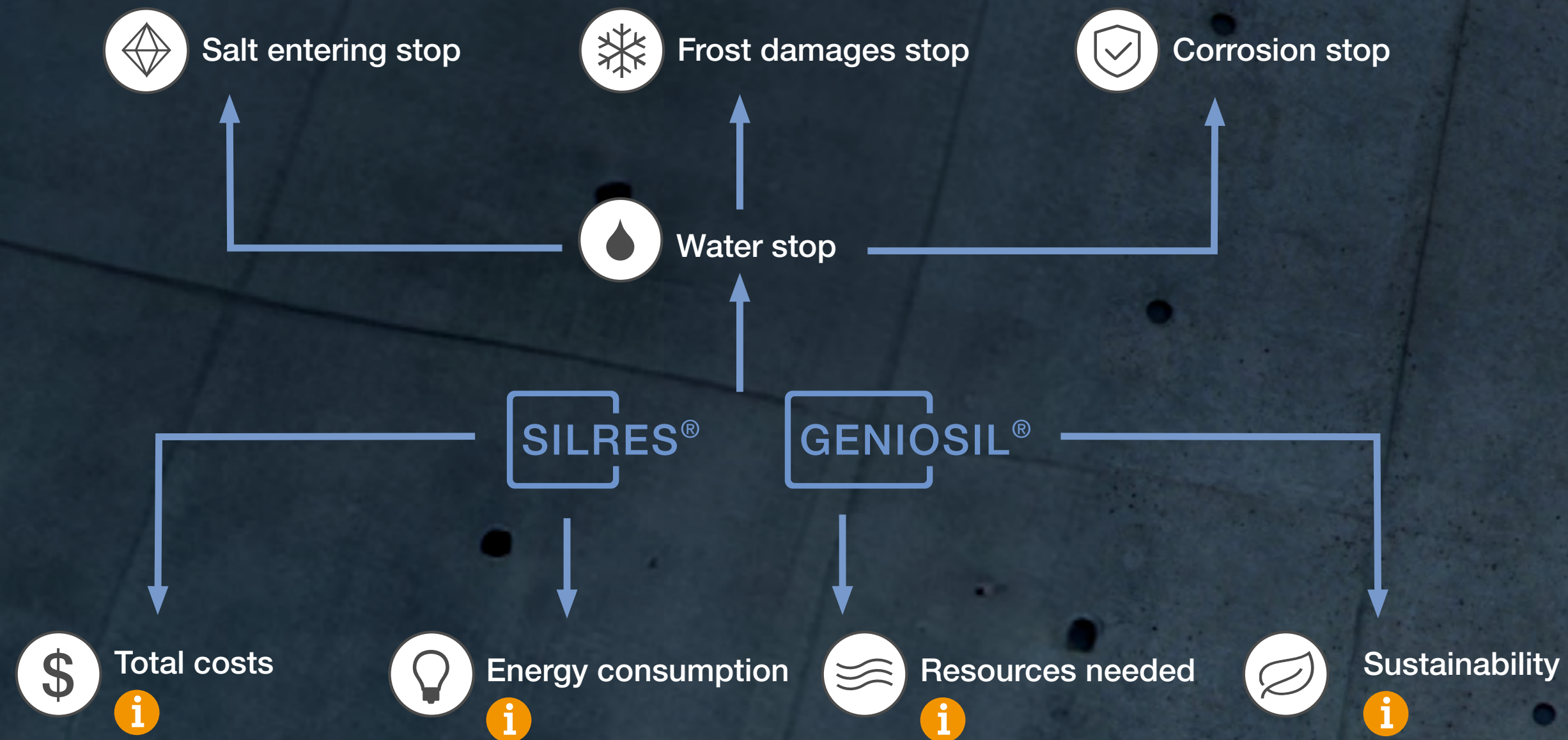


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CONCRETE SURFACE PROTECTION FOR CONCRETE ADVANTAGES

Repairing concrete structures is up to ten times more expensive than preventive measures such as hydrophobic impregnation. And what's more: concrete protection is also beneficial for the environment and for all of us who depend on a functioning infrastructure.



Sustainability

Buildings treated with SILRES® BS have an extended lifespan. And the fewer renovations and new buildings we need, the lower our resource and energy consumption and CO₂ emissions will be. (e.g. traffic diversions) and setting up the building site. In summary: more prevention = fewer repairs = lower overall costs.




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THE WACKER ACADEMY

CONNECTING THE BEST

The global forum for learners, networkers, creators and discoverers
WACKER ACADEMY offers cutting-edge expertise for regional markets. Participants can meet and swap experiences with colleagues from similar areas – at 14 locations around the world. 

Global Expertise for Regional Needs

All WACKER ACADEMY training centers focus on local challenges, and our facilitators are always regional experts. Our training centers are all networked together, allowing participants to make use of best-in-class solutions from all over the world.

The Perfect Blend of Theory and Practice

Experience training that is perfectly matched to your needs. Take courses that, along with an in-depth grasp of theory, give you a thorough practical understanding. Each of our 14 training centers is affiliated with a technical center. You can take what you learn at a morning seminar and apply it in the lab that very afternoon.

Industry-Specific Knowledge Sharing among Equals

Knowledge is the engine driving progress and development. Knowledge grows. It changes the world and offers all of us new opportunities and prospects. If we share it. This is the clear guiding principle behind the WACKER ACADEMY. Laboratory work is where solutions to questions take root. Through dialog ideas for new products are born.



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CREATING TOMORROW'S SOLUTIONS

A Diverse Array of Products for Growing Markets

Our product portfolio ranges from silicones, binders and polymeric additives all the way up to bioengineered pharmaceutical actives. Rounding these out is hyperpure silicon for semiconductors and solar applications.

Innovations That Improve Quality of Life

Resource scarcity, climate change, urbanization: the challenges of our time demand new responses. In our search for solutions, we invest some 3.5% of our annual sales in research and development. With their emphasis on using energy efficiently and protecting the climate and our environment, our products are already improving quality of life for people all over the world.

Global Knowledge for Local Markets

When you work with WACKER, you have 100 years of chemistry expertise at your disposal, with access to the research findings and best practices of our experts throughout the world. Our knowledge base consists of a network of 22 technical centers, 14 training centers and our basic research center.

And most importantly: we are there wherever you need us – worldwide. Our local specialists know your markets and speak your language. Working with them, you will find innovative solutions that win over your customers and make you more competitive.

Follow us:

Find us on LinkedIn, YouTube, X and Instagram, and we'll keep you up to date on the latest and discuss current issues with you.



All figures are based on fiscal 2023.



Silicones and Polymers

3,200 specialty products from organic and inorganic chemistry



Global Market Leader

In dispersions and dispersible polymer powders based on vinyl acetate-ethylene (VAE), in building-protection silicones and in the production of cyclodextrin and cystein.



Globally Active

- Sites worldwide
- Headquartered in Munich
- 27 production sites in Europe, Asia and the Americas
- 22 technical centers
- 14 WACKER ACADEMY training centers
- 48 sales offices



Employees: 16,400



Total Sales

€6.4 billion



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WACKER

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