WACKER

CREATING TOMORROW'S SOLUTIONS

CONSTRUCTION MATERIAL | CONCRETE | INFRASTRUCTURE

CONCRETE PROTECTION FOR LONG-LASTING INFRASTRUCTURE

Our age of globalization requires a stable and fully functional infrastructure that connects people and markets. This infrastructure is based on concrete. As a key fact reported by the umbrella organization Concrete Europe in 2014, 70% of the world's population live in concrete structures*. Modern infrastructure buildings would be inconceivable without concrete, as would skyscrapers and industrial buildings. Bigger, higher, wider – the global construction boom constantly sets new challenges for materials and technology, as the size and number of buildings increase.

According to Concrete Europe in 2020, the concrete sector has adopted life-cycle thinking and implemented ambitious goals to improve the sustainability, safety and health aspects of concrete construction. The durability of concrete is considered an important factor in the circular economy in construction, but in reality harmful mechanisms can show up quite quickly.

Concrete in Danger

Concrete is a versatile building material, used especially in civil engineering in combination with steel. However, concrete and steel are vulnerable to harmful substances that penetrate into the building material by means of moisture. This can result in costly concrete damage due to reinforcement corrosion.

Repairing concrete structures is up to ten times more expensive and time consuming than preventive measures such as film-forming coatings or hydrophobic impregnation, the latter lasting the longest.

Concrete Needs Protection

The main cause of concrete damage is reinforcement steel corrosion due to environmental influences. Reinforcement steel corrosion occurs when water-soluble salts, particularly chloride ions, are absorbed by the concrete in the form of road salt or seawater. This particularly affects highway structures, but also buildings in coastal regions.

When water-diluted salts penetrate into concrete, the salt-containing chloride reacts with the alkaline calcium hydroxide to form a pH-neutral salt, which leads to the loss of alkaline passivation. Under the influence of oxygen and moisture, the steel begins to rust. Since the iron's corrosion process involves a drastic volume expansion (bursting force), the concrete layer above the reinforcement spalls, resulting in serious concrete damage.

Enhancement of Concrete's Durability by Hydrophobic Impregnation

Forming a hydrophobic zone at the surface of the concrete greatly reduces the water uptake and therefore harmful substances are no longer included. The building fabric remains drier as a result and is consequently less susceptible to the harmful mechanisms described above.

There are generally two methods available to increase the durability of concrete: hydrophobic Impregnation and film-forming coatings. In both cases, protection against moisture is central since water plays a key role by transporting corrosive salts, as well as facilitating the corrosion mechanisms.

The concrete's pores remain open after water-repellent treatment through hydrophobic impregnation, so that water-vapor and gas diffusion are not significantly influenced. Thus, a concrete's natural properties are retained, and even when the surface is damaged with cracks at the time of application of the hydrophobic agent, it will be adequately protected. As a result, the water-repellent treatment has a significantly longer service life. These are clear advantages over film-forming coatings, e.g. CO_2 blocking paints, which easily flake off as they don't allow water to pass out. Moreover, a damaged protective film quickly leads to concrete damage, as water and aggressive substances can then easily penetrate.

* https://www.concrete-europe.eu/benefits-of-concrete/key-facts

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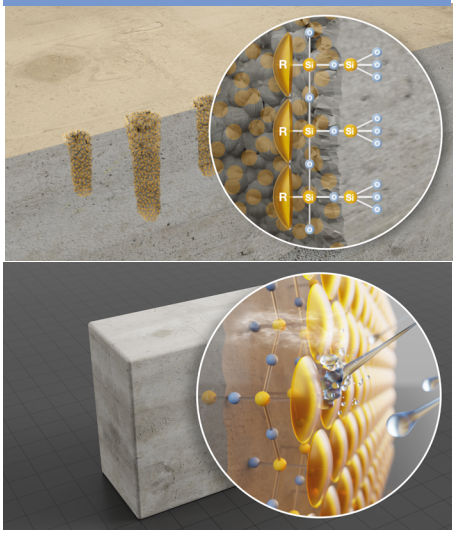
Hydrophobic Impregnation with Silanes

Organosilicon compounds have a long track record as water-repellent agents. They feature excellent water repellency without significantly impairing water-vapor permeability, and long durability, which stems from silanes' high resistance to external influences such as UV radiation, thermal stress, aggressive substances, and microbes. This is due to extremely stable covalent bonds between the silane and the silicate matrix of the pores and capillary walls in the concrete.

Long-Lasting Water-Repellent Effect due to Reaction of Penetrated Silane with Concrete Matrix



SILRES® BS and GENIOSIL®

WACKER offers a broad portfolio of products oriented to fulfill customer's needs for not only conventional formulations but also for modern hydrophobic agents formulated for example as a cream.

Since 1991, WACKER has been committed to Responsible Care® to promote products that provide better sustainability through quality construction and superior durability. Therefore, WACKER's products for concrete surface protection in Europe are certified to the EN 1504-2 standard (Products and systems for the protection and repair of concrete structures).

What is more, WACKER offers SILRES® eco BS products, working with sustainable raw materials and complying with the requirements of the REDcert² certification scheme, based on mass balance.

At a Glance: Benefits of Hydrophobic Impregnation of Concrete with Silanes

- Drastic reduction in water uptake
- Chloride barrier and thus protection against reinforcement corrosion
- High water-vapor permeability
- Extensive penetration
- High UV resistance
- Surfaces not rendered shiny or tacky, or caused to yellow
- High resistance to alkalis

Infrastructure Protection – Product Portfolio

	SILRES® BS				GENIOSIL®		
	Crème C	**1701 SQ**	**1701**	**17040**	**NOTE CE**	**NOTE**	**IBTE**
Product group	Silane cream	Silane	Silane	Silane emulsion	Silane	Silane	Silane
Basis	Isooctyl-triethoxysilane	Isooctyl-triethoxysilane	Isooctyl-triethoxysilane	Isooctyl-triethoxysilane	n-Octyl-triethoxysilane	n-Octyl-triethoxysilane	Isobutyl-triethoxysilane
Appearance	White to yellowish cream	Clear, colorless	Clear, colorless	Milky, white	Clear, colorless	Clear, colorless	Clear, colorless
Active content [%, approx.]	80	> 99	> 99	40	> 96	> 96	> 98
Flash point [°C]	64	65	42	70	65	65	65
Certified to EN 1504-2	Yes	Yes	Yes	Yes	Yes	No	No
Workability	●●● (loss free/one step)	●●	●●	●	●●	●●	●●

GENIOSIL® SILRES®

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