TECHNOLOGY & CONCEPTS
HYDROPHOBIC IMPREGNATIONS

REDUCING THE MAINTENANCE COSTS OF REINFORCED CONCRETE STRUCTURES

BUILDING TRUST

REDUCING THE MAINTENANCE COSTS OF REINFORCED CONCRETE STRUCTURES USING HYDROPHOBIC IMPREGNATIONS

HYDROPHOBIC IMPREGNATIONS reduce the maintenance costs of reinforced concrete structures by providing the concrete with a water repellent surface. This protects the concrete against the ingress of pollutants such as chlorides and sulphates. It also helps the concrete to dry out, increasing its electrical resistance and slowing down reinforcement corrosion. The drying of the concrete also slows or stops other deleterious processes such as alkali silica reaction.

HOW DO HYDROPHOBIC IMPREGNATIONS WORK?

Hydrophobic impregnations are liquids applied to the surface of the concrete by brush, roller or spray. They quickly penetrate into the concrete pores and capillaries where they react to form a water repellent silicone resin lining which is chemically bonded to the capillary walls. The capillaries of the concrete remain open so that the concrete is breathable, allowing water vapour to enter or leave the concrete. However, water droplets are repelled so rain and salt spray is not absorbed.

Because the impregnation is chemically bonded to the lining of the capillaries inside the concrete (where it is not subject to weathering), Sika's hydrophobic impregnations are extremely durable and when applied at the correct coverage rates may continue to work for 15 years or more with out being reapplied.

In addition, because of the high penetration and the extremely thin layer of silicone lining produced, hydrophobic impregnations rarely change the appearance of the concrete.

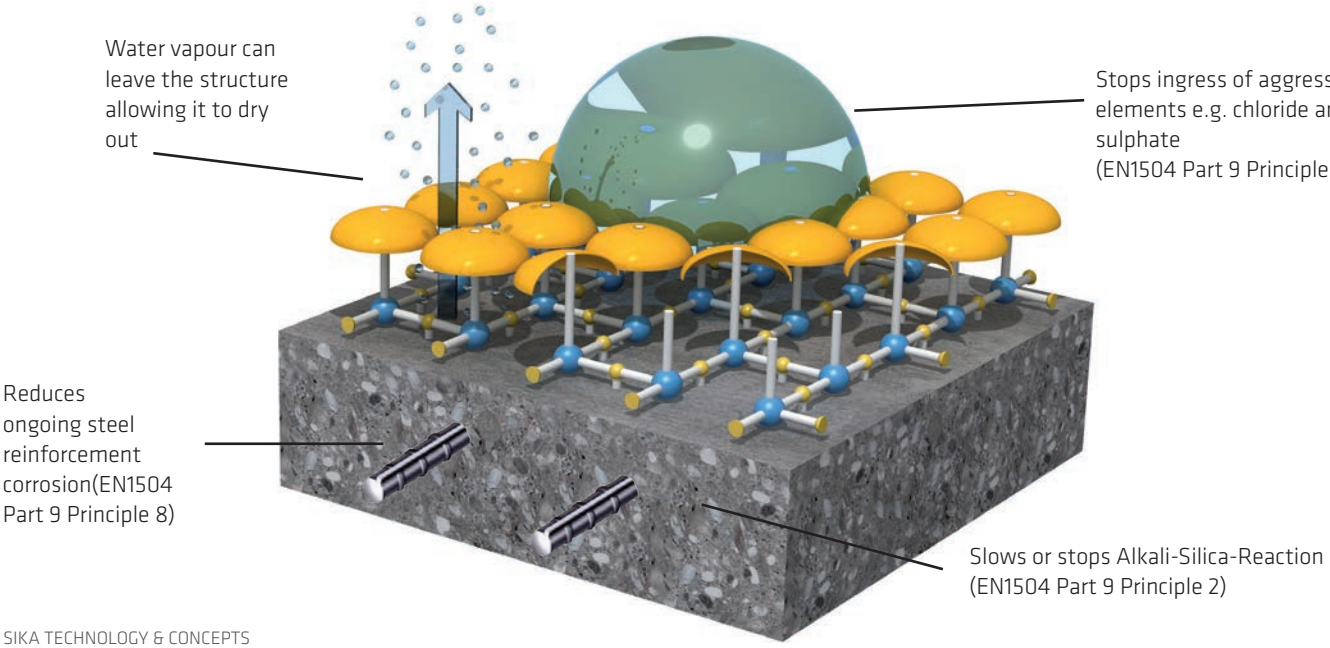
EN1504 - CONFIDENCE IN USING HYDROPHOBIC IMPREGNATIONS

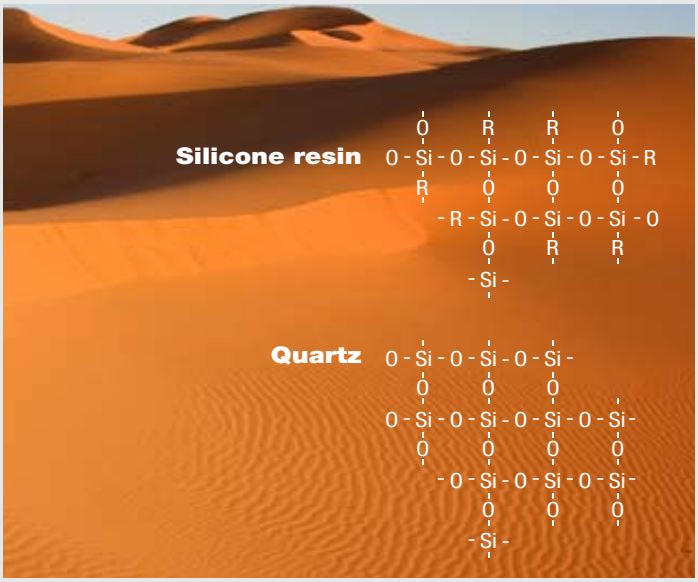
The protection of reinforced concrete by hydrophobic impregnations is widely recognized in international standards. One of the worlds largest concrete repair standards, EN1504 'Products and systems for the protection and repair of concrete structures' was adopted by all European states in 2009. It recognizes the value of hydrophobic impregnations in concrete protection.

EN1504 Part 9 details eleven principles and thirty five methods for concrete repair and protection. Hydrophobic impregnations are recognized as suitable for three principles:

- Principle 1 – protections against ingress
- Principle 8 – increasing resistivity
- Principle 2 – moisture control

In addition EN1504 Part 2 details the specifications of surface protection systems for concrete including hydrophobic impregnations. All of Sika New Zealand's hydrophobic impregnations comply with this specification.





IMPROVED AESTHETICS AND COMFORT

Unlike surface coatings, hydrophobic impregnations do not change the appearance of the concrete so architectural concrete is preserved. There is no need to continually recoat to maintain appearances. There are also additional comfort and aesthetic benefits from applying hydrophobic impregnations.

- Reduced efflorescence or salt damage
- Reduced growth of micro-organisms on the surface (algae, moss, lichen, etc.)
- Reduced effects of pollution (staining, dirt pick up, etc.)
- Improved thermal insulation, by effectively drying out the external walls

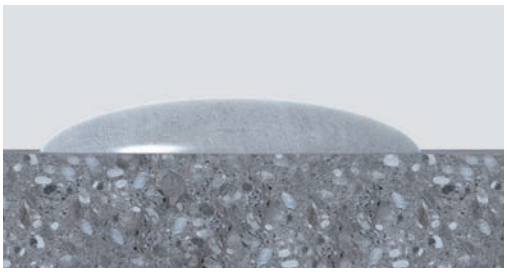
STRONG BONDING TO THE SUBSTRATE

The silicone resin network produced by hydrophobic impregnation is very similar to quartz. The only difference is the organic group R, which is responsible for the water repellent properties. This similarity between these chemical structures helps to explain the extremely durable bond to most mineral substrates.

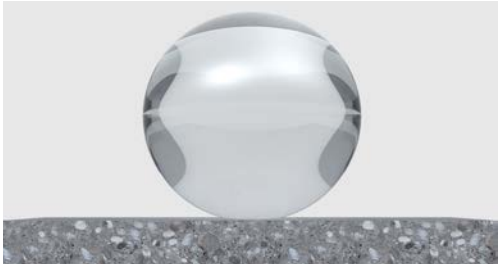
HYDROBHOBIC EFFECT

The surface tension of a non treated mineral substrate is higher than that of liquid water. Therefore, the attraction from the substrate to the water is also higher than the inter-attraction of the water molecules. This results in the absorption of the water by the mineral substrate. The presence of the hydrophobic impregnation in the pores at the surface of the substrate reduces this surface tension significantly. The inter-molecular attraction of the water molecules is then much higher than the attraction of the water into the substrate. This results in the surface repelling the water.

HYDROPHILIC MATERIAL



HYDROPHOBIC MATERIAL



THE SIKAGARD® HYDROPHOBIC IMPREGNATION RANGE SELECTION GUIDE

Sika (NZ) Limited market three hydrophobic impregnations for different applications:

- Sikagard®-706 Thixo
- Sikagard®-705 L
- Sikagard®-740 W

Sikagard®-705 L

Sikagard®-705 L is used where the maximum level of protection is required over a long period eg bridges and wharves.

ADVANTAGES	USES
Silane based (liquid type, high concentration, nearly 100% active content).	Concrete structures
Can provide a chloride barrier	New and repair works
Highly penetrating (EN 1504 Part 2, Class 11)	Application is possible on green concrete
Solvent free	Also used as a primer for coatings

Sikagard®-706 Thixo

The cream consistency of Sikagard®-706 Thixo minimizes application costs by enabling application in fewer coats with reduced run off and overspray. It is used where the maximum level of protection is required over a long period eg bridges and wharves.

ADVANTAGES	USES
Silane based (cream type)	Concrete structures
Can provide a chloride barrier	New and repair works
Highly penetrating (EN 1504 Part 2, Class 11)	Application is possible on "green" concrete
Water based emulsion	Also used as a primer for coatings
High coverage per coat	Easy overhead application
Low VOC content	
Efficient application	

Sikagard®-740 W

For use on most concrete structures.

ADVANTAGES	USES
Silane based	Concrete structures
Water based emulsion	New and repair works
Highly penetrating (EN 1504 Part 2, Class 1)	Also used as a primer for coatings
Low VOC content	

FOR CONCRETE STRUCTURES

PRODUCT	Minimum number of coats	Minimum run-off	Minimum overspray	Long term durability	Penetration Depth	
					Class II (≥10mm)	Class I (<10mm)
Sikagard®-705 L	**	**	**	****	****	****
Sikagard®-706 Thixo	****	****	****	****	****	****
Sikagard®-740 W	**	**	**	**	–	**

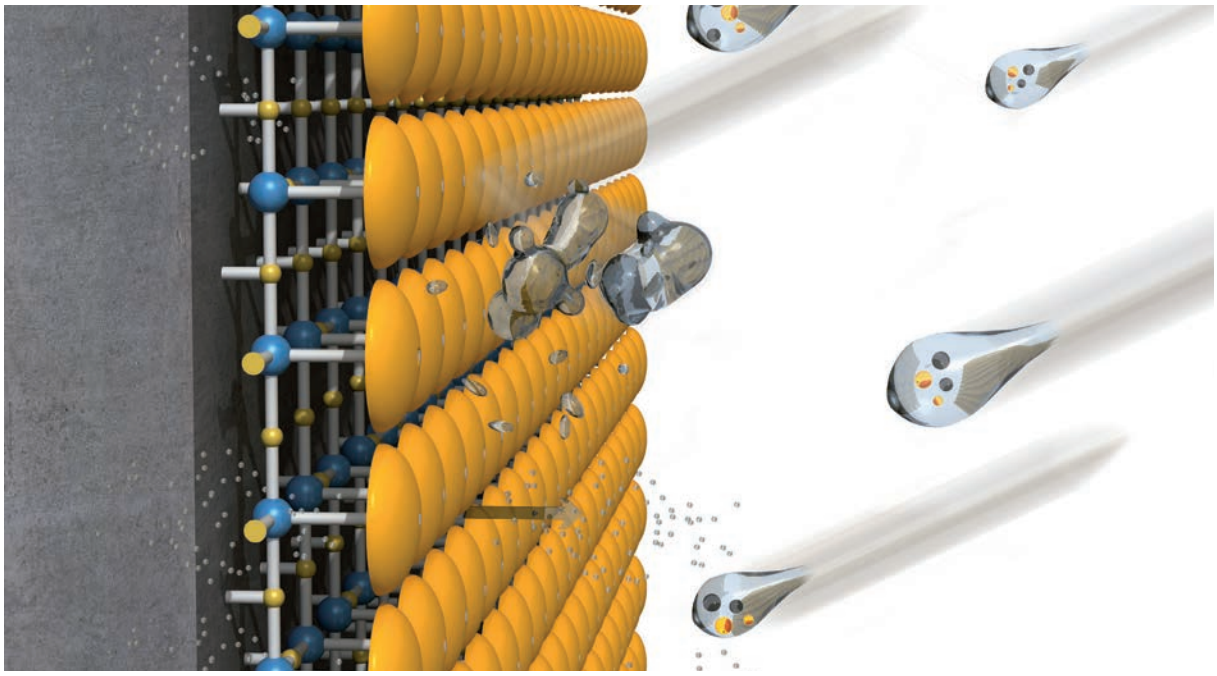
KEY:

**** Best technology for this criteria

** Good technology for this criteria

– Non-preferred technology for this criteria

SIKA APPLICATION ENGINEERING FOR COST PERFORMANCE OPTIMIZATION



THE INFLUENCE OF SITE CONDITIONS

The quality of existing concrete structures varies according to their age and exposure, the original construction methods, quality of the concrete, and location. The costs for hydrophobic impregnation materials and their application depend on the specific project, including the substrate condition, the technical requirements, weather conditions and the possible application methods, etc. Therefore, a detailed condition survey must always be carried out to optimize the application details and reduce the overall costs.

The table below explains the influence of different conditions during application and shows their implications.

	CONDITION	INFLUENCE	IMPLICATION
SUBSTRATE	Very dense concrete	■ Reduced penetration	■ Use Sikagard-706 Thixo for longer penetration time ■ Higher consumption to achieve the required penetration depth
	Very porous concrete	■ Deeper penetration ■ High absorption rate	■ Faster application speed
	Damp concrete	■ Lower penetration	■ Higher consumption to achieve the required penetration depth ■ Long waiting time between applications
WEATHER	High temperatures and/or windy applications	■ Increase of loss and wastage ■ Fast evaporation	■ Use Sikagard-706 Thixo to reduce wastage
	Rain	■ Risk of wash-out	■ Re-application might be required
APPLICATION METHOD	Spray application	■ Fast application	■ Faster application but with higher consumption
	Hand application	■ Slow application	■ Lower wastage but with higher application costs
TYPE OF MATERIALS	Liquid type	■ Lower quantity per application step possible	■ More application steps to reach the defined consumption rate
	Cream type	■ Longer contact time	■ Deeper penetration ■ Less application steps and faster working ■ Better application control

SIKA COMPETENCE IN COMPLETE CONCRETE PROTECTION

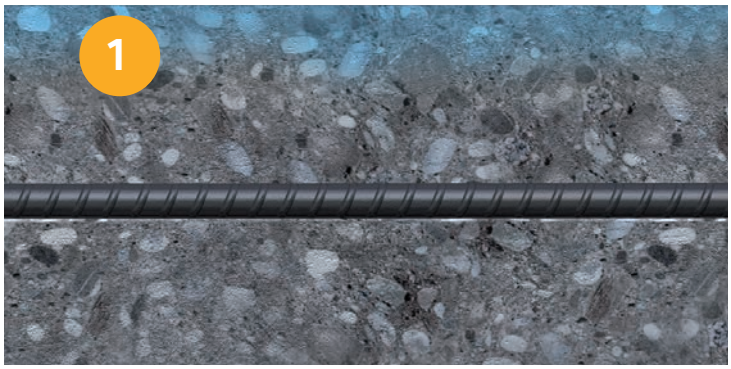
FULLY COMPATIBLE AND COMPLETE PROTECTION SYSTEMS

Reinforced concrete civil engineering structures are usually designed to last a very long time. However due to the extreme exposure conditions, with potential concrete damage and reinforcement corrosion related problems, owners and their engineers face considerable challenges to actually achieve this design life.
From our considerable expertise and long-term experience, Sika has developed a full range of integrated concrete protection systems that can address all of the issues related to achieving this required durability. Using hydrophobic impregnations in combination with Sika FerroGard corrosion inhibitor technology, Sika is able to provide unique, cost efficient protection systems which will protect the steel reinforcement and the concrete structure as a whole. In general, there are three different levels of these protection systems:

SYSTEM 1:
DURABLE CONCRETE PROTECTION

1 **Sikagard** deep penetrating hydrophobic impregnation

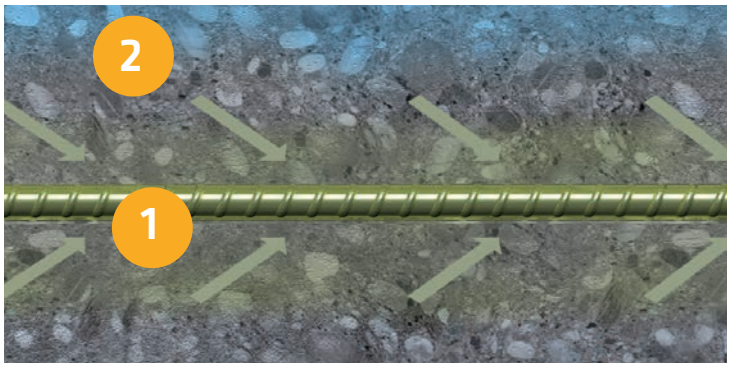
TYPICAL USE
For exposed concrete structures showing no visible concrete defects (crack width <0.3 mm).



SYSTEM 2:
DURABLE CONCRETE AND REINFORCEMENT PROTECTION

1 **Sika FerroGard** corrosion inhibitor
2 **Sikagard** deep penetrating hydrophobic impregnation

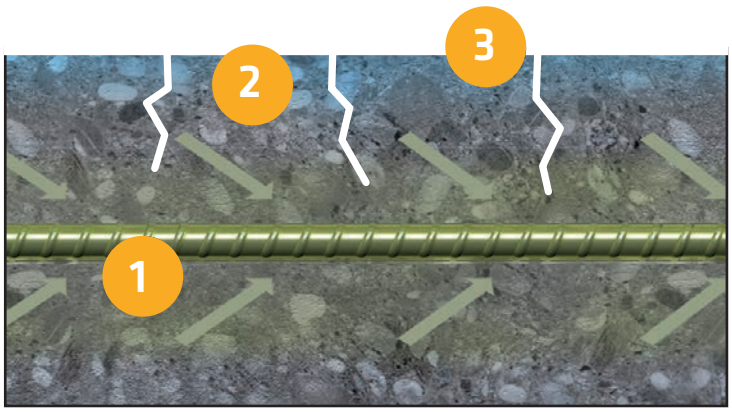
TYPICAL USE
For severely exposed or weak concrete with a high risk of steel corrosion.



SYSTEM 3:
HIGH PERFORMANCE PROTECTION FOR EXTREME CONDITIONS

1 **Sika FerroGard** corrosion inhibitor
2 **Sikagard** deep penetrating hydrophobic impregnation
3 **Sikagard** protective coating

TYPICAL USE
For severely exposed or weak concrete with a high risk of cracking.



Global expertise, local support, one phone call, problem solved.

FOR MORE Sikagard® INFORMATION:

WHO WE ARE

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

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