Technology Breakthrough for Treatment to Concrete Problem

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ECO Binder – Technology
Silicate Binder –Technology

new innovative binder system
with unique properties

ECO-Binder-System

Basis

We are using secondary raw industrial waste materials like:

GGBS

fly ash

pumice

kaolin

volcanic ash

ECO-Binder-System

Standard binder system are based on portland cement

portland cement contains after hydration

$Ca(OH)_2$ and **CSH** (calcium silicate hydrate)

$Ca(OH)_2$

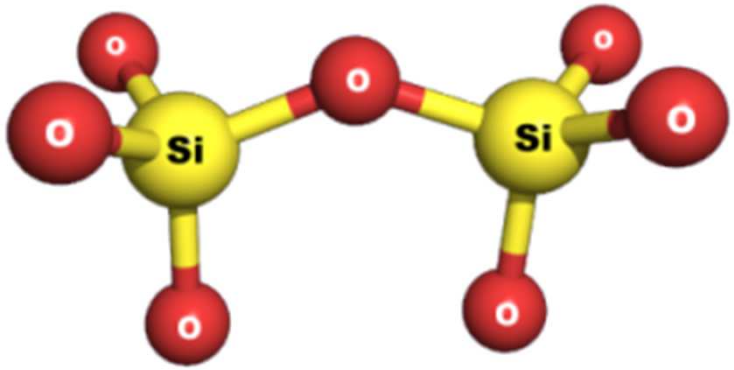
- no hardening effect of surface
- high reactiv with acid and water

CSH

- high abrasion resistant
- stable
- high chemical resistance for acids and alkalies

ECO-Binder-System

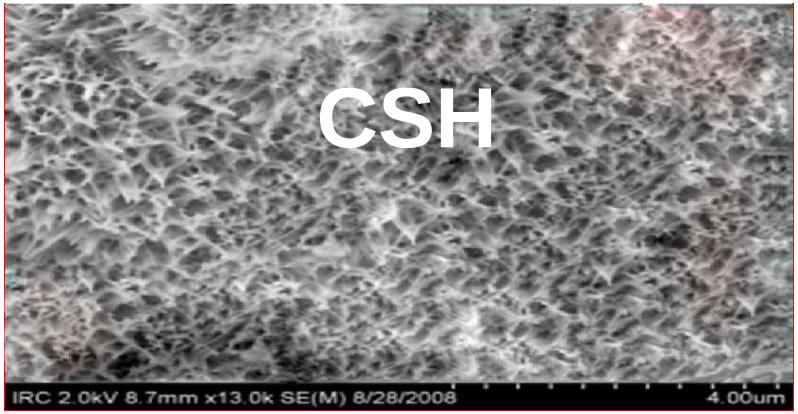
Basis



silicates

+

$Ca(OH)_2$



$Ca(OH)_2$ reacts with silicates and forms high resistant crystals (**Calciumsilicathydrate-CSH**)

ECO-Binder-System

higher acid resistance | higher density | no efflorescence

abrasion resistance | very high durability

Our Binder System :

- --> replaces Portland cement and parts of epoxy resin
- --> is produced by using alternative and environmentally friendly raw materials
- --> no hazardous labeling
- --> reducing CO_2 emission

Eco - Binder Products using alternative and environmentally friendly raw materials

-Self Levelling Mortar
-Industrial Floor System / IFS
-Waterproofing




Industrial Floor System – self leveling floor system

- **Unique and high-performance industrial floor**
- **High mechanical load with high abrasion resistance**
- **Crack and shrinkage free and fast curing**
- **Water vapor permeable**
- **Applicable from 3 to 45°C**
- **Walkable after 6h**
- **Fully loadable after 2 days**
- **Made with alternative materials that have low CO_2 footprint (No solvent , no resin)**

No binder system in the world does have such outstanding properties and unique features

Industrial Floor System

Application

Application by hand

Industrial Floor System

Application

Application by pump machine

Industrial Floor System

Finished Floor after 3 h

Waterproofing

- Made from environmentally friendly raw materials
- Resistant to chemicals (acids, alkalis and solvents)
- Resistant to sulfates (up to 3000 mg sulfate per 1 liter of water)
- No efflorescence and not damaging to concrete & masonry
- Fast loading capacity & frost resistant Not hazardous
- Heat resistant up to +300 °C
- For use on horizontal & vertical surfaces
- Completely inorganic
- Enhanced durability

Flexible waterproofing

- **High flexibility up to 1,3 mm**
- **High mechanical load with high abrasion resistance**
- **Applicable from 5 to 45°C**
- **Reworkable after 6h**
- **UV – resistance**
- **Waterproof even by a 1 mm thick layer**

Silicate binder system

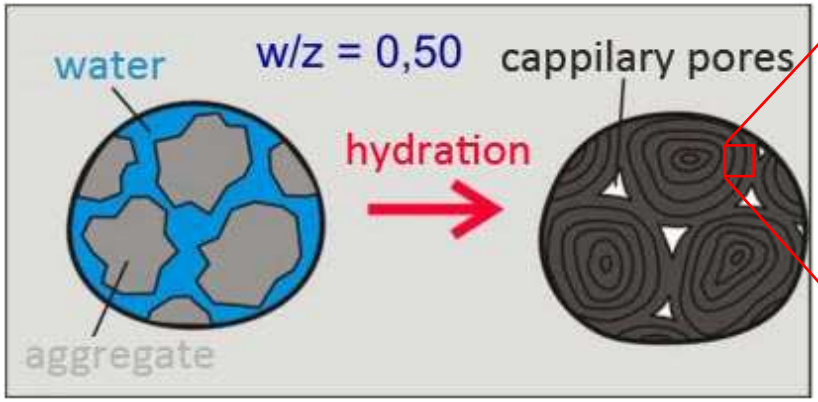
Silicate-Technology

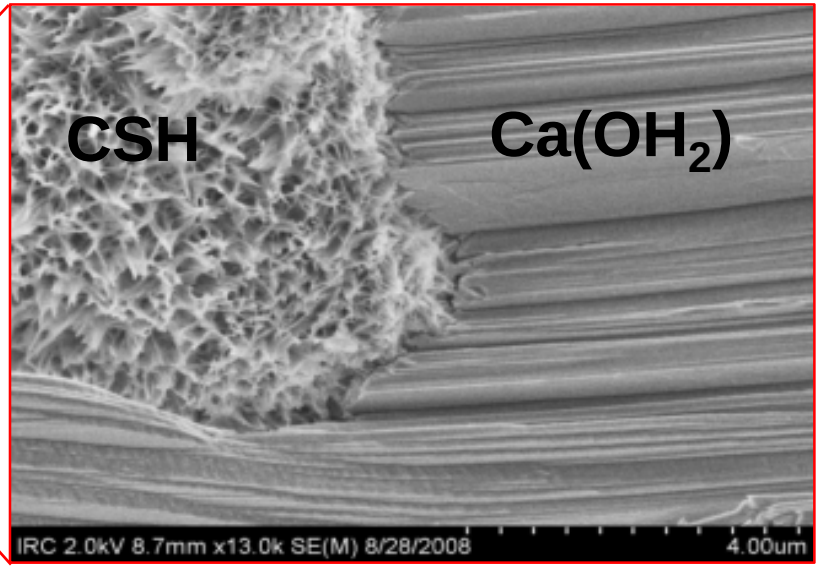
Solution for areas with

high chemical load and corrosion

Why cement based products are not suitable for high chemical load?

Disadvantage of cement





during hydration different phases occur:

calcium silicate hydrat (CSH) (chemically stable and unreactive)
calcium hydroxide ($Ca(OH)_2$) (highly reactiv – weak point of concrete!)

Silicates of the 1st generation

Silicate based products were used to replace organic based products.

However, practical tests showed that these products contain following problems:

Two or three component

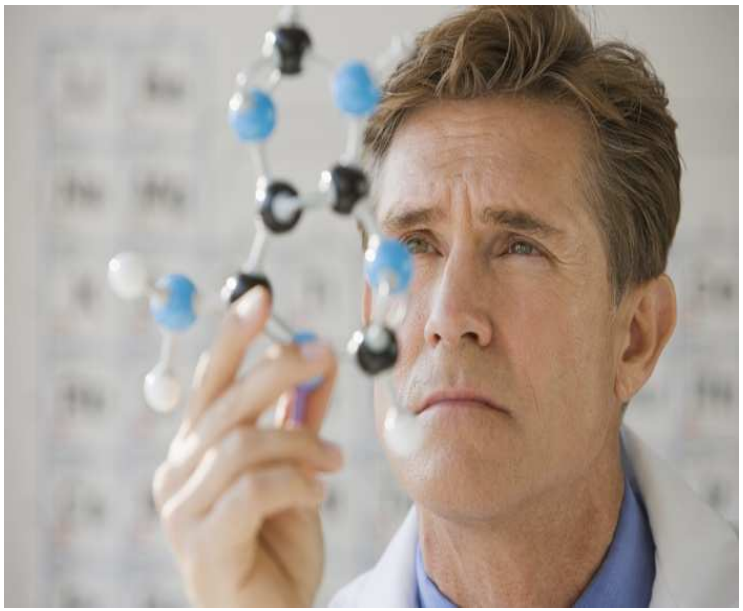
Difficult to apply

Not suitable for wet substrate

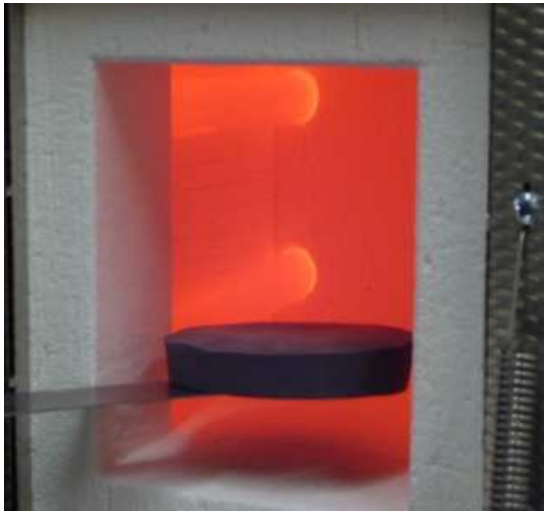
Silicates of the 2nd generation

We have developed new silicate binder systems with unique innovative propertises.

- Extremely high **chemical resistance**
- Extremely high **temperature resistance**
- Exceptionally high **abrasion resistance**
- **Easy application even on wet surfaces**
- **Environmentally friendly**, sustainable, non-hazardous to human health
- Enable the up cycling of secondary raw materials for effective **reduction of CO_2 Emissions**
- Our waterproofing system are impermeable to **high pressure water both positive and negative**



Silicate - Properties



temperature resistant

tensile adhesive strength

chemical resistant

Characteritistics	Cement	Epoxy	Silicate
Health risk			
Durability (pressure)			
Tensile strenght			
Acid resistance			
Bases resistance			
Solvent resistance			
Early water resistance			
Abrasion resistance			
Temperature resistance [°C]			
Price (lages scale production)			

Surface protection system

Liquid silicates

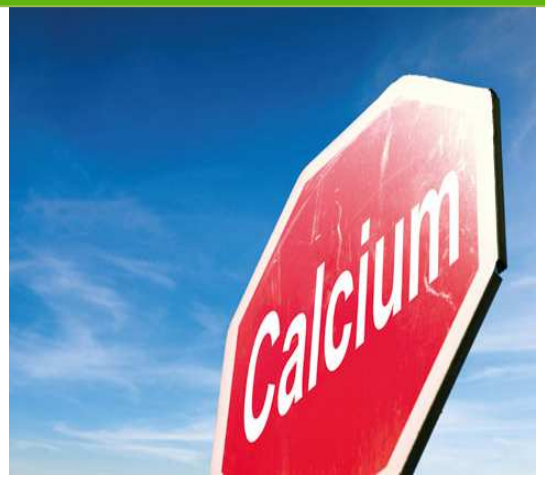
penetrate deep into the surface

reacts with the high reactiv components of the concrete (Ca-Ionen)

stable structure	chemical resistance	waterproof - but water vapour permeable
• **Increase of scratch hardness (prevent abrasion)** • **Solidifies soft or less solid surfaces** • **Very long, stable shelf life**	• **Concrete is long term protect from corrosive attack** • **100 times better protection** • **Improvement of the freeze-thaw resistance**	• **Pore closure** • **No air-tight closure** • **No efflorescence can occur**

Outstanding Properties of Liquid Silicate Silicate based Impregnation

- Penetrate deep into the substrate reacts with components from cementitious underground
- Form a dense Silicate matrix to strengthen the substrate and an acid resistant silicate structure
- Eliminates efflorescence
- Against positive and negative water pressure
- Increase the surface hardness and abrasion resistance of concrete
- Increases the temperature resistance of the substrate
- Solvent free ,
100 % environmentally friendly



Test for acid resistance

storage of the specimen at constant acid concentration

Test for acid resistance

storage of the XA 1 and XA 3 specimen at constant lactic acid concentration for 28 days

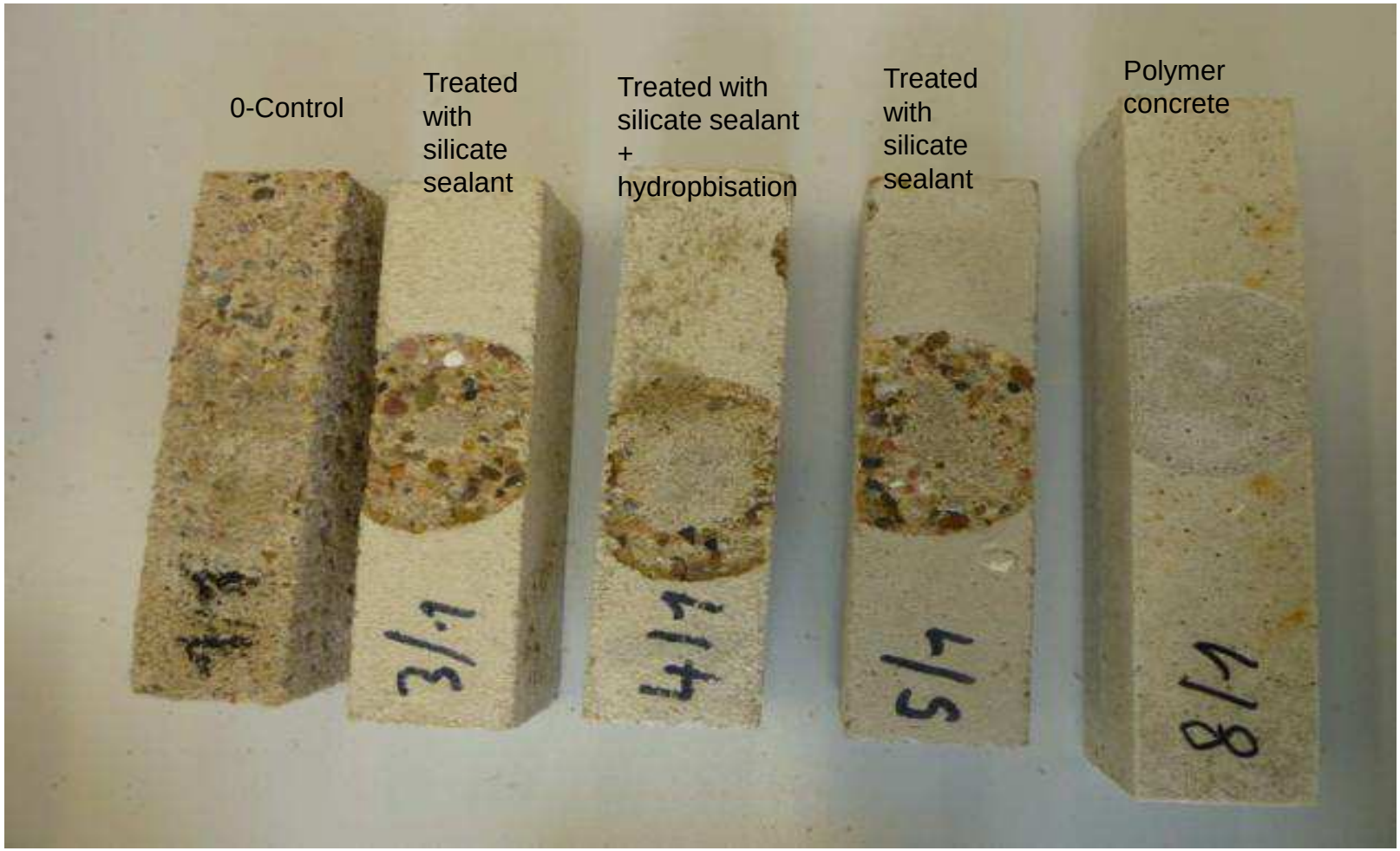
Test for water absorption

Water absorption after 40 min with the “Karsten'schen tube” and long time storage

untreated

treated

Test for abrasion resistant



Application - Protection against algea

Concrete surfaces after 3 years outside

untreated

treated

Silicate Products Applications

1. **Concrete upgrade and soil protection** for facades, design concrete, floor coating, biogas plants, halls, bridges, tunnels, agriculture and industry.
2. **Waterproofing and construction chemicals** in ground-, drinking-, sea- and wastewater (sewage treatment plants, swimming pools, water engineering, tunnels, bridges).
3. **Anti-corrosion protection on steel** for drinking water and sewage pipes, pipelines, geothermal plants, plant engineering and construction, heavy industry, power plants.
4. **Construction materials**, e.g. screeding systems especially for underfloor heating, hygienic- or rapid assemblies, currently still under development.

Application examples - International references

Sydney Opera basement renovation

Application examples - International references

Project with silicate technology products

Sydney Opera House, renovation

Realization the 07.03.2011

Sydney Opera basement renovation

Application Situation

The roof is covered with tiles , which have to be cleaned with acid cleaner . The basement is not protected concrete.

Problem

Corrosion protection on steel reinforced concrete to protected the concrete surface from acid cleaner and salt water

Products

Silicate Mortar for waterproofing / re profiling

Liquid Silicate for concrete protection

Stoerebelt Bridge in Denmark

waterproofing from inside against salt water

Stoerebelt Bridge in Denmark

waterproofing from inside against salt water

Application Situation

Concrete bridge over the sea . The anchor block got cracks in the concrete matrix , where salt water was penetrating through and corrosion starts inside the anchor block

Problem

Waterproofing on wet surface against salt water (6 m below sea level . 0.6 bar water pressure) salt contaminated concrete.

Products

Primer

Silicate Mortar for waterproofing and re-profiling

Flexible waterproofing

Protection of road areas to contamination and freeze-thaw damage

Silicate impregnation with excellent resulting salt resistant and anti pollution effect

APPLICATION SITUATION

A new concrete road area with colored concrete should be protected against corrosion.

PROBLEM

Salt, freeze-thaw attacks destroys very quickly during winter time.

PRODUCTS

-Liquid Silicate – deep waterproofing
-Liquid Silicate – to protect the surface

1. Construction site

2. Substrate before treatment

3. Application of 2 Liquid Silicate

4. Surface 6 month later

Concrete upgrade and soil protection
Facade protection in Sulzbach

Facade protection with reactivation of corrosion protection for steel reinforcement and protection principle W, reinforcement of surface, reduction of water uptake and optimization of frost-dew-resistance and microbiological protection, biocide free, Arnstadt, 5.700m²

Concrete upgrade and soil protection
Floor protection

Eco binder advantages:

- Easy to apply, large surface efficiency
- Short drying time
- Long lasting in use
- High surface hardness, low abrasion
- Health-, safety and environment friendly, low CO2 emissions
- Acid and oil resistant
- Excellent soil protection
- Fast and easy cleaning
- Indoor and outdoor use

Application - Agriculture

Treated end of 2009

Untreated surface

Waterproofing and levelling of concrete and steel

Biogas plant

Application Situation

A concrete tank has to be protected and renovated against sulphuric acid and cracking

Problem

The silage and the sulphuric acid attack strongly the concrete or any waterproofing

Therefore, the old damaged epoxy waterproofing had to be replaced

Products

Flexible waterproofing

Protection of an biogas plant against chemical corrosion

Highly flexible waterproofing with excellent chemical resistance

1. Biogas plant

2. Old damaged coating

3. Application of by brush

4. Final coated tank

Renovation of waste water treatment plant
Corrosion protection of concrete waste water pipelines,

Innovative silicate mortar with excellent adhesion on humid surfaces, salt and acid resistant, with excellent corrosion protection for steel reinforcement

Application situation

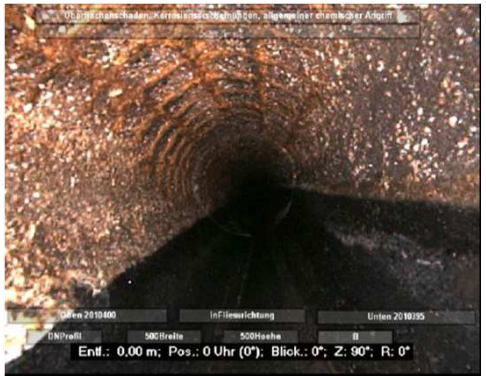
Biogenic sulfuric acid attack has heavily corroded the concrete surface and the steel reinforcement. The ambient conditions are very wet and dirty. Only automatic cleaning by robot possible.

Problem

Corrosion protection of the concrete and steel surface against waste water and biogenic sulfuric acid attack.

Products

Silicate mortar – waterproofing
Liquid Silicate – sealant



1. Pipeline before Cleaning

2. After high pressure water cleaning

3. Application completed, next day

4. Perfect after 24 month in service

Silicate Products

Silicate Waterproofing
Silicate Total Protection Coating

Silicate Mortar

Silicate Grout




Silicate Waterproofing

Properties and benefits:

- hardening in areas with high humidity
- applicable on wet surfaces
- pH 0-14 resistance against inorganic and organic acids
- water pressure stable up to 1.5 bar
- environmental friendly solvent free

Silicate Waterproofing

strengthen the substrate, renovation of a manhole



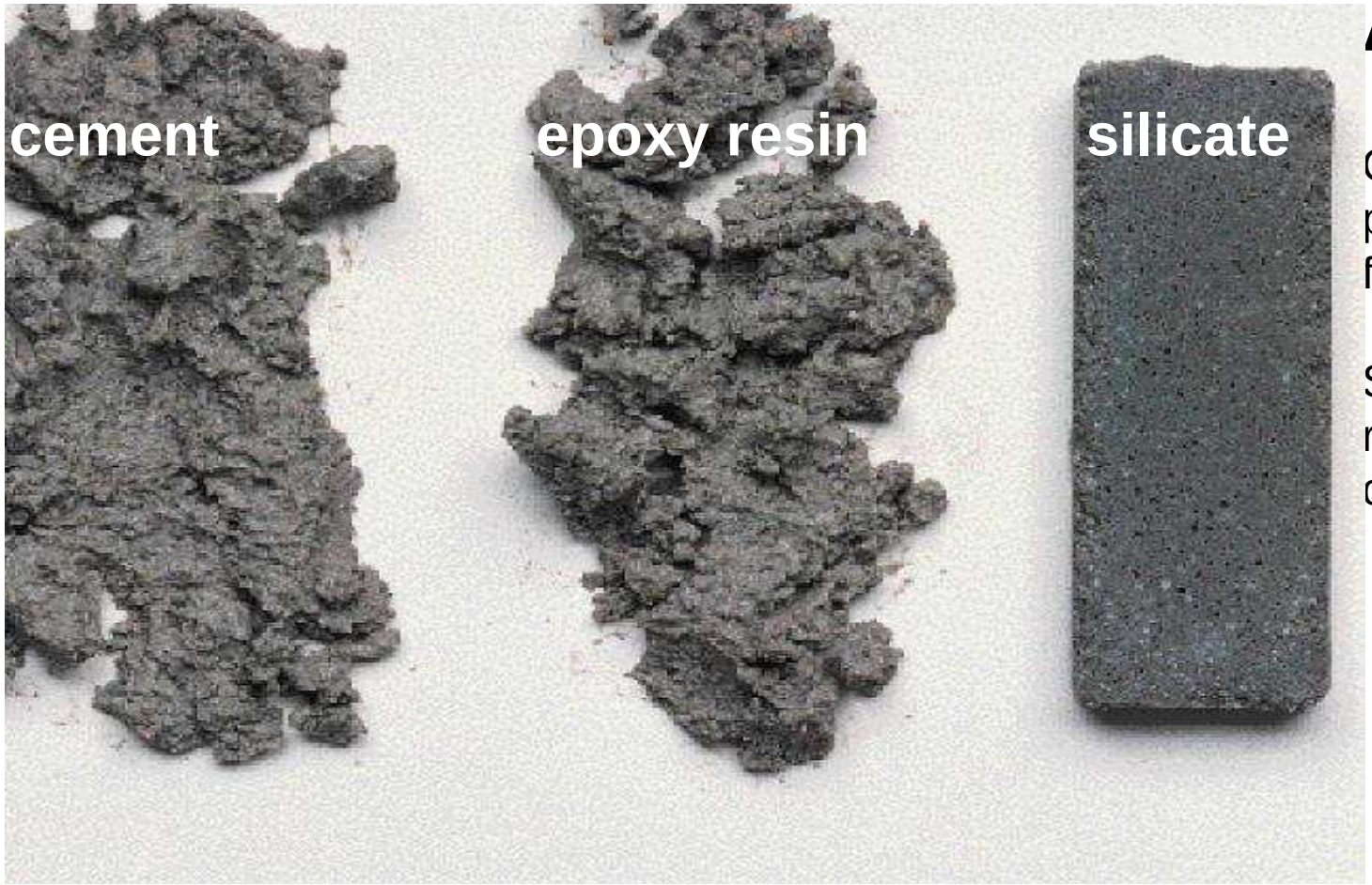



Total Protective Coating
extreme high chemical resistant

Properties and benefits:

- **resistant to all organic and anorganic solvents or acids**
- **extreme high temperature resistant up to 1350 °C**
- **outstanding tensile adhesive strength on mineral substrates**
- **excellent adhesive strength on steel and glazed surfaces**

Total Protection coating
extreme high chemical resistant



Acid attack:

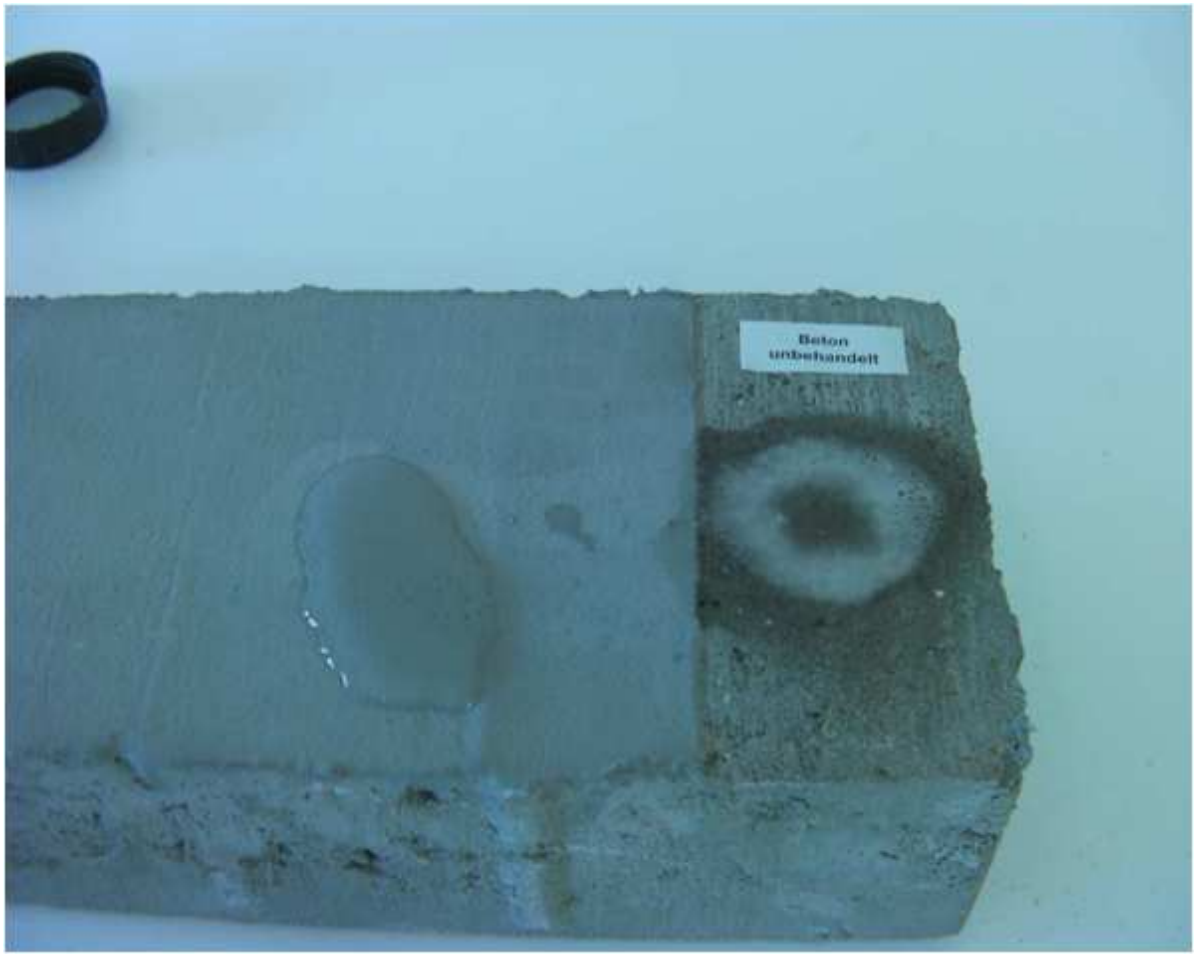
Only silicates are permanent resistant from pH 0-14!!!

Silicate mortar are resistant like ceramic tiles.

Total Protection coating
extreme high chemical resistant

A 0.5 mm thick coating protects your anorganic or mineral surface for highly agressive chemicals.

The product penetrates deep into the surface and reacts with the calcium ion (Ca^{2+}) to CSH phases and solidify the surface.



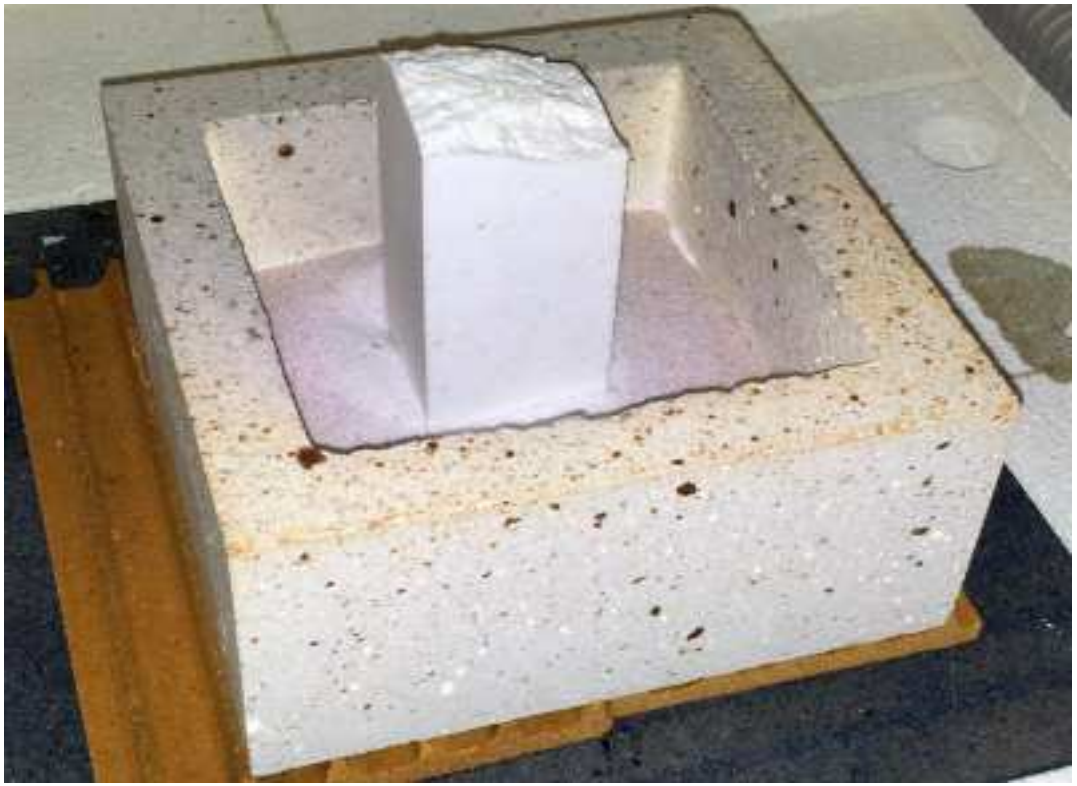
Total Protection coating
extreme high chemical resistant

Table 1: Results of sample storage „Total Protective Coating (TPC) gray"

No.		Concen-tration	Change in Diameter [%]	Change in Mass [%]	Colour of Inspection Liquid before Storage	Colour of Inspection Liquid after Storage	Colour of Sample after Storage	Consistence of Storage after Storage
0.	Water		+0.37	-2.10	colourless	colourless	grey	no alteration
Inorganic Acids								
1.	Hydrochloric Acid	5%	-0.36	-6.94	colourless	milky-cloudy, formation of sediments	light grey	no alteration
2.	Hydrochloric Acid	20%	-0.10	-6.16	colourless	citreous, slight formation of sediments	light grey	no alteration
3.	Sulphuric Acid	conc.	+0.17	+5.60	colourless	brown	grey	slightly affected
4.	Phosphoric Acid	5%	-0.34	+0.60	colourless	colourless, slight formation of sediments	light grey	no alteration
5.	Phosphoric Acid	conc.	-0.19	-0.97	colourless	colourless	light grey	no alteration
6.	Nitric Acid	5%	+0.61	-5.98	colourless	milky-cloudy, slight formation of sediments	light grey	no alteration
7.	Nitric Acid	10%	+0.33	-6.62	colourless	milky-cloudy, slight formation of sediments	light grey	no alteration
8.	Nitric Acid	conc.	+0.27	-1.88	colourless	yellow, cloudy, slight formation of sediments	light grey	no alteration
9.	Boric Acid	saturated	-0.17	+4.61	colourless	colourless, formation of sediments	grey	no alteration
Organic Acids								
10.	Lactic Acid	5%	+0.13	+1.07	colourless	colourless, slight formation of sediments	light grey	no alteration
11.	Lactic Acid	conc.	-0.41	-1.10	colourless	colourless	light grey	no alteration
12.	Acetic Acid	10%	+0.46	+2.31	colourless	colourless	light grey	no alteration
13.	Acetic Acid	20%	+0.26	+3.61	colourless	colourless	light grey	no alteration
14.	Citric Acid	5%	-0.13	-1.21	colourless	yellowish, slight formation of sediments	light grey	no alteration

Total Protection coating
extreme temperature resistance

Up to 1350°C



Silicate re-profiling mortar

Properties and benefits:

- hardening in areas with high humidity
- applicable on wet surfaces
- pH 0-14 resistance
  inorganic and organic acids
- 1,5 bar waterproof
- environmental friendly, solvent free
- one-component, 100% inorganic

Silicate re profiling mortar

Silicate re profiling mortar

Silicate tile adhesive

Properties and benefits:

- 100 % inorganic, one-component
- high slip resistance and adhesion according to DIN EN 1308 & 1348
- long open time according to DIN EN 1346
- C2-FTE according to DIN EN 12004
- non-flammable
- water resistant, frost-proof and temperature resistant

Silicate grout

Properties and benefits:

- one-component
- high mechanical strength with high abrasion resistance
- no efflorescence
- water vapor permeable
- no allergy potential
- no hazard labeling required

Silicate Binder Technology

- Protects the concrete durable
- Increase the resistance against salt water and chemicals
- Easy to apply
- Environmental friendly
- 100 % mineral based protection system
- Water vapor permeable
- Hazardous labeling free

Thank you for your attention