Protectosil® products for renovation

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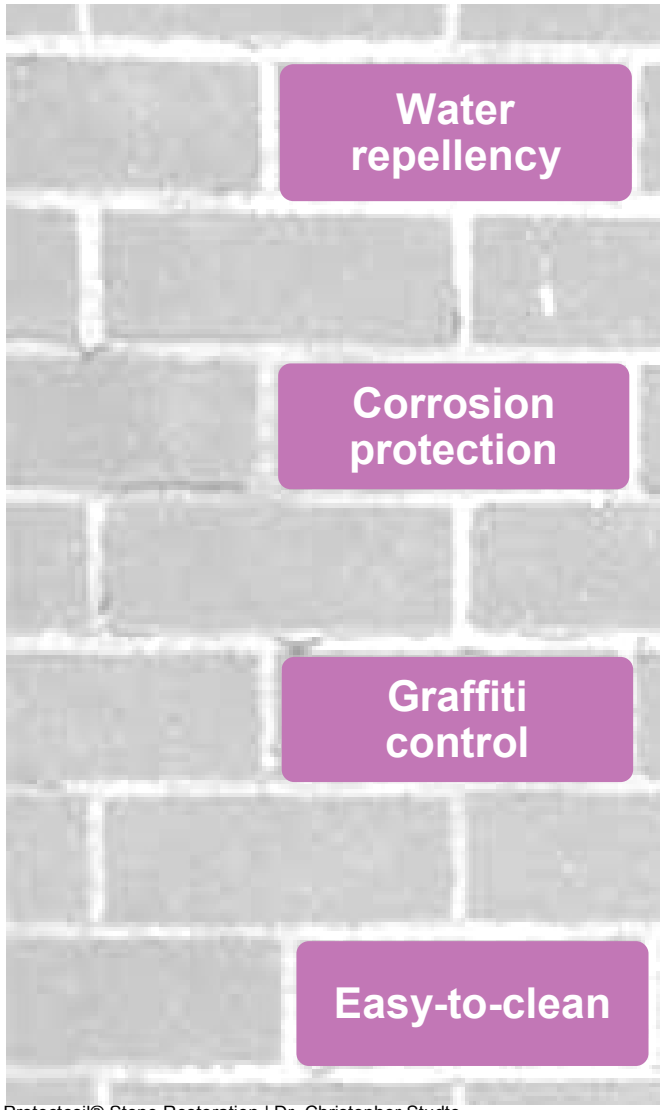
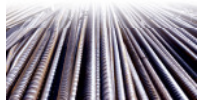
Silane products for the building industry





Evonik IM products

Protectosil® BHN, 60 SK, 80 SK, 100 NK, 40 S
Protectosil® 266, 800, 871
Protectosil® MH 10, MH 50, 851
Protectosil® WS 405, WS 630, WS 700P, WS 808
Protectosil® SH

Protectosil® CIT
Protectosil® DRY CIT

Protectosil ANTIGRAFFITI®
Protectosil ANTIGRAFFITI® PRIMER
Protectosil ANTIGRAFFITI® SP
Protectosil® PROFICLEAN GEL

Protectosil® SC CONCENTRATE
Protectosil® SC 30, SC 60, SC 100, SC 1000

Types of stone deterioration

Mechanical damages:

- due to volumetric changes of water
- due to crystallisation, hydration, hygroscopicity of salts
- solvation and transportation of salts forms additional pores

Chemical damages:

- chemical reactions with water or dissolved products
  - ⇨ water soluble reaction products are transported by water
  - ⇨ products with higher volume lead to mechanical stress

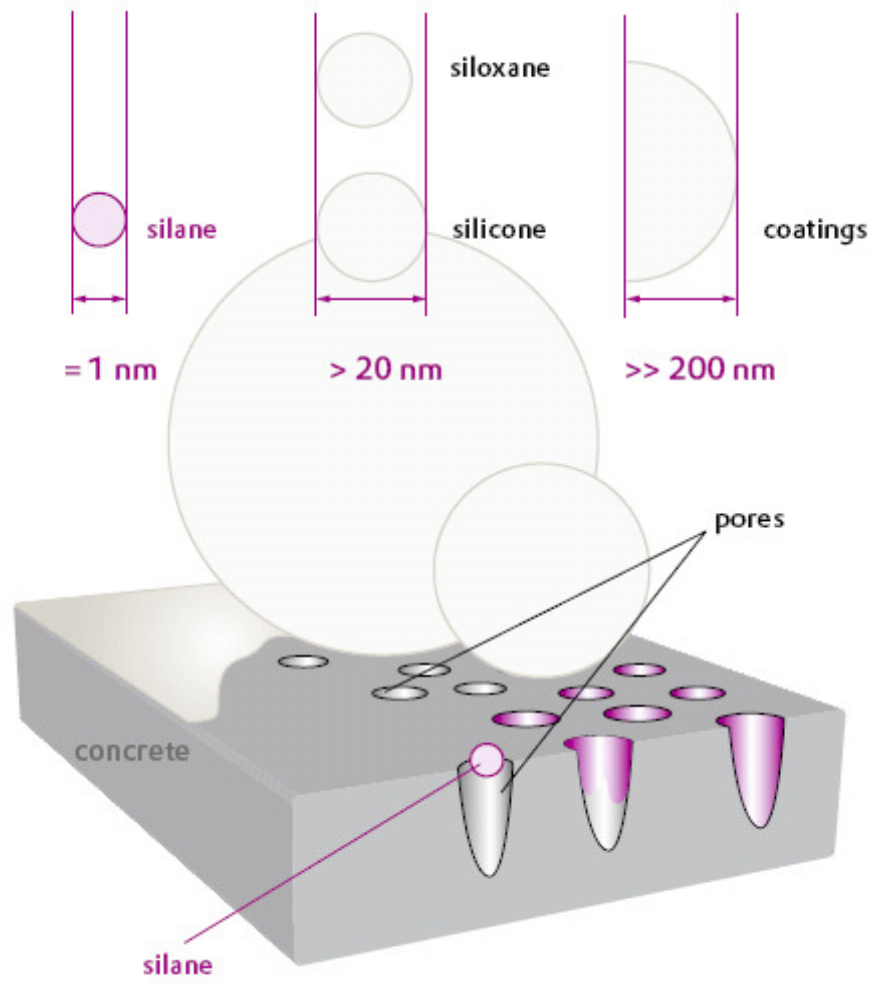
Biological damages:

- colonization and attack by microorganisms

Other damages:

- loss of thermal insulation properties
- optically unpleasent appearance

Mode of action of organofunctional silanes



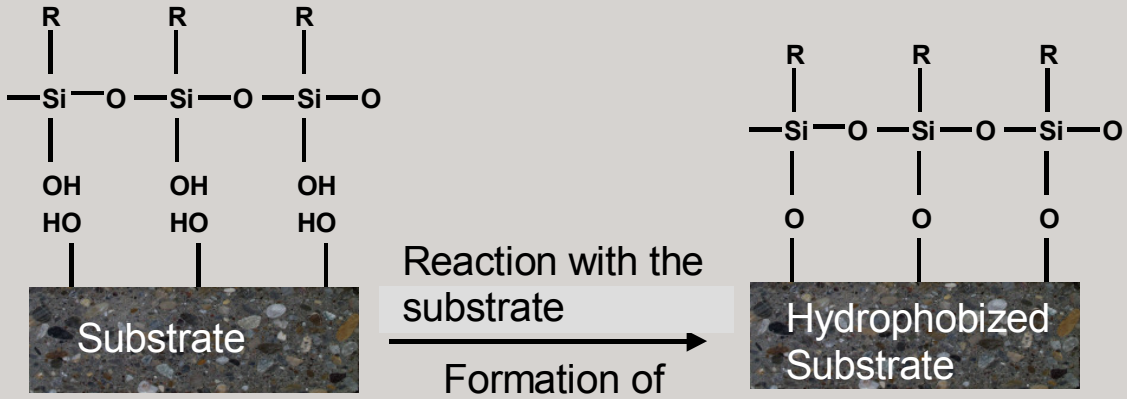
Penetration

M. Brand et al. *Z. für Naturfoschung* **1999**, *54b*, 155-164.
F. Beari et al. *J. Orgmet. Chem.* **2001**, *625*, 208-216.

Mode of action of organofunctional silanes

Penetration

Reaction



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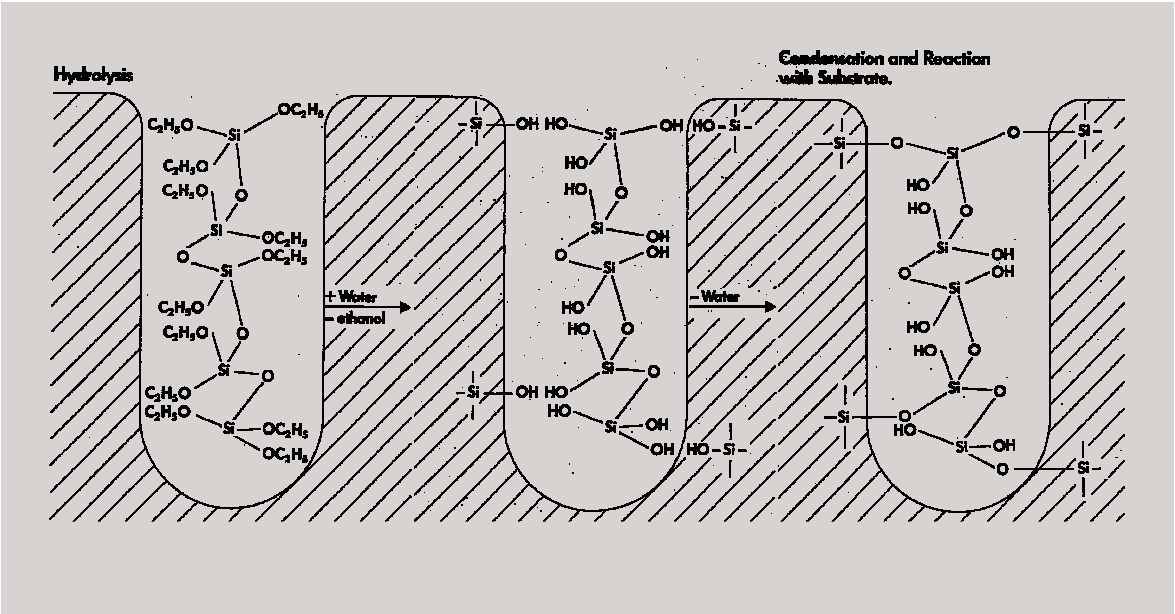
Mode of action of organofunctional silanes

Penetration

Reaction

Condensation



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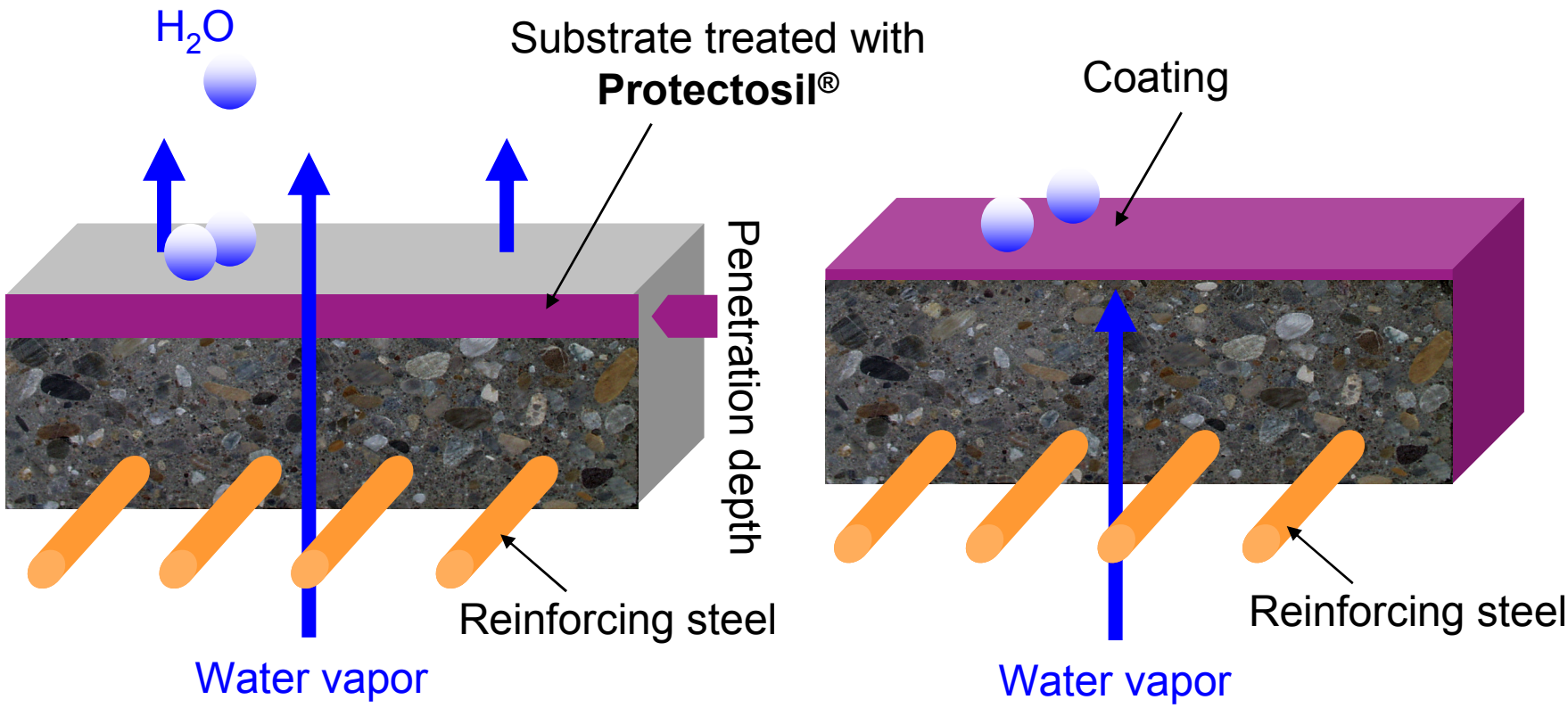
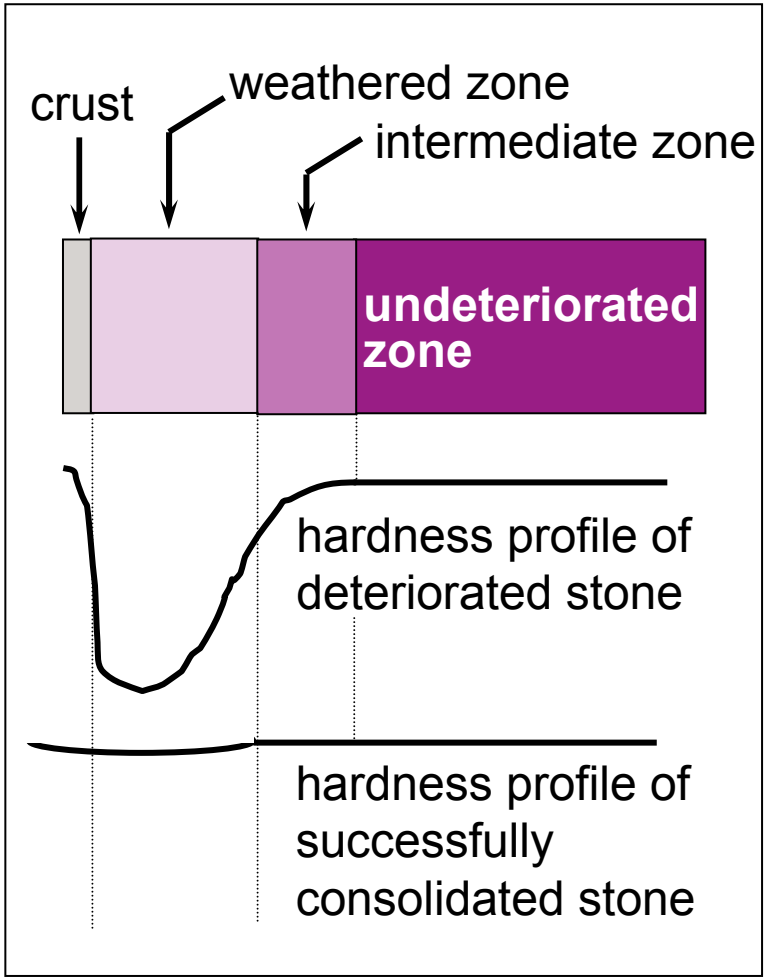
Substrates treated with Protectosil® retain their water vapor permeability



Some advantages of silane systems

- Based on Silicon Chemistry
  - Chemically bond to the substrate
  - Retain water vapor permeability
  - Do not change surface appearance
  - Resistant to alkalinity, chemicals and biological degradation
- Penetrate into the substrate
  - Small molecular size
  - Protected from UV attack
  - Resistant to abrasion
  - Long service life even on bridge decks

Protectosil® SH – mode of action



Mode of action of **Protectosil®** SH:

- penetration into stone down to undamaged core
- deposition of weather-resistant mineral binder
- build-up of uniform strength profile through cross-section of the stone
- no formation of harmful salt-like by-products
- no discoloration of stone surface
- no impairment of water-vapour permeability, thermal and hygric behaviour
- reduced water and pollutant absorption

Protectosil® SH - product description

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Product Description:

- mixture of ethyl esters of polysilicic acid
- contains 40% SiO2
- colorless, low viscous liquid
- solvent free

Performance Description:

- qualified for the consolidation of mineral construction materials
- has a sufficient amount of ethoxy groups which can be activated by acidic or alkaline catalysts
- may be used for the restoration of natural stone
- improves the thermal and chemical stability and mechanical properties of treated substrates

Reference Object: Private House in Lucerne (CH)
Yellow sandstone protected with **Protectosil®** SH and **Protectosil®** SC CONCENTRATE

Protectosil®

Protectosil® SH - product description

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Application Details:

- not miscible with water
- usually applied after dilution in ethanol, methanol or white spirit together with catalysts such as mineral acids, ammonia, titanates or tin compounds
- the substrates to be treated should be hand-dry and clean (cleaning is possible by washing with cold or warm water or water vapour blasting)
- during application the temperature of the substrate and the environment should be within the range of +5 to +40 °C
- consumption rates depend on the type of substrate and range between 0,5 and 1,0 l/m²
- should not come into contact with water before or during application
- should not be applied if there is a strong wind or if it is raining
- treated area should be protected from rain for 2 days
- should be applied by spraying to the surface
- should be applied wet-in-wet until no further material is absorbed
- excess material should be washed away from the surface using white spirit or alcohol
- Glass, wood, plastic, metal, and plants in the vicinity of the substrate to be treated should be protected against overspray
- it is strongly recommended to do a test batch first

Reference Object: Private House in Lucerne (CH)
Yellow sandstone protected with **Protectosil®** SH and **Protectosil®** SC CONCENTRATE

Protectosil®

Protectosil® 40S - product description

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Product Description:

- water repellent impregnation
- based on monomeric silane systems
- colorless, clear liquid
- contains ethanol

Performance Description:

- especially suited for the water-repellent impregnation of mineral construction materials in outdoor areas
- very high penetration depth
- water-vapor permeable protection
- colorless protection
- protection resistant to chemical and biological attack
- is suited for the protection of consolidated substrates

Reference Object: Military museum in Vienna (AT)
Red sandstone protected with **Protectosil®** 40S

Protectosil®

Protectosil® 40S - product description

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Application Details:

- supplied ready-to-use and used undiluted
- consumption rates depend on the type of substrate and vary between 0.4–0.8 l/m²
- repair mortars have to be fully cured
- substrate should be clean and hand-dry before treatment (cleaning is possible by sandblasting or water blasting)
- temperatures of the substrate and the environment should range between 0 °C and +40 °C
- should not come into contact with water before or during application (equipment and containers must be clean and dry)
- should not be applied during wind or rain
- should be applied by flowcoating to the saturation point
- applied by airless spray guns (brush or roller not acceptable)
- horizontal surfaces should have a shiny, wet appearance for 3-5 seconds, vertical surfaces should exhibit a 30-50 cm shiny curtain of liquid
- glass, wood, plastic, metal, and plants in the vicinity of the substrate to be treated should be protected against contact
- it is strongly recommended to do a test patch first to determine consumption rates and avoid unwanted side effects

Reference Object: Military museum in Vienna (AT)
Red sandstone protected with **Protectosil®** 40S

Protectosil®

Protectosil® SC 30 - product description

Product Description:

- aqueous formulation based on silane systems
- yellowish to orange, slightly turbid liquid
- essentially free of volatile organic compounds (VOC)

Performance Description:

- for easy-to-clean surfaces
- aqueous and oily substances are easier to clean away
- growth of microorganisms is slowed down
- water-vapour permeable, colourless protection
- no formation of sticky silicone films
- is suited for the treatment of water repellent substrates

Reference Object: Parade Platz, Zurich (CH)
Sandstone protected with **Protectosil®** SC CONCENTRATE

Protectosil® SC 30 - product description

Application Details:

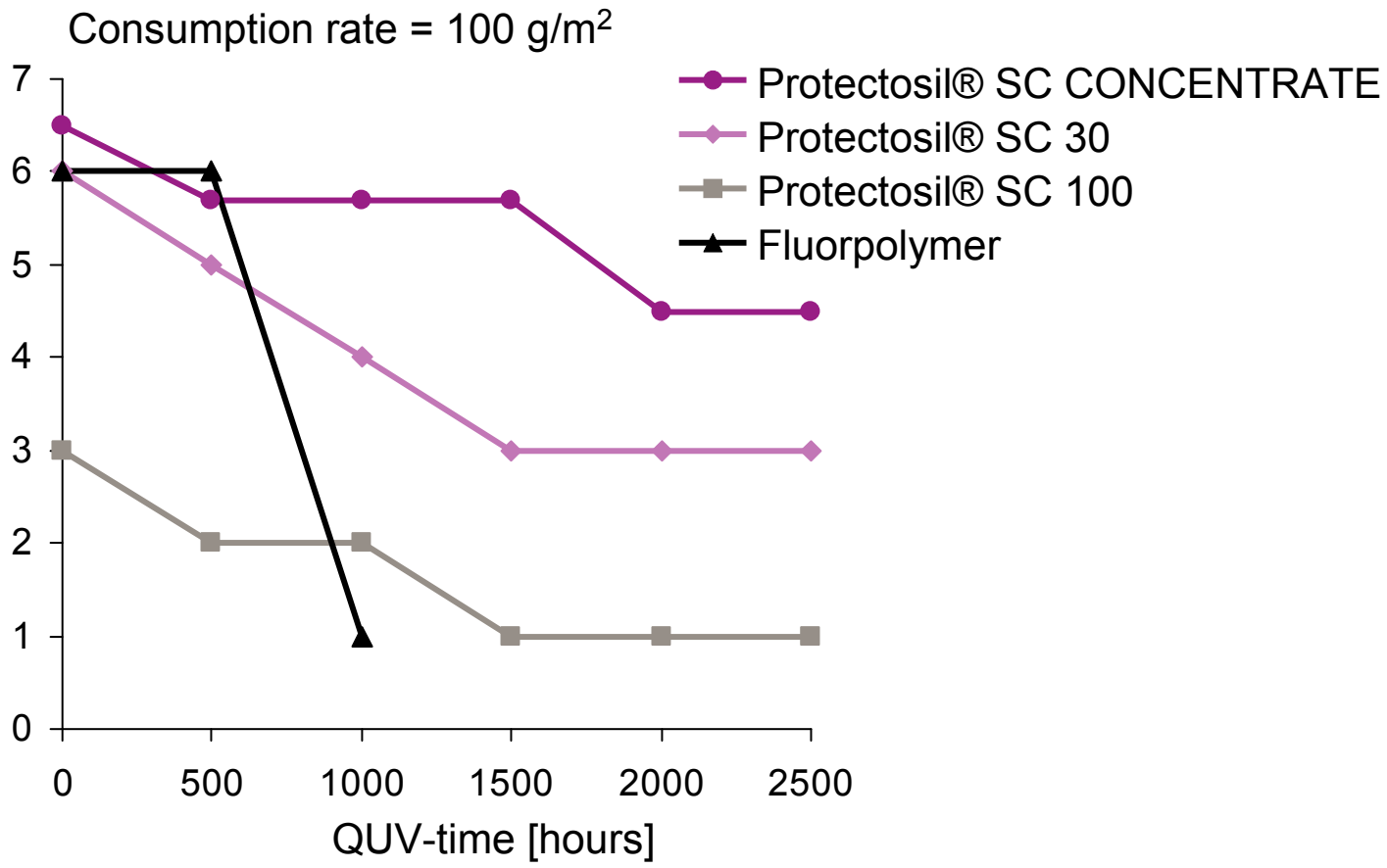
- supplied ready-to-use
- exact amount to be applied, suitable dilution rate and mode of application is highly depending on the type of substrate and may vary between 30 and 130 g/m²
- usually applied by HVLP technique in 1 to 2 coats
- substrate to be treated must be clean and hand-dry (high pressure or water vapour cleaning is suitable)
- air and substrate temperatures should be between 5 °C and 40 °C
- should not be applied during rain or strong wind
- a water repellent should cure for 14 days before **Protectosil**® SC 30 is applied
- droplets formed during application should immediately be distributed with a brush
- glass, wood, plastic, metal, and plants in the vicinity of the substrate to be treated should be protected against contact
- it is strongly recommended to do a test patch first to determine consumption rates and to avoid unwanted side effects
- too much product applied or a faulty application may lead to sticky surfaces and discoloration

Reference Object: Parade Platz, Zurich (CH)
Sandstone protected with **Protectosil®** SC CONCENTRATE

Long-term effectiveness of Protectosil® SC on red sandstone

Strong beading effect (good easy-to-clean properties)

Weak beading effect (no easy-to-clean properties)



300 hrs. artificial weathering correspond to about 1 year outside weathering (conditions South-West Germany)

Recommendations for stone restoration projects

General:

- it is strongly recommended to do test patches and evaluate **Protectosil®** products
- use **Protectosil®** SH and **Protectosil®** 40 S
- evaluate use of **Protectosil®** SC 30
- apply **Protectosil®** SH and **Protectosil®** 40 S on mineral substrates (old and new sandstone, old and new laterite)
- make sure surfaces to be treated are clean and dry
- make test patches to determine comsumption rates and check unwanted side effects, especially with repair mortars
- refer to product information for more details and follow instructions

Restoration procedure for consolidation, hydrophobation & easy-to-clean effect

Possible start point for a test and evaluation:

- apply **Protectosil®** SH undiluted, application by airless spraying in various coats (wet-on-wet) to the saturation
- let cure for 7 days
- apply **Protectosil®** 40 S undiluted, application by airless spraying
- let cure for 7 days
- evaluate stone consolidation, reduction of water uptake and penetration depth
- apply **Protectosil®** SC 30 by HVLP in 2 coats (appr. 150 g/m² in total)
- let cure for 14 days
- evaluate easy-to-clean properties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