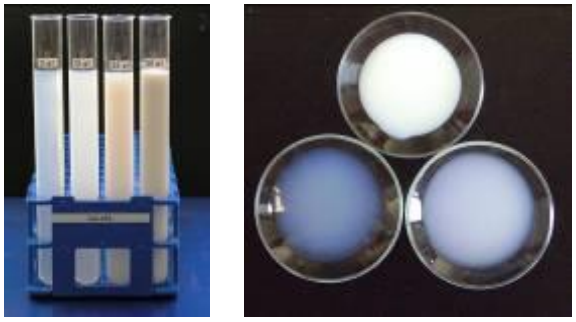
Technical Leaflet

IBZ-Salzchemie GmbH & Co.KG

CaLoSiL®

Colloidal nano-particles of lime for stone and plaster consolidation



CaLoSiL® in different concentrations

Properties

CaLoSiL® contains nano-particles of lime hydrate ($Ca(OH)_2$) suspended in different alcohols. Typical concentrations are between 5 g/L and 50 g/L. The average particle size is 150 nm. Ethanol, iso-propanol or n-propanol serves as solvents. Due to the low particle size stable sols are formed. That means the solids do not sediment for a long time.

CaLoSiL® is a ready-to-use stone and plaster consolidant. Treatment of stone, mortar or plaster with CaLoSiL® results in the formation of solid calcium hydroxide after evaporation of the alcohol. That converts into calcium carbonate in a way similar to traditional lime mortars by reaction with atmospheric carbon dioxide. All alcohols evaporate completely. Chemicals or residues deteriorating stone or mortar are not formed.

CaLoSiL® can be applied by dipping, capillary suction, spraying or injection. It is important that the complete weathered zone of the stone is treated.

Available types of CaLoSiL® / Packaging

CaLoSiL® is available in concentrations between 5 g/L and 50 g/L. The letters behind the name "CaLoSiL®" indicate the used solvent, the numbers give the total calcium hydroxide concentration in g/L. E stands for ethanol, IP for iso-propanol and NP for n-propanol. For example, E25 means, 25 g/L calcium hydroxide dispersed in ethanol.

Standard products are:

CaLoSiL® E5, E25 and E50
CaLoSiL® IP5, IP15 and IP25
CaLoSiL® NP5, NP15 and NP25

All CaLoSiL® types are available in 500 mL, 1 L, 2,5 L, 5 L and 10 L containers.

Properties of formed calcium hydroxide / calcium carbonate

The calcium hydroxide particles formed after evaporation of the alcohol cover the surface of treated cracks, pores or joints. Dense films of calcium hydroxide films are formed, depending on the number of treatment cycles and the concentration of the used sols. The particles have sizes between 50 nm and 250 nm. Their detection by means of standard optical microscopy may be difficult, the use of SEM is recom-

mended. Calcium carbonate formation by reaction with atmospheric carbon dioxide requires the presence of humidity. Carbonations takes place within few days and weeks, depending on the conditions and the amount of calcium hydroxide brought into the stone. In some cases, the carbonation process can be accelerated by increasing the humidity, for example by covering with wet clothes.

Penetration behaviour

The penetration into mortar, stone or plaster depends on many factors. Of special importance are:

- Characteristics of the CaLoSiL® type applied,
- Structure and surface characteristics of the materials to be treated,
- Porosity and capillary rise,
- Moisture content of the material
- Air temperature and air humidity during the application

When dense materials are treated with highly concentrated CaLoSiL® products (CaLoSiL® E50, CaLoSiL® paste-like etc.) the penetration behaviour may be only low. Especially the presence of dense surface layers (for examples gypsum crusts on mortars, plasters) prevent a penetration of CaLoSiL® into deeper zones.

The penetration into materials with high moisture contents is generally more difficult than into dry substances. Pre-wetting with ethanol may help to reduce the moisture content of the material. After evaporation of the ethanol, it should be possible to apply all CaLoSiL® products without any problems.

White haze formation

The formation of a white haze on the surface of the treated material depends not only on the penetration behaviour of CaLoSiL® but also on the evaporation conditions of the alcohol. Fast evaporation is often connected in the most cases with a transport of the nano-particles back to the surface. In such case, the time was insufficient to fix the calcium hydroxide particles within the treated materials. General rules to prevent / reduce the formation of white haze are:

- Start the treatment with low concentrated products, increase the calcium hydroxide concentration step by step.
- Avoid the treatment of wet materials, reduce the moisture content by pre-treatment with ethanol or ethanol-water mixtures (1:1).
- In the case of sensitive surfaces, try to use CaLoSiL®-grey, which has a special consistency allowing deep penetration without white haze formation.

- Avoid an "oversaturation" of the treated stone, plaster or mortar. Remove all CaLoSiL® which could not penetrate into the treated material, for example with a sponge.
- Test the addition of small amounts of acetone or heptane.
- Test the combination with CaLoSiL® micro, which has a bigger particle size allowing the fixation of small particles.
- Test the addition of small amounts of alcohol soluble cellulose.

Times

The alcohols evaporate within a few hours. The carbonation process itself requires between few a days and weeks, depending on the amount of calcium hydroxide formed and on the environmental conditions (humidity, possibility of carbon dioxide migration).

CaLoSiL® and silicic acid esters

The combination of CaLoSiL® with silicic acid esters allows the successful consolidation and strengthening of materials at which pure silicic acid esters do not work satisfactorily. It is recommended to treat the materials in question in a first step by CaLoSiL® (for example E-25 or IP-25) and apply silicic acid esters after the evaporation of the alcohol. The calcium hydroxide formed from CaLoSiL® acts as an adhesion promoter as well as catalyst accelerating the hydrolysis of the silicic acid ester. The final strength is in many cases much higher than it can be achieved by single treatment with silicic acid esters. All commercially available silicic acid esters can be used. Detailed information are summarised in a special technical leaflet.

Mixability with other materials

All CaLoSiL®-products can be intermixed. Blending with ethanol, n-propanol or isopropanol is also possible without any difficulties. In contrast to that, the addition of water results, when amounts greater than 10 wt.-% are added, in the formation of solutions characterised by a gel like consistency. Higher water amounts will flocculate the calcium hydroxide particles.

Storage

All materials have to be stored between +5 °C and +30 °C. When CaLoSiL® remains in unopened, original containers, storage for at 12 months is possible. After that time, agglomeration and connected with that, sedimentation may occur. The settled particles, however, can be re-dispersed by shaking the closed bottle or by ultrasonic treatment. The properties of the nano-sols remain unaffected.

Safety

CaLoSiL® is flammable/combustible. Keep away from oxidisers, heat, sparks and flames. Avoid spilling, skin and eye contact. Ventilate well, avoid breathing vapours. CaLoSiL® is strongly alkaline. Do not smoke. Keep container closed. Use safety gasses and glovers. Wash thoroughly after handling. Keep away from sources of ignition. Please store in a cool, dry place and in a tightly closed container. Further information concerning safety during transport, storage and handling as well as for disposal can be found in our latest Material Safety Data Sheets. Before using in large scale we recommend to treat a small test field with CaLoSiL® in order to find out the most favourable application method and the required volumes of CaLoSiL®.

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