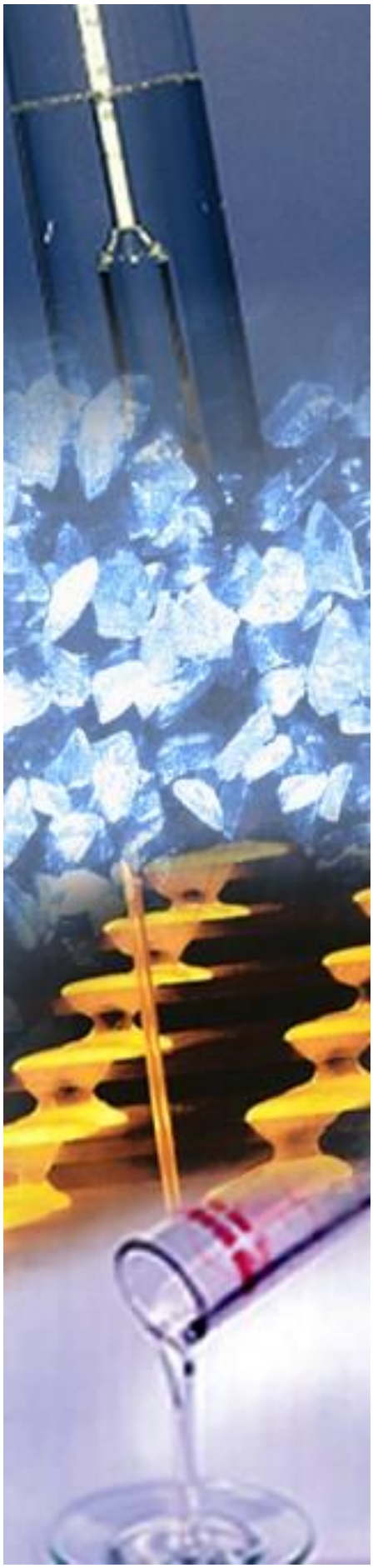
T R A S O L ®
CYCLOQUART ®

Inorganic binders based on potassium silicate for the production of paints and coatings for mineral surfaces.

Application areas:
Outdoor and indoor paints,
plasters, primers, industrial coatings of construction- and insulation boards.



C O N T E N T S

1 Description of Products

1.1 General

Our Trasol products are Potassium silicate solutions with a high silica content, their molar ratio of SiO_2 / K_2O is approximately 3.5 - 4. In comparision to Sodium silicates, Potassium silicates give a hardened coating of higher water resistance and much lower tendency for efflorescence. Modifications with small amounts of linear or cross linked organic polymers improve the rheology of paints and coatings compared to standard silicate solutions. Special additives improve the dispersing properties of fillers and pigments and significantly reduce their tendency to settle. Compared to non-modified purely inorganic standard potassium silicate solutions modified Trasols result in a better silicified and more elastic coating of higher water resistance.
Some Trasols are additionally stabilized. They may easily be combined with different kind of fillers and pigments without coagulating silica from the silicate solution or gelling the paint mixture too much.

Piece of Potassium Silicate Glass

Intermediate in the production of siliceous Potassium silicate solutions

In particular, the use of Trasol is advantageous when the coating formulation contains synthetic organo-dispersions such as saponification-resistant acrylate-, styrene-acrylate or styrene-butadiene dispersions. These may be incorporated without any problems, while the use of non-modified standard silicate solutions tend to coagulate in direct contact with synthetic dispersions.
Trasol products differ in their own rheological properties and in the final rheology of the paints and coatings. Higher addition levels of modifiers lead to Trasol products with lower content of potassium silicate.

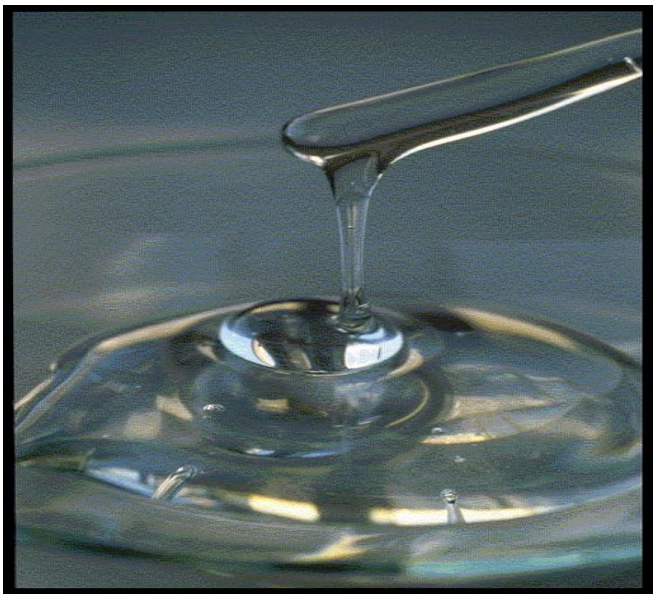
1.2 Technical data

As an overview physico-chemical data of our Trasol products are listed:

Product	$\%SiO_2$	$\%K_2O$	approx.density kg/m^3
Trasol KH-K	23.8	10,7	1325
Trasol KA-N	13.5	5.2	1155
Trasol KC-K	14.5	5.7	1170
Trasol KE-K	20.2	7.9	1245
Trasol KI-S	20.1	8.7	1255
Trasol KW-N	20.8	8.1	1255

1.3 Choice of grades

When selecting the grade of Trasol most suitable for a specific purpose, the preferred method of application of the Trasol-based product is of major importance. For sprayable mixtures the lower viscous grades Trasol KA-N, KE-K and KC-K are preferred. If higher filling rates are desired, e.g. for interior application, available water at the beginning for dispersion may be limited; the use of modified, but still highly concentrated Trasol KI-S is recommended.



Highly concentrated aqueous solution of potassium silicate

Base of Trasols

1.4 Applications

Trasol products are primarily used as binding agents for paints and coatings in the building industry. This application is described in more detail in this pamphlet. Besides this, Trasol may be used for coating of fibre cement, calcium silicate-, mineral-fibre and other boarding materials.
Trasol-based paints and coatings differ in important aspects from products containing synthetic organo-dispersions as main binders. The distinctive characteristics can be seen from a comparison of the properties of the binding agents:

Trasol	Organic dispersion
Binder silicifies Formation of a silicate lattice	Binder forms a film
Penetrates into the substrate	Binds at the surface
Lattice is vapour permeable	Organic binder film has low vapour permeability
Porosity inhibits condensation of water	Condensed water may form on surface
Low sensitivity to dirt No yellowing, UV-stable	Dirt sticks to surface Unstable to UV-light
Inflammable Heat-resistant	Film is sensitive to heat and fire
High chemical resistance	Swelling in contact with solvents
Inhibits the growth of germs	Addition of suitable biocides for pot-conservation is essential

1.5 Packaging

Trasol products are supplied in drums, in containers or else in tank trucks in lots up to 24 t net.

1.6 Storage

Being solutions in water, all Trasol products are sensitive to freezing and should be stored indoors at temperatures above +4 °C.
For storing Trasol unpainted iron drums or plastic containers with low vapour permeability may be used. Galvanized or light-metal containers are unsuitable.
If properly stored in closed containers Trasol has a shelf life of one year.

1.7 Safety instructions

Trasol products are all no hazardous materials according to OECD/EU directives.
Spilled product should be caught up with a binding agent, as silicate films are rather slippery. In case of eye-contact we suggest to rinse with plenty of fresh water. A doctor should be contacted in any case.
Trasol products do as well need no labelling according to transportation regulations RID/ADR, GGVS/GGVE, ADNR, IMDG, ICAO-TI/IATA-DGR.

2 Organosilicate Paints based on Trasol

2.1 General characteristics

Paints formulated in conformity with the recommended standars formulations outlined in this pamphlet are organosilicate paints according to German Standard VOB/C DIN 18.363, § 2.4.6. These kinds of paint contain besides the main silicate binding agent an appropriate amount of alkali-resistant synthetic dispersion, pigments, fillers and other additives. The total amount of organic substances, determined by loss on ignition, may only be up to 5wt% of the formulation.
The allowed minute amount of synthetic dispersion does not form a film and is thus not considered to be a binding agent. However, it has a rheological and protective function during the initial period after

application of the paint until silicification has sufficiently progressed. Organosilicate paints based on Trasol and formulated according to DIN 18.363 § 2.4.6. are designated “Silicate paints“ in the following text.

2.2 Fields of application

Silicate paints may be used for coating mineral substrates, e.g. cement and cement lime plasters, sand-lime brick and concrete. They can be used for painting new surfaces as well as for restoring old silicate and other mineral surfaces. Further applications are coating glass fibre or mineral fibre boards. On gypsous surfaces a precoat test should be performed to check, whether a pre-treatment with a Trasol-primer is necessary.
Unsuitable substrates for Trasol paints are smooth synthetic surfaces, organo-paint films, distemper paints and hydrophobic surfaces.

Silicate Paints in outdoor Application

2.3 Properties

Primers, paints and plasters based on Trasol

- silicify with the substrate to an inseparable stone-like structure
- are very permeable to water vapour, so that no condensed water is generated and walls remain dry
- can not be submigrated by water and do not blister from the substrate
- penetrate into the substrate and solidify brittle and sandy areas
- are hard and scratch-proof
- are resistant to UV light and thus do not yellow
- can not be charged electrostatically and thus do not attract particles of dirt
- do not provide a nutritive substrate for algae and fungi
- have an affinity to mineral building materials, giving treated ares a natural look

Silicate paints in indoor Application

2.4 Advantages versus conventional paints

No film formation

Contrary to conventional building paints, which are generally dispersion paints, Silicate paints do not form a film upon the surface of the building material. Silicate paints react chemically with the substrate, creating a solid chemical compound within the zone of contact. Hardening of the paint results from chemical reaction with atmospheric carbon dioxide, forming a lattice of silica. This chemical reaction is called “silicification”.

Due to the lattice-like structure of the hardened Silicate paint, these coatings can not be submigrated by water and thus do not blister from the substrate.

Durability

Silicified Trasol coatings exhibit hardness, resistance to scratching and high stability towards aggressive atmospheric influences (exhaust gases). Therefore Silicate paints are very durable and long lasting.

High water vapour permeability

An essential and first task of any building paint is to protect the facade from rain. At the same time humidity arising from inhabitation should be able to escape from inside to outside of the building. Film forming paints do fulfil the first task rather well, but in some cases discharge of humid air from inside to outside is insufficient. Water vapour may condense inside the wall structure and cause negative effects. Trasol painted walls remain sufficiently dry at all times.

Natural look

Due to their inorganic mineral character Silicate paints show a matt stony look. This harmonizes better with the character of building material than glossy looking synthetic coatings.

Greater dirt resistance

Containing predominantly inorganic materials Silicate paints are relatively resistant to the attack of algae, fungi and bacteria. Compared to dispersion paints the coatings show less tendency to green. The binding in Trasol is absolutely resistant to UV-light and can not yellow, coatings are not sticky and do not charge electrically. As a result, Silicate painted surfaces retain their original immaculate look for many years, while

organic binder based paints tend to become grey and must be renewed after a shorter period of time.

2.5 Storage of Trasol Paints

The storage time of Silicate paints depends on the nature of the additives used in the formulation.
Generally Silicate paints will show a more or less pronounced increase in viscosity for some days after formulation, but should reach a constant level after a few days. This effect should be considered when designing a formulation. By using suitable raw and auxiliary materials and by carefully formulating the paints, a storage life of one year may be achieved.
With regard to container materials and storage temperature, recommendations as given in chapter 1.6. apply here as well.

3 Silicate Paints, Plasters and Primers

Paints, plasters and primers are produced with equipment like stirrers, dissolvers, homogenisers – all commonly used equipment in the paint industry.
Regarding the choice of other raw materials for the formulation the following aspects should be taken into consideration:

Synthetic dispersions

Dispersions must be based on alkali resistant, non saponificable polymers. Pure acrylate or styrene-acrylate copolymers may be used. To avoid development of an off-odour in the paint formulation they should be ammonium-free. Their film forming temperature should be as low as possible.

Fillers, Extenders

Inert additives are suitable for Trasol formulations. Inorganic materials such as oxides, carbonates and silicates are preferred, e.g. quartz, cristobalite, marble-flour, calcites and talcum. These materials should not contain free multi-valent cations (Ca^{2+}, Mg^{2+}, Al^{3+}, Fe^{3+}).

Reactive fillers would lead to increasing viscosity of Trasol-containing products and thus shorten shelf-life. Effects may be manifold, caused by their surface charge, particle form, particle size, binder consumption, reactivity towards alkalinity or change of pH-level. If the final viscosity of

a formulation remains too high, Cycloquart/Cycloquart HS may be added as viscosity-control additives.

Pigments

Inorganic pigments are especially suitable for Silicate paints, e.g.:

- Titanium dioxide (white), SiO_2-coated
- Iron oxide pigments (yellow, red, black)
- Chromium oxide (green)
- Cobalt green or blue
- Manganese blue

as well as their mixed oxides or silicates modifications, e.g. finely ground coloured glasses. Very fine iron oxide yellow may cause an undesired intense increase of viscosity. In many cases the undesired viscosity effect may be reduced by preliminary soaking the pigments in water some hours before mixing the paint. Dispersants and additives used in pigment pastes should be alkali-proof.
In the following, standard guide formulations are given for the main product classes using Trasol binders: Outdoor paints, indoor paints, plasters and primers.

3.1 Outdoor paint

80-150	parts	water
2-4	parts	dispersing agent
3-8	parts	CYCLOQUART® stabilizer
2-4	parts	thickener (cellulose ether, xanthan gum)
80-120	parts	pigment (titanium dioxide)
60-80	parts	styrene-acrylate-dispersion appr. 50%
2-3	parts	defoamer
50-100	parts	Al-silicate
200-300	parts	extenders (marble, calcite flour)
300-380	parts	TRASOL® KC-K
3-8	parts	CYCLOQUART® HS visco regulator
2-4	parts	fibrous cellulose
3-5	parts	hydrophobing agent

After mixing a relatively constant viscosity level will develop after a “ripening“ time of about one week.

3.2 Indoor paint

200-300	parts	water
1-3	parts	dispersing agent
1-4	parts	thickener
2-3	parts	defoamer
60 -80	parts	titanium dioxide
20-50	parts	styrene-acrylate-dispersion appr. 50%
400-550	parts	extender mixture
120-180	parts	TRASOL® KI-S

3.3 Plaster

50-90	parts	water
1-3	parts	dispersing agent
1-4	parts	thickener
3-5	parts	CYCLOQUART® stabilizer
20-50	parts	pigment
3 - 5	parts	defoamer
50-80	parts	styrene-acrylate-dispersion appr. 50%
90-200	parts	TRASOL® KA-N
590-630	parts	extender mixture
4 - 12	parts	fibrous material

3.4 Primers

350-400	parts	soft water
100-180	parts	styrene-acrylate-dispersion appr. 50%
400-500	parts	TRASOL® KI-S

This primer may be further diluted with water up to a ratio of 1:2 before use.

4 Application of Silicate Paints

4.1 General

Compared to other building paints, Trasol-based paints feature a number of special characteristics which should be taken into account when applying these paints.
The Trasol binder system is based on an aqueous special potassium silicate solution, which contrary to colloidal dispersions, is characterized by a high penetration power, just like any other molecular solution. It thus

penetrates rapidly and easily into porous substrates. Dilution with water would additionally increase this penetration speed.
For this reason, Trasol paints should not be applied to absorbent and/or wet surfaces. Wet surfaces must be dried, and high absorbancy must be reduced by careful priming and/or previous fluosilicate sealing. Trasol paints should not be applied at external temperatures below 6 °C.

4.2 Adherence to previous coatings

Previous silicate or other mineral coatings may be painted over with Trasol-based paints after cleaning, patching of cracks and removing of loose particles. It is recommended to totally remove previous dispersion paints or other paints which contained organic film building binders. Under humid condition the organic materials may possibly react later on with the silicate binder, causing the Silicate paint to loose its adherence to the previous coating.

4.3 Drying time

Under usual atmospheric conditions, Silicate paints will be dry and resistant to rain after 4 to 6 hours after application. Complete hardening (silicification) and weather resistance will require some more time. If necessary, each further coating should be applied not earlier than 12 hours after the previous one.

4.4 Residues of forming oil

Contamination of concrete surfaces with forming oil must be removed before Trasol coatings are applied. This is best done by foam cleansers which may be combined with ammonia or fluosilicate.

4.5 Capillary water adsorption and water vapour permeability

For testing, the following sequence of coatings was supplied 1. Trasol primer (undiluted), 2. Trasol paint, 3. Trasol paint.

Primer and paint were formulated as follows :

Trasol primer:

500 pbw	TRASOL ® KC-K
15 pbw	CYCLOQUART ®
5 pbw	CYCLOLQUART® HS
400 pbw	deionized water
80 pbw	Acronal 290 D

Trasol paint:

2 pbw	Coatex P50
46 pbw	deionized water
100 pbw	Tiona 535
2 pbw	test benzine
5 pbw	CYCLOQUART®
2 pbw	Dehydran 1767
400 pbw	TRASOL ® KC-K
2 pbw	CYCLOQUART® HS
75 pbw	Plastorit OOO
200 pbw	Durcal 5
100 pbw	Durcal 2
65 pbw	Acronal 290 D

Determination of capillary water adsorption was performed according to DIN 52 617 on sandlime brick; determination of water vapour permeability according to DIN 52 615 on a plaster of mortar group II. Resulting in 1. $w=0.43\ kg/m^2*h^{0.5}$ and 2. sd=0.097m.
Sd multiplied by w amounts to $0.04\ kg/m*h^{0.5}$, a value which is considerably lower than the admissible maximum value of $0.2\ kg/m*h^{0.5}$. Therefore, the above-mentioned Trasol coating fulfils the water protection requirements of German standard DIN 18 558.

4.6 Precautions

During Trasol paint application surfaces of glass or ceramics, natural stone, metallic (aluminum) frames of doors or windows and japanned areas must be covered. Undesired splashes of paint must be removed timely and thoroughly with water.

Silicate coatings in modern construction

5 Liability

Use and application of supplied products are in the responsibility of the user. Our technical advice by word, in writing, or by trials is only a recommendation corresponding to our technical knowledge and experience and is not legally binding. Our recommendations do not exonerate the user from ascertaining the suitability of products and from attention to possible infringements of patents. We only guarantee the constant quality of our products. Should there be nonetheless any question of liability, this is limited to the value of the products supplied, and applied by the customer.