ZACLON LLC
ZACSIL® POTASSIUM SILICATES

Zaclon potassium silicates (trade name ZACSIL®) are a group of products with properties that vary with the ratio of silica to potassium oxide. They are designed to meet the requirements of a wide range of end uses. Products are available as water solutions or in solid form as glass-like flakes. The Chemical Abstracts index name for potassium silicate is silicic acid, potassium salt and the CAS Registry Number is 1312-76-1.

*SPECIFICATIONS AND TYPICAL PROPERTIES**
ZACLON POTASSIUM SILICATES, TECHNICAL

Solution Grade	Weight Ratio SiO_2:K_2O	Mole Ratio SiO_2:K_2O	Wt% SiO_2	Wt% K_2O	Baumé @ 60 °F	lbs./gal. @ 60 °F	Viscosity Cps @ 77 °F
30	2.50	3.92	20.80	8.30	30.00	10.5	40
E200	2.10	3.30	19.70	9.36	30.55	10.6	5
865	2.07	3.33	26.00	12.50	40.20	11.6	325
865D	2.10	3.33	24.36	11.60	37.50	11.2	37
18	1.80	2.83	26.40	14.40	42.50	11.8	45

Glass Grade	Weight Ratio SiO_2:K_2O	Mole Ratio SiO_2:K_2O	Wt% SiO_2	Wt% K_2O	Bulk Density lb/cf	Particle Size
30	2.50	3.92	71.0	28.4	70	-80 mesh <10% -200 mesh <1%
865	2.17	3.44	68.3	31.2	73	-80 mesh <10% -200 mesh <1%

* These tables contain properties based on historical production performance. Zaclon does not make any express or implied warranty that all future production will demonstrate or continue to possess these typical properties.

NOTICE: **POTASSIUM SILICATE FLAKES CAUSE EYE BURNS AND SKIN IRRITATION. POTASSIUM SILICATE SOLUTIONS MAY IRRITATE THE EYES AND SKIN. SEE PERSONAL SAFETY AND FIRST AID SECTION AND MSDS.**

PROPERTIES

Potassium silicate glass is a colorless super-cooled melt of potassium carbonate and pure silica sand. It is slightly hygroscopic, but will remain free flowing if stored in the original unopened drum.

Potassium silicate solutions are prepared by dissolving potassium silicate glass in hot water. By varying the silica-to-potassium oxide ratio, products of definite but widely different properties are produced.

Viscosity is a function of the silica-to-potassium oxide ratio, or alkalinity, and the solids content: as either of these variables decreases, the viscosity is reduced. Viscosity is also a function of water content of the solution (relatively small changes in water content have a marked effect on viscosity) and of solution temperature. The pH of potassium silicate is a function of both composition and concentration.

A good way to think of potassium silicate solution is as a polymer solution of SiOx-SiOx oligomers, stabilized by the K2O (another way to express KOH:H2O). So when altering the pH, for example, removing or neutralizing too much of the KOH will cause rapid development of large chains SiOx. This increases viscosity, and can even lead to complete gellation of the silica portion.

ADVANTAGES VS SODIUM SILICATE

Although potassium silicate has properties and uses similar to those of sodium silicate, certain differences offer advantages in many uses, forming a basis for selecting potassium silicate in place of sodium silicate.

SOLUBILITY

Potassium silicates are more soluble than sodium silicates of equal levels of alkalinity, making blends with potassium silicate more life-cycle stable, more rinsable, and offers the potential for higher concentration formulations.

Potassium silicate glass dissolves more rapidly than sodium silicate glass of equal molar silica-to-alkali ratio. Potassium silicate glass can be dissolved in atmospheric dissolvers, whereas pressure dissolvers are generally used for sodium silicate glass.

TEMPERATURE RESISTANCE

Potassium Silicates offer higher temperature resistance for insulation applications, up to 100 ^{o}F or 50^{o}C higher than sodium silicates. This also applies to inorganic coating temperature stability as well, such as inorganic zinc coatings.

LOW EFFLORESCENCE

Sodium Silicates tend to react with atmospheric carbon dioxide to form carbonates and become progressively less water-soluble. Potassium silicate films are less likely than sodium silicate to develop a carbonate bloom or white efflorescent coat of alkali carbonate.

LOWER TACK

Zaclon potassium silicate solutions are not as sticky or tacky as sodium silicate solutions and are therefore easier to handle and use.

WELDING RODS

Potassium silicate is specifically recommended as a binder for consumable electrodes ("stick rods") which are used with alternating current welding machines. Along with good binding properties, potassium silicate serves as a fluxing component and produces a steady hot arc, with lower arc voltage than sodium silicate, which tends to sputter or extinguish. Higher tensile strength and less elongation of weld metal can be obtained. Potassium silicate finds use as a binder in welding rods for mild, low-hydrogen, and stainless steel. Zaclon

No. 865 grade, available in glass or solution form, represents an excellent balance of potassium for a uniform arc and silicate for binding and fluxing.

ELECTRONICS APPLICATIONS

Potassium silicate is almost universally used to settle and bind phosphors to the face of black and white television picture tubes, as well as color projection TV tubes. Zaclon Electronics No. 200 grade is produced from high-purity raw materials for this application, and other electronics applications needing ultra-high purity.

These phosphor screens are prepared by mixing the phosphor with an electronics-grade potassium silicate solution and introducing this mixture into a clean tube filled with a dilute electrolyte solution such as strontium nitrate. A gel forms around the individual phosphor particles, which then settle to the bottom of the tube.

The strength of the phosphor-to-glass bond is a function of the concentrations of silica, potassium oxide, and electrolyte, as well as of trace ions, water purity, settling time and temperature.

Compatibility is excellent with the wide range of phosphors. Uniform films are obtained in contrast to sodium silicate, which binds in an erratic, uneven manner. The very high purity of Zaclon Electronics No. 200 grade insures that each phosphor will emit the desired color without influence by contaminants.

CLEANING COMPOUNDS & CORROSION INHIBITION

The superior solubility and compatibility of potassium silicate with surface-active agents, solvents, electrolytes and diluents give the formulator a wider choice than permitted with sodium silicate. Potassium silicate enhances the wetting and cleaning properties of soaps and detergents. Liquid cleaners that show excellent storage stability can be compounded with potassium silicate. In addition, the silicate ion has marked anticorrosion properties to protect metal surfaces, and potassium silicate can be effective as a corrosion inhibitor in non-cleaning applications as well.

CATALYST SUPPORT

Silica supports for catalysts can be prepared with potassium silicate or sodium silicate via formation of a gel with acid. Catalyst preparation typically requires prior analysis of many processing variables; the choice between potassium silicate and sodium silicate will depend on the nature of the catalyst desired, and on the comparison between the effects of the respective cations, K+ or Na+, on the finished product. Note that in general, K+ ions are more soluble and thus easier to rinse out in most of the salts it forms.

MORTARS

Potassium Silicate shows a high value-in-use as a binder in mortars which must withstand acidic conditions other than hydrofluoric acid. In particular, potassium silicate should be considered where sodium silicate in mortars shows limited durability. Mortars prepared with potassium silicate show less tendency than sodium silicate mortars to stick to the trowel and have more "body" (thixotropy) to hold bricks in place before setting permanently. Mortars containing potassium silicate will withstand higher temperatures than those containing sodium silicate will. This favors its use in refractory cement. Silicate mortars also show excellent acid resistance.

COATINGS

Since potassium silicate films resist “bloom” or effloresce, potassium silicate is useful as a pigment vehicle for brick, concrete, and stone. Silicates are also used in hardening and dustproofing concrete. A siliceous deposit closes the pores to make the concrete surface less permeable to oils and other liquids, and can also act as an “anti-dusting” compound.

The non-blooming characteristic of potassium silicate also accounts for its excellent performance as a binder in roofing granules. The silicate binder is blended with pigments such as titanium dioxide, clays, and insolubilizing agents, coated on a granule base, and heated to 1000 ^{o}F (538 ^{o}C) to produce a water-insoluble, weather-resistant coating. The clear colorless silicate film does not effloresce or hide pigment in the granule system.

PERSONAL SAFETY AND FIRST AID

HEALTH HAZARDS

Potassium silicate solutions and flake are alkaline materials and may irritate skin and cause eye injury.

Potassium Silicate Nos. 30, 865, and Electronics No. 200 solutions cause moderate to severe eye irritation. Potassium Silicate Glass (Flake) is corrosive to the eye
and can cause permanent eye damage if not promptly flushed out with water. With prompt flushing, the effects are reversible. Solutions or suspensions of the glass in water can cause eye irritation.

Laboratory tests indicate the alkali silicates are not primary irritants. Effects on the skin would be typical of a mild alkali, so that the more alkaline products may cause irritation.

SAFETY PRECAUTIONS

Do not get solid potassium silicate in the eyes. Avoid contact of aqueous solutions of potassium silicate with eyes, skin, and clothing. Whenever potassium silicate is handled, wear chemical safety goggles and rubber gloves.

FIRST AID

In case of eye contact, immediately flush eyes with plenty of water for at least 15 minutes, and call a physician. In case of skin contact, flush skin with water. Remove contaminated clothing and wash before reuse.

STORAGE AND HANDLING

Carbon-steel tanks, pipes and equipment are generally suitable for storage and handling of potassium silicate solutions. Cast-iron or steel rotary gear or centrifugal pumps are recommended for potassium silicate solution transfer. Equipment for Electronics No. 200 grade potassium silicate should be fabricated from stainless steel, lined steel or plastics suitable for highly alkaline service.

The freezing point of liquid silicate solutions is very close to that of water. Storage tanks and transfer equipment must be designed or located to prevent freezing. Drums should be stored in a heated area. If the solution is exposed to temperatures below 32 F (0 C), move the container to warm storage until thawed and mix thoroughly before using.

Electronics No. 200 grade potassium silicate is filtered, clear and water white as shipped. Extended exposure to hot or cold temperature extremes can develop undesirable turbidity and must be avoided.

All spills of potassium silicate solutions should be washed away immediately to a chemical sewer with large volumes of water to avoid slippery footing. Prompt action is recommended because spills can build up layers and become more difficult to remove later.

SHIPPING CONTAINERS

Zaclon ships Zacsil potassium silicate solutions in tank cars, tank trucks and drums. The flake grades of Zaclon potassium silicate glass are shipped in 61 gal (545 lb/247 kg net) nonreturnable fiber drums. Zacsil No. 30 and No. 865 solutions are shipped in 55 gallon nonreturnable plastic drums containing net weights of 550 lb (249 kg) and 620 lb. (281 kg) respectively. Zacsil Electronics No. 200 grade solution is available in 55 gallon (550 lb/249 kg net) plastic drums.

Potassium silicate is not regulated as a hazardous material by the Department of Transportation*.

CONTACTING ZACLON LLC

For placing orders or requesting additional product information, please contact us as shown below.

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