P-Sil®

Silica Sols from Patalia Chem Industries

The term silica sol is derived from silicic acid sol, or more accurately silicic acid aquasol. Silica sols are colloidal dispersions solutions of silicic acid in water. Chemically speaking, a distinction should be made between colloidal dispersions of high molecular polysilicic acids and amorphous silica particles with particle sizes in the nm range. Insofar as dilute, colloidal silicic acid solutions are formed in chemical reactions, e.g. between an alkali silicate and acid, the solutions involved are often polysilicic acid solutions with a high molecular weight. Even after appropriate purification, they remain unstable and solidify by gelling. They cannot be produced in high concentration of up to approx. 50%. ***P-SIL*** products on the other hand are colloidal dispersions of silicon dioxide particles that are immensely stable and resistant to gelling. Depending upon the type, the products can be manufactured to a concentration of 50% and then dispatched in this form. We have decades of experience in the production and application of colloidal dispersions. Depending upon the type, the products can be manufactured to a concentration of 50% and then dispatched in this form. We have decades of experience in the production and application of colloidal dispersions.

P-SIL products are being used in numerous branches of industry as bulk raw materials and as indispensable auxiliaries for special applications. ***Patalia Chem Industries*** produces a wide range of products with a variety of properties. New product types are continually being developed for new applications.

Products

The ***P-SIL*** types are aqueous colloidal dispersions of amorphous silica (SiO2). The silica particles contained in it occur in the form of discrete spheres that are not cross linked with each other and that have been hydroxylated on the surface. The particle size lies within the colloidal range, the average particle size being between 5 and 75 nm, depending upon the type. Special types with larger and smaller particles can be made on request. The basic types of ***P-SIL*** with a specific surface area of 200 m2/g or greater are homogeneous, low viscosity liquids that do not separate into their individual components. They are either opalescent or slightly turbid. Types with a specific surface area smaller than 200 m2/g have an increasing tendency to sedimentate when stored or left standing for longer periods. This is due to the fact that specific gravity causes larger particles to congregate in the lower parts of a packing drum (formation of a concentration gradient). Stirring is, however, the simplest way to re-homogenize the silica sols. Weakly alkaline ***P-SIL*** types with pH values of between approx. 8 and 11 are stabilized with small quantities of alkali. The sodium ions, or exceptionally potassium or ammonium ions, generate a negative charge on the silica particles. The alkaline types of silica sol are therefore anionic. ***P-SIL*** types are produced from moleculary dissolved silicic acid by means of growth processes. They are not produced by redispersion of solid, fine, amorphous silica. The presence of crystalline silica components can therefore be ruled out. The ***P-SIL*** types are X-ray amorphous.

Stabilization of colloidal particles takes place as the result of charges on the surface of the particles and not, as often is the case with organic polymer dispersions, by way of surfactant substances. ***P-SIL*** is synthesized in an aqueous medium, which consists exclusively of inorganic substances, with no organic solvents being present. Subsequent processing, if necessary using additives, allows further products with specially requested properties to be produced. Examples of cationic types obtained through subsequent reprocessing are ***P-SIL*** 100S/30% and ***P-SIL*** 200S/30%. These are produced by means of adding aluminium salts to the anionic basic types. Further examples of subsequent processing stages are the targeted addition of ethylene glycol, biocides or polymer dispersions to the basic types and ion exchanging in order to create special products. A notable characteristic of the ***P-SIL*** types is the fact that the transformation of colloidally dissolved silica into silica solids that are insoluble in water is irreversible. Once it has agglomerated and dried out, for example on the walls of a vessel, ***P-SIL*** is insoluble in water. For this reason, small quantities of sediment consisting of amorphous silica solids are practically unavoidable. However, careful post-production cleaning enables the quantity of ***P-SIL*** residue that is capable of sedimentation in the original packing drums to be limited to 0.1 percent of the total mass. As a rule, this particular level of sedimentary residue does not affect the product or processing quality and can be removed as necessary by filtration.
The ***P-SIL*** types contain colloidally distributed non water-soluble solid silica in an aqueous solution. The key feature of most applications is that the ***P-SIL*** types are used as colloidal solutions, and that after use, solid amorphous silica, which is insoluble in water, is left over.

P-Sil - Types

P – SiL	**PSL – 30 – SL2**	Specific Surface Area	200 Sq.m/gm
		Solid Content	30 %
		Ionicity	Anionic
P – SiL	**PSL – 30 – SL3**	Specific Surface Area	300 Sq.m/gm
		Solid Content	30 %
		Ionicity	Anionic
P – SiL	**PSL – 30F – SL3**	Specific Surface Area	300 Sq.m/gm
		Solid Content	30 %
		Ionicity	Anionic
		Additive	Biocide
			e.g Formaldehyde
P – SiL	**PSL – 30F – SL1**	Specific Surface Area	100 Sq.m/gm
		Solid Content	30 %
		Ionicity	Cationic
		Additive	Aluminium Salts

The Principal Applications of P-Sil SILICA SOL

The Following properties of the P-Sil types are of particular significance to its applications:

[] transformation from non-crosslinked sol to specially crosslinked gel form
[] finely distributed , colloidal form with P-Sil particles in the nm range
[] high degree of purity, and in particular the almost total absence of alkalis and electrolytes
[] solidilty , inertness , resistance to heat and temperature change of the dried P-Sil particles of amorphous silica.

The numerous possible uses of ***P-Sil*** can be divided up as follows:

Use as a binder

Examples - precision casting using shell process
- production of vacuum-formed products made from inorganic fibers
- production of granules

Use as a Surface Modifier

Examples - anti - slip treatments for linings
- anti - slip paper bags
- anti - blocking for films and aqueous coatings

Use in reactions of colloidal chemicals

Examples - fining of beverages
- paper retention
- modification of shortcrete

Examples of application by various types :

Sector/Application	Suitable P-Sil Types
Steel & Foundry sector	
Precision casting using	**P-Sil** PSL-30-SL3
the Shell Process	**P-Sil** PSL-30-SL2
Coating of grain oriented	**P-Sil** PSL-30-SL2
Silicon steel plates	**P-Sil** PSL-30-SL3
Refractory Sector	
Production of Vacuum Formed	**P-Sil** PSL-40-SL2
Parts from Ceramic Fibre	**P-Sil** PSL-30-SL2
	P-Sil PSL-30-SL3
Mixing liquid for impression	**P-Sil** PSL-30-SL2
Materials	**P-Sil** PSL-30-SL1
Coating Systems	
Adhesion reinforcement ,	**P-Sil** PSL-40-SL2
Antiblocking and increasing the	**P-Sil** PSL-30-SL2
Strength of aqueous emulsion paints	**P-Sil** PSL-30F-SL2
Paper Sector	
Non-slide paper bags and	**P-Sil** PSL-40-SL1
Cardboard products	**P-Sil** PSL-45-SL1
Coating of specialty papers	**P-Sil** PSL-45-SL1
Construction Sector	
Additive for shortcrete	**P-Sil** PSL-40-SL2

P-Sil Colloidal Silica Sol For Foundry

There are few places where precision, strength, safety and reliability are more important than in a foundry. **Colloidal silica** is one of the most important products used in foundry operations.

The foundry sector uses more colloidal silica than practically any other industry in the world, and has done for a long time. Colloidal silica's main function at the foundry is as a binder used in:

- **Refractory Fiber Bonding (RFB)**
- **Refractory Cement/ Ceramics**
- **Precision Investment Casting (PIC)**

We have several products that will meet all of your requirements in these areas.

The right stuff

Refractory Fiber Bonding (RFB)

Refractory fibers used in high temperature insulation products require a safe and reliable binder. Colloidal silica is used for this purpose. Products made in this way include parts for the steel and glass industries, coal and log fire parts, and insulation rings for radiant heaters. Such products are normally manufactured using a vacuum forming process. There are both organic (colloidal silica plus starch) and inorganic processes. Colloidal silica is ideal for refractory fiber bonding due to its ability to withstand continuous operating temperatures of 1500C with little shrinkage and good resistance to thermal shock.

A vital ingredient

Ceramic

In the refractory cement/ceramics industry Colloidal Silica is used as a binder in the manufacturing of big molded high temperature insulation parts/blocks. They are mainly used in steel, aluminium and gas furnaces. The ability of Colloidal Silica to withstand continuous operating temperatures of 1500C with little shrinkage and good résistance to thermal shock make it indispensable in the ceramics casting process

Perfect results

Investment Casting

When it comes to investment casting, only the best materials give great results.

Colloidal Silica is the preferred binder in investment casting. It is used in the building of shells for ceramic molds during the investment casting process. It allows for greater intricacy of design and its high temperature tolerance and chemical inertness make it useful in binding a wide variety of refractory materials and for casting many metals and alloys.

Typical products made this way include turbine blades for aerospace and stationary engines, turbo fans and other parts for the automotive and weapons industries, medical and dental implants/instruments, and parts for household appliances.