

Silicone Spectator

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Silicone Spectator™ is electronic newsletters in the field of Silicone Chemistry, placed on the web four times a year. We welcome comments, articles and information on the content of this newsletter.

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Silicon the Element, the Origin

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Silicon to Silicone

The image to the right represents the first step in the metamorphosis from quartz to silicone polymers. The material on the left is quartz (SiO_2). It makes up 25% of the earth's crust. The material to the right is silicon metal (Si), which is a necessary raw material in making the variety of silicone materials used today.

The transformation from quartz to silicon is first step to opening the world of silicone chemistry.



Silicon is not Silicone!

Silicon (Latin: silicium) is the chemical element in the periodic table that has the symbol Si and atomic number 14. A tetravalent metalloid, silicon is less reactive than its chemical analog carbon. It is the second most abundant element in the Earth's crust, making up 25.7% of it by mass. It does not occur free in nature. It mainly occurs in minerals consisting of (practically) pure silicon dioxide in different crystalline forms (quartz, chalcedony, opal) and as silicates (various minerals containing silicon, oxygen and one or another metal), for example feldspar. These minerals occur in clay, sand and various types of rock like granite and sandstone.

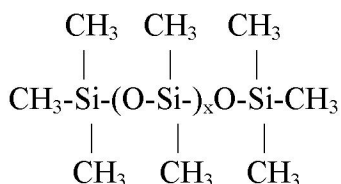
Silicon is not Silicone! (continued)

Silicon is the principal component of most semiconductor devices and, in the form of silica and silicates, in glass, cement, and ceramics.

Silicone is a term used for polymers with alternating silicon and oxygen atoms with various organic radicals attached to the silicon, are unique compounds both in terms of their chemistry and in their wide range of useful applications. Some of these properties include low surface tension, high lubricity, enhanced softness, chemical inertness, low toxicity and non-stick properties promotes a new product.

Silicone Homopolymers

Silicones, or polysiloxanes, are inorganic-organic polymers with the chemical formula $[R_2SiO]_n$, where R = organic groups such as methyl, ethyl, and phenyl, but most commonly methyl). These materials consist of an inorganic silicon-oxygen backbone, Typical is silicone fluid:

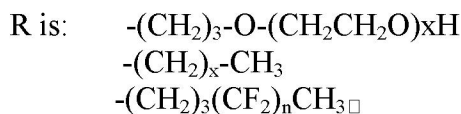
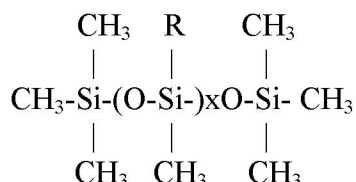


Silicones

Silicones are a class of compounds derived from Quartz, that have had an impact on almost every industrial market segment.'

Organosilicone Compounds

Often organic side groups attached to the silicon atoms, producing many interesting compounds;



In some cases organic side groups can be used to link two or more of these -Si-O- backbones together. By varying the -Si-O- chain lengths, side groups, and crosslinking, silicones can be synthesized with a wide variety of properties and compositions. They can vary in consistency from liquid (fluid) to rubber (elastomeric) to hard plastic (resins).

Silicone Properties

Silicone oils, polymers and cured sealants are odorless and colourless, water resistant, chemical resistant, oxidation resistant, stable at high temperature, and have weak forces of attraction, low surface tension, low freezing points and do not conduct electricity. Silicone caulking is odourless only when cured. Silicones have many uses, such as lubricants, adhesives, sealants, gaskets, breast implants, pressure compensating diaphragms for drip irrigation emitters, dishware, Silly Putty, and many other products. Due to their thermal stability and relatively high melting and boiling points, silicones are often used where organic polymers are not applicable. Their unreactivity generally makes them non-toxic (see below). Dimethicone, a silicone-based anti-foaming agent, has remained available as an over-the-counter drug and food additive.

A Mistake that Stuck

The word "silicone" is derived from ketone. Dimethylsilicone and dimethyl ketone (aka acetone) have analogous formulas, thus it was surmised incorrectly that they have analogous structures. The same terminology is used for compounds such as silane, which is an analogue of methane). A true silicone group with a double bond between oxygen and silicon do not exist, Polysiloxanes are called "silicone" due to early mistaken assumptions about structure.

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