Silicones

Silicone is a generic term that refers to a class of man-made polymers based on a framework of alternating silicon and oxygen bonds, with organic substituents attached to the silicon.

From: Nanofinishing of Textile Materials, 2018

Related terms:

Elastomers, Elongation at Break, Polyurethanes, Resin, Tensile Strength

View all Topics

Silicones

Johannes Karl Fink, in Reactive Polymers Fundamentals and Applications (Second Edition), 2013

8.7 Applications and Uses

Silicone products are used for a wide variety of applications, including building and construction material, medical applications, sealing, impregnation, putty, surface treatments, and painting applications. Silicone rubbers can be fabricated into tubing, hose, gaskets, and seals.

Silicone oils are oligomeric chains of poly(dimethyl siloxane). The fluids are thermally stable and chemically resistant. They can serve as excellent lubricants.

8.7.1 Coatings

Coatings with flake carbonyl iron particles as absorber and silicone epoxy resins as matrix have been prepared. Characterization of the electromagnetic and mechanical properties revealed that the coatings possess good microwave-absorbing and mechanical properties [42].

A silicone resin with silphenylene units in the backbone was synthesized by a hydrolysis-polycondensation of 1,4-bis(hydroxydimethylsilyl)benzene with chlorosilanes [43]. Chemical characterization suggests that the silphenylene units have been

incorporated into the polymer of silicone resin. This silicone resin can be applied as the film forming material of coating. The silicone resin with these silphenylene units can form full and uniform films, and the surface morphology of clear paints is not damaged by heat below 350 °C. In addition, a good resistance to corrosion is observed [44].

Heat-resistant surface coatings have been formulated from diethoxydimethyl silane and an aminopropyldiethoxymethyl silane. The amino siloxane was cured with a commercially available epoxy resin PG 100 and toluene diisocyanate [45].

Siliconized epoxy resins have been developed to overcome the drawbacks of epoxy resins, such as poor impact strength, high rigidity, and moisture absorbing nature [46]. For these reasons they are not applied as such as corrosion-resistant coating. Silicone moieties can be introduced into the backbone of the polymer resin in order to reduce these drawbacks.

Siliconized epoxy resins can be prepared by the reaction of an amine-terminated silicone resin with a novolak-type epoxy resin. *m*-Phenylenediamine is a suitable curing agent. Coating films are cured at 150 °C. These, by the way, ecological friendly compositions can be used in anticorrosive formulations. In addition, good thermal properties are provided [46].

Phenyl silicone-acrylic polyol coatings show a significant improvement in strength and adhesion, compared to a pure acrylic polyol resin [47]. The composition is fabricated by simple blending of the phenyl silicone and the acrylic polyol resin. The presence of bonds in the phenyl silicone moiety contributes to an enhanced strength, adhesion, and improved thermal properties.

Transparent silicone resin coatings have been prepared through the reaction of methyltrimethoxysilane, aminopropyltriethoxysilane, and hydroxyl-terminated silicone oil. These coatings can be used for gold commemorative coins as they exhibit some good properties, including high hydrophobicity, high water contact angles, high light transmittance, good heat resistance, adhesion, hardness, and weatherability, and others. The uniform, clear, transparent, and dense coating films do not cover the symphony surface patterns or affect the metallic luster [48].

Superhydrophobic coatings can be prepared from a silicone resin precursor, aminopropyltriethoxysilane, and nanoparticles [49]. Finally the curing occurs at ambient temperature. The contact angle of these formulations to water is 158.3° and the sliding angle is 4.3. Further, the coatings have a pencil hardness of B, excellent weatherability, and electromagnetic shielding effectiveness beyond 60% in the frequency range of 10–3000 MHz.

Poly(*N*-isopropylacrylamide) is an intelligent temperature-sensitive polymeric hydrogel with a lower critical solution temperature of 33 °C. It can change from

transparent to opaque due to a phase separation. Silicone coatings have been doped with poly(*N*-isopropylacrylamide) particles. This composite enhances the diffuse reflection and operability in intelligent thermal control applications [50].

8.7.2 Adhesives

Silicone resin from chlorotrimethylsilane and tetraethyl orthosilicate can be used as a pressure-sensitive adhesive [51]. The adhesive exhibits excellent tack, peel strength, and high-temperature resistance.

8.7.3 Antifoaming Agents

The low surface tension enables silicones to be used as antifoaming agents, foam stabilizers, and free flowing agents, e.g., in paints.

8.7.3.1 Antifoaming Agents

Silicone antifoaming agents are important constituents in the suspension polymerization of PVC. Also, foaming in spinning baths of man-made fibers can be controlled by silicone antifoaming agents.

8.7.4 Release Agents

8.7.4.1 Mold Release Agents

Silicones are used as mold release agents in the rubber and plastics industries. Molds made from silicone rubber itself are common.

Silicone resins are typically applied to surfaces by dissolving the silicone resin in volatile solvents. Evaporation of the solvent leaves behind the silicone resin in the desired location, e.g., on the surface of the mold for release, or in the cavities and interstices of the port as a sealant. Then, with the application of heat or chemicals, the resin is cured in situ, forming a hard, polymeric network.

Waterborne silicone release agents are common. An advantage of using water as a carrier is that the presence of water can prevent or delay silanol condensation of the resin. A catalyst may be added and stored in a water-based composition without inducing immediate curing. Hence, the use of water as a carrier improves the shelf life of the composition.

The most significant difficulty associated with using water as a carrier is that silicone resins are relatively immiscible in water. Water-based silicone resin compositions can be formulated using conventional surfactants. Large amounts of surfactant, however, are usually required, and the dispersion formed may not

be very stable. The dispersion can be stabilized with a hydrophobically modified polycarboxylic acid [52].

8.7.4.2 Paper Release Agents

Crosslinkable silicone polymers are used as silicone release papers. These have a wide range of applications for labels and coatings.

8.7.5 Sealing and Jointing Materials

Silicone seals have found widespread uses in cars, gaskets, household engines, and medical devices. Silicone jointing materials are used for expansion joints on building facades, connecting aluminum or plastic, and in the sanitary field, e.g., for bathroom tiles. Various silicone rubber grades have been developed with different curing systems.

8.7.6 Electrical Industry

The high insulating power of silicones is appreciated in the electrical industry. Applications are in cables, electrical motors, seals, and heating elements. Silicone rubber rollers are used in photocopying device, and facsimile devices.

A curable silicone resin system with excellent dielectric and thermal properties has been developed from only two components: poly(methylphenylvinylsiloxane) and an end capped hydrogen-functionalized hyperbranched polysiloxane [53]. The dielectric and thermal properties can be tailored by the stoichiometries. It has been suggested that these resins can be used as high-performance resins in microelectronic and insulation applications.

8.7.6.1 Optical Applications

By the combination of CdSe quantum dots and a silicone resin nanocomposites with tunable emission colors can be prepared [54]. The homogeneous dispersion of CdSe quantum dots leads to good transparency of the nanocomposites. The nanocomposites show interesting luminescent properties with different colors and emit lights with a wide peak wavelength range of 501–582 nm.

Optically clear silicone/epoxy hybrid resins have been developed for use as high-brightness light-emitting diode packaging [55]. The silicone part with Si–H, Si–$CHCH_2$, and Si–OH groups was prepared by hydrolytic condensation. Blends of this resin with the diglycidyl ether of hydrogenated bisphenol A are then cured by hydrosilylation and a polymerization that is catalyzed by aluminum acetylacetonate.

The ratio of the silicon resin to the diglycidyl moieties plays an important role with respect to curing. The Si–OH groups react with the epoxy resin and thus prevent a phase separation.

The cured hybrid resins are single-phase materials with a transmittance of about 87% at 400 nm at a thickness of 3 mm. The adhesive strength is significantly improved by a small fraction of diglycidyl ether of hydrogenated bisphenol A with only a marginal influence on the UV resistance. However, increased amounts of epoxy moieties have a negative influence on the thermal stability [55].

Luminescent silicone resins can be formed by the sol-gel method. Here, the silicone precursors are modified via acylamidation reactions to introduce structural molecular bridges. These in turn can capture chromophore groups containing rare earth ions, such as , and . A red emission with narrow width was observed for -modified resins and green emissions were observed for - and -containing resins. This behavior can be explained by an efficient intramolecular energy transfer [56].

8.7.7 Medical Applications

Silicones are mostly inert to living organisms. They are considered nontoxic materials and can be used in pharmaceutical and medical applications.

Injections of silicone fluid were clinically evaluated to treat and prevent foot ulcers due to diminished plantar fat-pad in neuropathic diabetics [57]. Minimally invasive subdermal injection of a liquid silicone can be used to augment the soft tissue of the foot to mitigate high pressures that cause diabetic foot ulcers. A detailed study suggested that silicone particles in combination with a growth factor might enhance the fibroblast aggregation and the stability of an implant [58].

> Read full chapter

Silicones

Günter Lorenz, Andreas Kandelbauer, in Handbook of Thermoset Plastics (Third Edition), 2014

Silicones are found in a variety of applications with requirements that range from long life at elevated temperatures to fluidity at low temperatures. This chapter first considers silicone elastomers and their application in room temperature vulcanizing (RTV) and heat curing systems (HTV). Also, new technologies for UV curing are introduced. Coverage of RTVs includes both one-component and two-component systems and the different cure chemistries of each, and is followed by a separate discussion of silicone laminates. Due to the high importance of silicone fluids, they

are also discussed. Fluids include polishes, release agents, surfactants, and dielectric fluids.

> Read full chapter

Silicones

Johannes Karl Fink, in Reactive Polymers: Fundamentals and Applications (Third Edition), 2018

8.2.8 Synthesis

8.2.8.1 Direct Synthesis

Silicones are synthesized via methylchlorosilanes by the Müller–Rochow process. The reaction is carried out at temperature of 250 to 300 °C and pressure of 2 to 5 bars. A copper catalyst used with antimony, cadmium, aluminum, zinc, and tin is effective for improving the activity. However, lead would act as an inhibitor.

A finely homogenized mixture of silicon and copper is introduced into a fluidized bed reactor. The reactor is fluidized by gaseous methylchloride. The reactants are separated from the solid components and on cooling a crude liquid silane mixture is obtained. Silicon conversions of 90 to 98% and methylchloride conversions of 30 to 90% can be achieved. The reaction is strongly exothermic and requires a precise control. Dimethyldichlorosilane is the main product. Other major products obtained are shown in Table 8.3.

Table 8.3. Products Obtained by the Rochow Synthesis [14]

Silane	Yields (%)	Boiling points (°C)
Methyldichlorosilane	0.5	41
Methyltrichlorosilane	8–18	66
Dimethyldichlorosilane	80–85	70
Trimethylchlorosilane	2–4	57

The selectivity for producing dimethyldichlorosilane is highly sensitive to trace amounts of other metals present. The selectivity for dimethyldichlorosilane is reduced if the Cu, Zn, or Sn concentrations exceed the generally used concentrations or if the reaction temperature exceeds 300 °C. A silver promoter increases the selectivity to dimethyldichlorosilane [15,16]. The crude silane mixture is then separated in distillation columns. A high separating capacity is needed, because the boiling

points of and differ by only 4□°C. A high purity is required, because even a small amount of leads to branched and eventually gelled products.

8.2.8.2 Hydrosilylation

The hydrosilylation reaction consists of the addition of hydrogen-containing silanes to products with double or triple bonds. This reaction is suitable for introducing organo functions into silicone compounds. Therefore, hydrosilylation is extensively used to synthesize organofunctional silicones with pendant vinyl groups, amino groups, etc. [17]. In a further step, chlorine atoms, hydrogen atoms, and alkoxy groups can undergo a nucleophilic substitution. The hydrosilylation reaction requires often high temperatures.

Vinyl Groups

The hydrosilylation of aromatic compounds containing vinyl unsaturation can lead to radical polymerization of the monovinylaromatic compounds, especially at elevated temperature. The use of radical polymerization inhibitors, such as phenols or quinones, is often necessary; however, most of these inhibitors are not sufficiently active at elevated temperatures and require the presence of oxygen to improve their activity. However, special conditions and precautions make the use of a radical polymerization inhibitor unnecessary. Styrene and □-methylstyrene can be hydrosilylated with heptamethyltrisiloxane with a Karstedt platinum catalyst at 90□°C [18].

When 4-vinyl-1-cyclohexene is reacted with a hydrogenchlorosilane, both the vinylic double bond and the double bond in the cyclohexene ring react. Thereby an organic silicon compound of the formula given in Figure 8.4 is obtained in which the hydrogenchlorosilane is added to each of the two double bonds in 4-vinyl-1-cyclohexene.The cyclohexane ring within the molecule imparts a high hardness and scratch resistance and is useful as a coupling agent to be added to paints for use in automobiles, buildings, and adhesives. The compound is also useful as an intermediate to an alkoxysilane coupling agent [19].

Figure 8.4. Hydrosilylation of 4-vinyl-1-cyclohexene.

Organophosphorous Plasticizers

Hydrosilylation curable silicone resins plasticized with organophosphorous compounds have been described [20].

Silicone compositions were prepared by mixing a silicone resin, a crosslinking agent, i.e., phenyltris(dimethylsiloxy)silane, an organophosphate compound resorcinol bis(diphenylphosphate), a catalyst (Dow Corning Catalyst K, platinum complexed with divinyltetramethyldisiloxane and inhibited with triphenylphosphine), and a solvent such as toluene [20].

8.2.8.3 Grignard Synthesis

The Grignard synthesis is suitable to introduce organic groups to silicon. The Grignard synthesis is used on a laboratory scale. An example for a Grignard synthesis is shown in Figure 8.5. With water, methylphenyldichlorosilane condenses to a linear polymer.

Figure 8.5. Grignard synthesis.

8.2.8.4 Condensation

Hydrolysis of chlorosilanes results in silanols. These silanols are not stable and undergo a polycondensation. Intramolecular and intermolecular condensation takes place. Intermolecular condensation yields linear siloxanes, and intramolecular condensation yields cyclic products. When trichlorosilanes undergo hydrolysis, highly crosslinked silicone resins are obtained. The reaction can be catalyzed by acids. An equilibrium between the linear siloxanes and cyclic siloxanes can be established.

If the catalyst is deactivated, the condensation stops and the cyclic products that consist mostly of a tetramer can be removed by distillation. On the other hand, cyclic siloxanes can be transformed to polymers in the presence of alkali. If the catalyst is not deactivated then cyclic siloxane forms until the equilibrium is established. In equilibrium ca. 20% of cyclic products are present, which is relevant to the recycling of polysiloxanes.

Chain Stoppers

To obtain stable or functional terminal groups, chain stoppers are added. The reaction proceeds under continuous cleavage and recombination of siloxane bonds. The reaction is catalyzed by acids.

Bodying

Bodying is a technology that consists of the base catalyzed depletion of the silanol groups in a silicone resin prepared by the hydrolysis and condensation of organoalkoxysilane. In this process the molecular weight of the silicone resin is simply increased, while control of the molecular weight, softening point, and glass transition temperature is not possible [9].

Crosslinking

The degree of crosslinking depends on the presence of either tetrachlorosilane for the production of very rigid resins, or for softer grades.

> Read full chapter

Silicones

Rodney F. Patterson, in Handbook of Thermoset Plastics (Second Edition), 1998

INTRODUCTION

Silicones are a class of synthetic compounds, the molecules of which consist of polymer chains of alternately connected silicon and oxygen atoms. They are found in a variety of applications with requirements ranging from long life at elevated temperatures to fluidity at low temperatures. They are true polymers because their basic silicon-oxygen linkage, the "mer", is repeated along the polymer chain backbone many hundreds to thousands of times. Their Si-O siloxane structure makes them chemically different, however, from the typical organic polymer materials whose backbone chain consists of all carbon atoms linked together. The silicone bond linkage is similar to the repeating inorganic structure found naturally in silicate minerals such as quartz, glass and sand; hence, the outstanding high-temperature properties of silicone rubber. This chemical makeup also accounts for the general inertness of silicone rubber products toward many deteriorating influences, such as ozone, chemicals, weathering, and radiation.

Another contributor to this chemical inertness is the lack of double bonds in the molecular chain, a state called saturation. When a polymer is unsaturated, i.e., contains double bonds in its backbone chain (as do most organic rubbers), it can be attacked by ions or radicals such as ozone, O_3.

Ozone can open up or cleave one of the two electron pairs of the double bond, a process known as oxidative cleavage, and, thereby weaken the polymer.

Still another contributor to the inertness of silicones is their high covalent bond (electron pair bond) energy. The bond energy of its Si-O linkage is 106.0 kcal/mole, which is much higher than the 84.9 kcal/mole bond energy of the carbon-to-carbon bond of other organic rubbers. This difference in bond energies accounts for the superior stability of silicone rubbers. In general, they have much better heat resistance, electrical insulation, chemical stability, etc., than organic rubbers.

Up to this point, we have represented the repeating unit or "mer" of the silicone polymer as "Si-O" to show that it is repeating. Each silicon atom, like carbon in its same column in the Periodic Table, has a normal valency of four, and, therefore, can connect to four adjacent atoms. It therefore connects not only to the two adjacent oxygen atoms but also to two other atoms and whatever atoms they connect to, forming two pendants coming off the main chain. This structure is represented as $[R_2Si0]_n$ where "n" is the number of times that the R_2Si0 structure is repeated. The two "R's" represent the two pendant groups extending from the silicon atoms along the polymer chain. The "R" group or pendant is typically methyl (CH_3), phenyl (C_6H_{11}), propyl (C_3H_7), or a combination thereof.

The polymer chains are connected to one another (to an adjacent chain or chains) by covalent bonds and so are crosslinked into a three-dimensional structure. All of

the crosslinking takes place at the ends of the polymer chains. The reactive groups at the ends are either hydroxyl (-OH) or vinyl (-CH=CH_2) groups. They react with the crosslinking agent and sometimes a catalyst to give a cured elastomer.

Let us look further at the silicon atom as compared to the carbon atom concerning their roles and differences in polymer backbones. The silicon atom is below carbon in its column in the Periodic Table, indicating that it is less electronegative than carbon. This means that its bonds with carbon and oxygen are less covalent and partly ionic. This polar nature of the bonds, together with the larger size of the silicon atom, may account, in part, for the great freedom of motion and flexibility of the -Si-O-Si- bond. As may be expected, it was found that very free rotation of methyl and bulkier alkyl and aryl groups about the silicon-oxygen bond persisted even at low temperatures. The very free rotation about bonds attached to silicon, including the Si-O bond, is a contributing factor to the unusual properties of the -Si-O-Si-chains. Also, the premise of weak intermolecular forces between the "polysiloxane" chains, as they are called, is used[1] as a partial explanation for the viscosity characteristics of silicone fluids, as well as their low freezing points, remarkably low second-order transition temperatures (i.e., Tg's), and very low boiling points.

As we have said, silicones are polymers consisting of silicon and oxygen atoms covalently bonded as linear long chains of inorganic siloxanes (-Si-O-Si-). Their properties can be varied by introducing organic side groups, i.e., "pendant", on the silicon atom. The phenyl group, for example, provides enhanced low-temperature properties. For another example, the trifluoropropyl group provides excellent fuel and solvent resistance.[2] The form in which the polymers can be produced ranges from fluids to rubbers to lubricants, and to hard and soft coatings and resins.

This chapter first takes up silicone fluids that include polishes, release agents, surfactants, and dielectric fluids. (Silicone fluids are the lowest in molecular weight among the silicone polymers.) Silicone rubbers are taken up next with consideration of both room-temperature vulcanizing (RTV) and heat curing systems. Our coverage of RTVs includes both one-component and two-component systems with the different cure chemistries of each, followed by a separate discussion of silicone laminates.

> Read full chapter

Silicones

André Colas, Jim Curtis, in Handbook of Polymer Applications in Medicine and Medical Devices, 2013

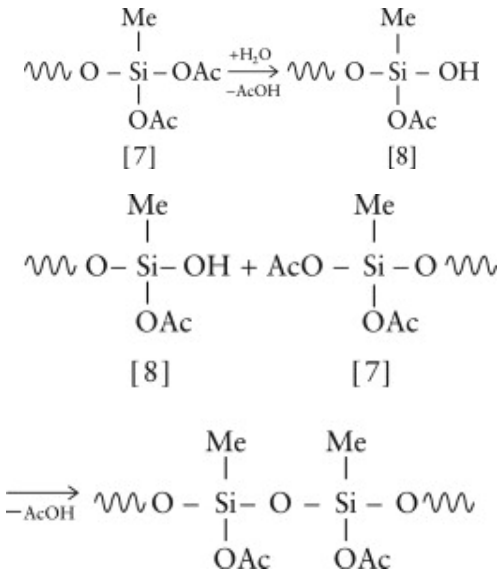
Cross-linking by condensation

Although mostly used in construction sealants and caulks, condensation-cure silicone materials have also found utility in medical device manufacturing as silicone adhesives (facilitating the adherence to materials of silicone elastomers), encapsulants, and sealants.

One-part products are ready to apply and require no mixing. Cross-linking starts when the product is squeezed from the tube or cartridge and comes into contact with moisture, typically from humidity in the ambient air. These materials are formulated from a reactive polymer prepared from a hydroxy end-blocked polydimethylsiloxane and a large excess of methyltriacetoxysilane.

where

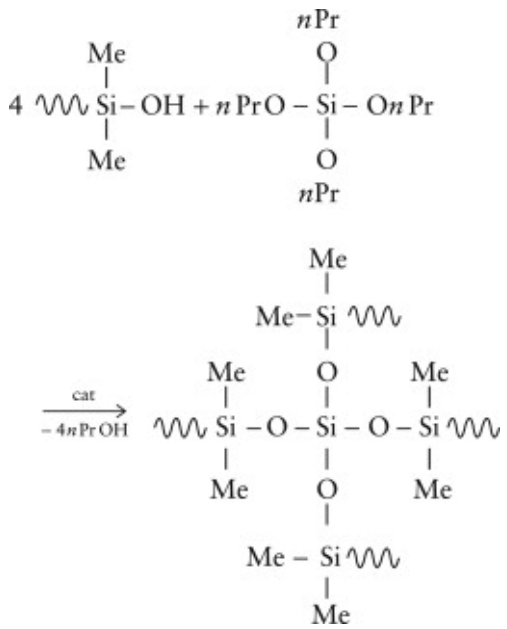
Because of this excess, the probability of two different chains reacting with the same silane molecule is remote. Consequently, all the chains are end-blocked with two acetoxy functional groups. The resulting product is still liquid and can be packaged in sealed tubes and cartridges. Upon opening and exposing the sealant to room humidity, acetoxy groups are hydrolyzed to give silanols, which allow further condensation to occur.



In this way, two chains have been linked, and the reaction continues from the remaining acetoxy groups. An organometallic tin catalyst is normally used, and the cross-linking reaction requires moisture to diffuse into the material. Accordingly, cure will proceed from the outside surface inward. These materials are called one-part RTV (room temperature vulcanization) sealants, but actually require moisture as a second component. Acetic acid is released as a by-product of the reaction. Problems resulting from the acid can be overcome by using other cure (cross-link-

ing) reactions developed by replacing the methyltriacetoxysilane $MeSi(OAc)_3$ with oximosilane $RSi(ONCR\square)_3$ or alkoxysilane $RSi(OR\square)_3$.

Condensation curing is also used in some two-part products where cross-linking starts upon mixing the two components (e.g., a hydroxy end-blocked polymer and an alkoxysilane such as tetra-*n*-propoxysilane, $Si(OnPr)_4$) [4]:



Here, no atmospheric moisture is needed. Usually an organotin salt is used as a catalyst, but it also limits the stability of the resulting elastomer at high temperatures. Alcohol is released as a by-product of the reaction, leading to some shrinkage after cure at room temperature (0.5–2% linear shrinkage). Silicones with this cure system may not be suitable for the fabrication of parts with precise tolerances.

> Read full chapter

Silicones

André Colas, Jim Curtis, in Biomaterials Science (Third Edition), 2013

2. Cross-linking by condensation

Although most-ly used in construction sealants and caulks, condensation-cure silicone materials have also found utility in medical device manufacturing as silicone adhesives (facilitating the adherence to materials of silicone elastomers), encapsulants, and sealants.

One-part products are ready to apply and require no mixing. Cross-linking starts when the product is squeezed from the tube or cartridge and comes into contact with moisture, typically from humidity in the ambient air. These materials are formulated

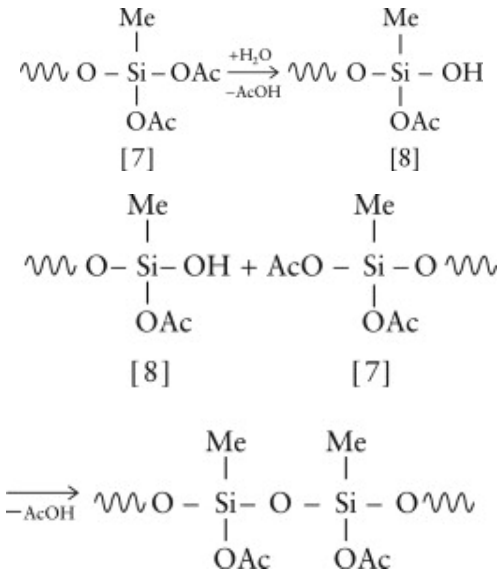
from a reactive polymer prepared from a hydroxy end-blocked polydimethylsiloxane and a large excess of methyltriacetoxysilane.

$$\mathrm{HO-(Me_2SiO)_x-H} + \textit{excess}\ \mathrm{MeSi(OAc)_3} \xrightarrow[-2\mathrm{AcOH}]{} \mathrm{(AcO)_2MeSiO(Me_2SiO)_xOSiMe(OAc)_2}$$

[7]

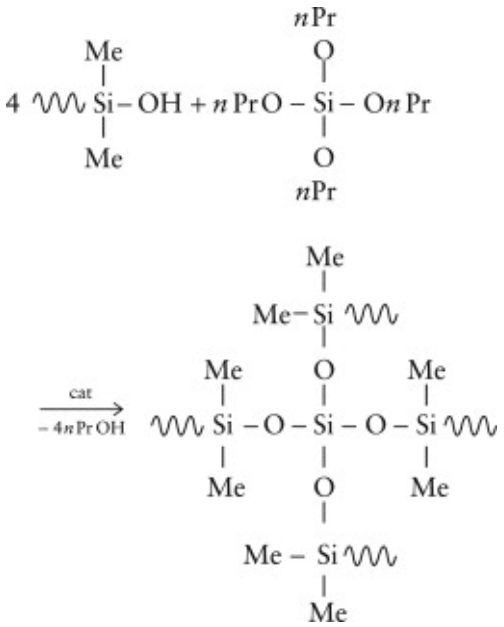
$$\text{where Ac} = -\overset{\overset{\displaystyle CH_3}{|}}{C}=O$$

Because of this excess, the probability of two different chains reacting with the same silane molecule is remote. Consequently, all the chains are end-blocked with two acetoxy functional groups. The resulting product is still liquid and can be packaged in sealed tubes and cartridges. Upon opening and exposing the sealant to room humidity, acetoxy groups are hydrolyzed to give silanols, which allow further condensation to occur.



In this way, two chains have been linked, and the reaction continues from the remaining acetoxy groups. An organometallic tin catalyst is normally used, and the cross-linking reaction requires moisture to diffuse into the material. Accordingly, cure will proceed from the outside surface inward. These materials are called one-part RTV (room temperature vulcanization) sealants, but actually require moisture as a second component. Acetic acid is released as a by-product of the reaction. Problems resulting from the acid can be overcome by using other cure (cross-linking) reactions developed by replacing the methyltriacetoxysilane $MeSi(OAc)_3$ with oximosilane $RSi(ON = CR\square)_3$ or alkoxysilane $RSi(OR\square)_3$.

Condensation curing is also used in some two-part products where cross-linking starts upon mixing the two components (e.g., a hydroxy end-blocked polymer and an alkoxysilane such as tetra-*n*-propoxysilane, $Si(OnPr)_4$) (Noll, 1968):



Here, no atmospheric moisture is needed. Usually an organotin salt is used as a catalyst, but it also limits the stability of the resulting elastomer at high temperatures. Alcohol is released as a by-product of the reaction, leading to some shrinkage after cure at room temperature (0.5–2% linear shrinkage). Silicones with this cure system may not be suitable for the fabrication of parts with precise tolerances.

> Read full chapter

Medical Applications of Silicones

Jim Curtis, André Colas, in Biomaterials Science (Third Edition), 2013

Extracorporeal Equipment

Silicone tubing and membranes found application in numerous extracorporeal machines, due in large part to their hemocompatibility and gas permeability properties. Silicone has been used in kidney dialysis, blood oxygenators, and heart bypass machines. Blood compatibility was also a factor in the application of silicone in several mechanical heart valves (Figure II.5.18.2). The use of silicone in extracorporeal applications continues today. Hemocompatibility testing has suggested that platinum-cured silicone tubing may be superior to poly(vinyl chloride) (PVC) in several respects (Harmand and Briquet, 1999).

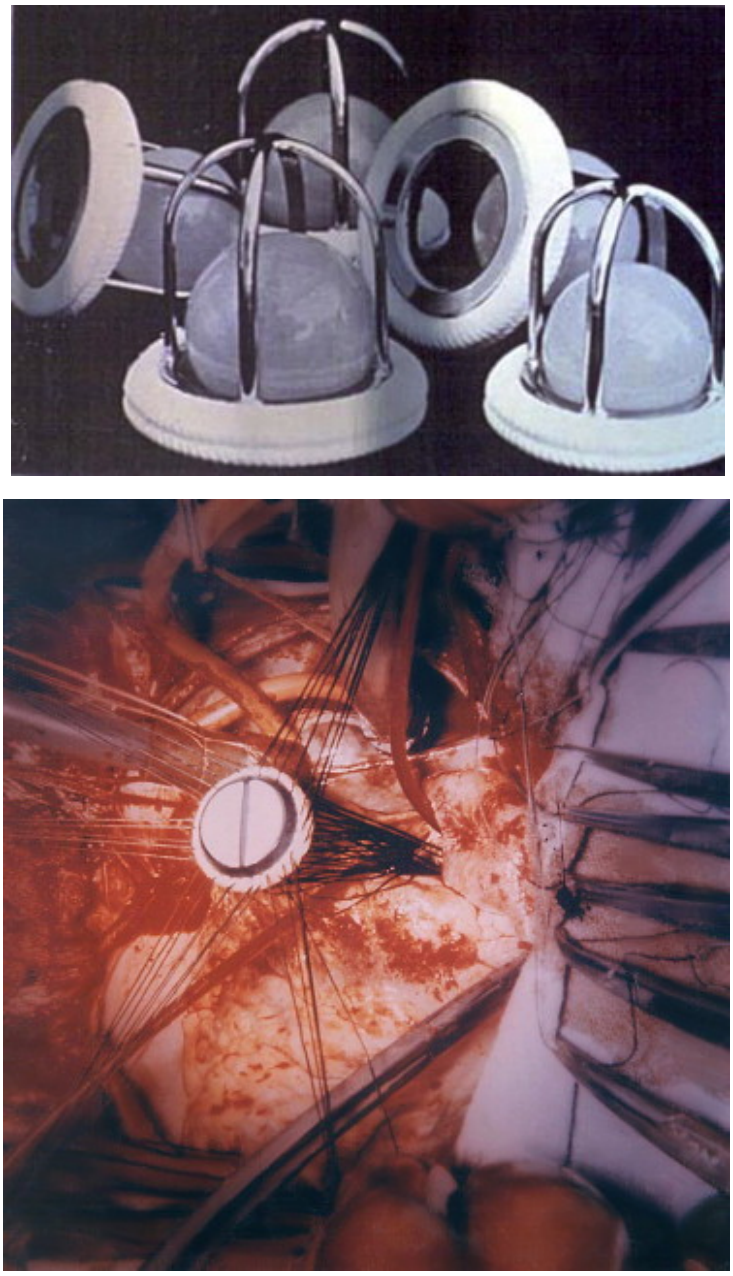


FIGURE II.5.18.2. Examples of early heart valves containing silicone elastomer.

(© Dow Corning, top: AV06433, bottom: AV06434)

> Read full chapter

Drilling Fluids

In Water-Based Chemicals and Technology for Drilling, Completion, and Workover Fluids, 2015

3.1.4 Silicone Resins

A silicone resin-based composition may act as a fluid loss control additive for water-based drilling fluids and is nondamaging [19]. The composition is stable in saturated salt at 120 °C and also at elevated pressure. Solid particles of a silicone resin with a glass transition temperature of more than 70 °C are used. Wellbore fluids are prepared by first forming the solid silicone resin particulate with the desired particle size distribution from a solution of the silicone resin, and then dispersing the silicone resin into a liquid carrier.

> Read full chapter

Protecting machinery parts against the loss of surface

Heinz P. Bloch P.E., Fred K. Geitner P.ENG., in Machinery Component Maintenance and Repair (Fourth Edition), 2019

Silicone or PVMQ

Silicone is a semiorganic elastomer with outstanding resistance to extremes of temperature. Specially compounded, it can provide reliable service at temperatures as low as – 175°F (– 115°C) to as high as 482°F (250°C) continuously. Silicone also has good resistance to compression set.

Low physical strength and abrasion resistance combined with high friction limit silicone to static seals. Silicone is used primarily for dry heat static seals. Although it swells considerably in petroleum lubricants, this is not detrimental in most static sealing applications.

Advantages are as follows:

- Excellent at temperature extremes.
- Excellent compression set resistance.

Disadvantage is as follows:

- Poor physical strength.

> Read full chapter

Advances in structural silicone adhesives

WhiteC. , ... CarbaryL. , in Advances in Structural Adhesive Bonding, 2010

4.5.4 Domestic appliances

Silicone structural adhesives are used in domestic appliances where flexible bonding and resistance to harsh environments are important. For example, the metal base plate of a steam iron is bonded to the plastic water tank with silicone adhesives. in electric or gas ranges, silicone adhesives bond the glass pane to the metal door frame and often also the hinges to the door frame. Numerous other applications of silicone adhesives exist in domestic appliances where they function as durable dielectric insulation, barriers against environmental contaminants and stress-relieving shock and vibration absorbers over a wide temperature and humidity range. However, in these applications, silicones are used primarily as assembly adhesives and their application would not qualify as truly structural in nature.

> Read full chapter

ELSEVIER ScienceDirect is Elsevier's leading information solution for researchers.
Copyright © 2018 Elsevier B.V. or its licensors or contributors. ScienceDirect ® is a registered trademark of Elsevier B.V. Terms and conditions apply.
RELX Group™