SiSiB SILANE Crosslinkers

for Silicone Sealants

The organofunctional group of the silane can react, and bond to, the polymer backbone. Residual moisture activates the silane's alkoxy groups to the active silanol form which react with each other, liberating moisture, and forming siloxane bonds between the polymers. The resulting Si-O-Si crosslink is extremely durable, offering excellent weather, UV, temperature, chemical and moisture resistance.

The cross-linking agent used in RTV silicone systems consists of a species that can be represented as R-Si-X3 (typically used in one-component systems) or Si-X4 (typically used in two-component systems). The R is an organic group such as a methyl, ethyl, or vinyl, phenyl, and the X is a moisture hydrolysable group. A simplified cure mechanism for a one-component silicone RTV sealant is show below:

Figure A: Reaction of crosslinker with polymer ends:

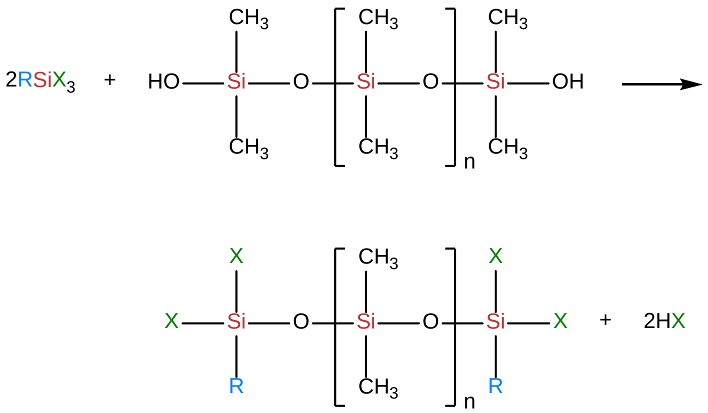

Figure B: Reaction of crosslinker-capped polymer end with moisture:

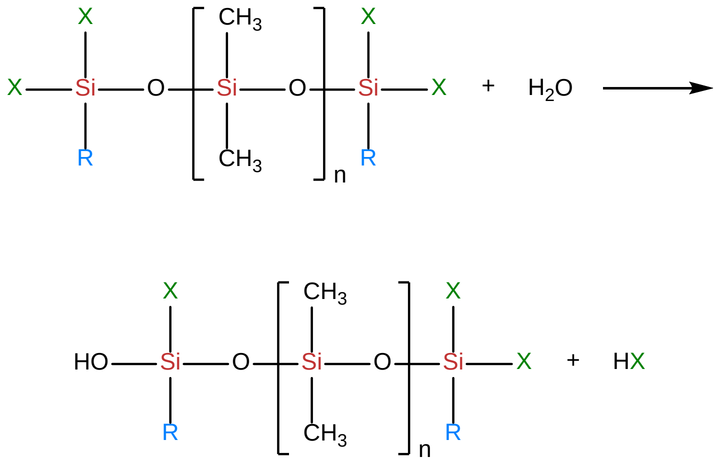

Figure C: Reaction of resultant polymer end with another polymer:

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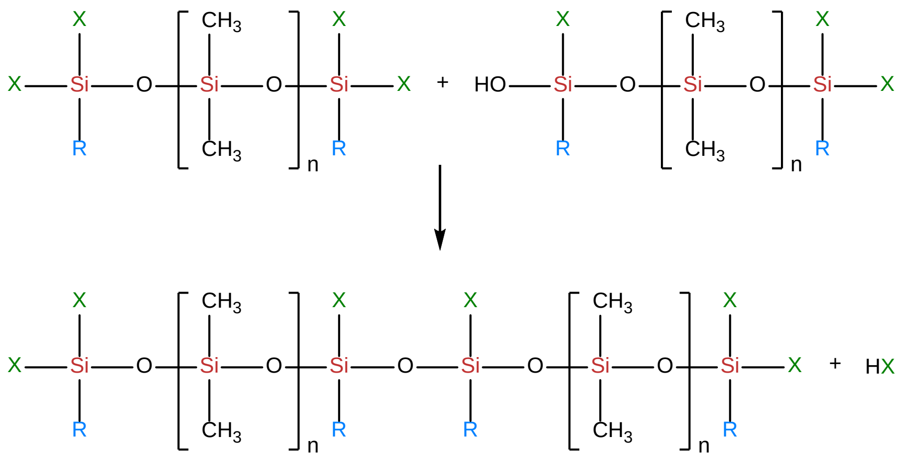

Repeated hydrolysis and reaction of resultant polymer end groups lead to full cure with elimination of HX as a by-product of the condensation reaction.

The acetoxy cure system is the most common RTV system, and it has been used for the longest period of time. However, the by-product is acetic acid, and this could be corrosive to metal substrates or undesirable because of the odor. The alkoxy cure systems produce a by-product that is noncorrosive and has an unobjectionable odor. The acetoxy, alkoxy, and oxime chemistries are all prevalent today. The characteristic of these cure systems are summarized in table below:

Characteristics of Various RVT silicone Cure Systems

RTV cure system	Characteristics
Acetoxy	Relatively fast cure time and short tack-free time. Good adhesion.
Alkoxy	Longer talk-free time and slower cure than acetoxy. By-product produced is noncorrosive and without objectionable odor. Adhesion is not as good as acetoxy.
Oxime	Low corrosion behavior but somewhat longer tack-free and cure times than acetoxy or alkoxy.

In one component systems, the crosslinker is added to filled polymer and immediately reacts with the polymer as indicated in figure A. The reaction results in the formation of two moisture-hydrolysable reactive sites at each end of every polymer chain. Once reacted in such a manner, the product is ready for packaging. It must be kept away from moisture or moisture vapor to avoid the subsequent curing steps and to provide long shelf life.

Once applied and exposed to ambient moisture, two adjacent polymer chains will react through the hydrolysable reactive sites as show in figure B. The cross-linking will continue until all cross-link sites have been completely consumed. The resulting molecule is a highly cross-linked network with good elasticity.

The cure of a RTV two-component silicone sealant occurs in a similar manner. Most often an alkoxy

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cross-linking agent and a catalyst are packaged together leaving the siloxane as the second part. A reactive metal catalyst such as dibutyl tin dilaurate is generally used to begin the curing reaction. The components must, of course, be kept dry to provide adequate shelf life. Once the two components are mixed, the hydrolysis reaction begins. After this occurs, the cross-linking reaction may be accelerated by exposure to slightly elevated temperatures.

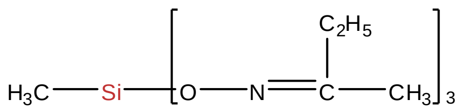
Cross-linking of either one-component or two component RTV silicone systems at room temperature may be accelerated by the use of catalysts at low levels. The catalyst is usually a tin octoate or dibutyl tin dilaurate. The rate of crosslinking is a function of catalyst concentration and its chemical nature. Catalyzed systems are especially useful in forming a quick dry skin that is often desirable in outdoor application where the weather and elements cannot be controlled.

SiSiB SILANES has been developing and producing crosslinkers and coupling agents for the sealant industry for over twenty-five years, supplying world markets with a successful range of innovative products.

Acetoxy Silane Crosslinker	Oximino Silane Crosslinker	Alkoxy Silane Crosslinker
SiSiB® PC7930 MTA	SiSiB® PC7130 MOS	SiSiB® PC5131 MTMS
SiSiB® PC7950 ETA	SiSiB® PC7500 VOS	SiSiB® PC5132 MTES
SiSiB® PC7960 VTA	SiSiB® PC7400 TOS	SiSiB® PC5420 TEOS
SiSiB® PC7970 PTA	SiSiB® PC7600 POS	SiSiB® PC5424 TEOS-40
	SiSiB® PC7133 Methyl MIBKO Silane	SiSiB® PC5430 TPOS
	SiSiB® PC7530 Vinyl MIBKO Silane	SiSiB® PC6110 VTMO
	SiSiB® PC7410 Tetra MIBKO silane	SiSiB® PC6151 Enoxy
	SiSiB® PC7131 Methyl Acetoxime Silane	SiSiB® PC8151 Enoxy
	SiSiB® PC7531 Vinyl Acetoxime Silane	

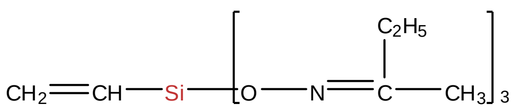
SiSiB® PC7130 [CAS 22984-54-9]

Methyltris(methylethylketoxime)silane(MOS)



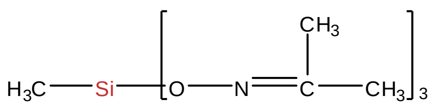
SiSiB® PC7500 [CAS 2224-33-1]

Vinyltris(methylethylketoxime)silane (VOS)



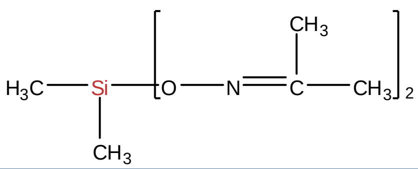
SiSiB® PC7131

Methyltris(acetoximino)silane



SiSiB® PC7220

Dimethyldi(methylethylketoximino)silane



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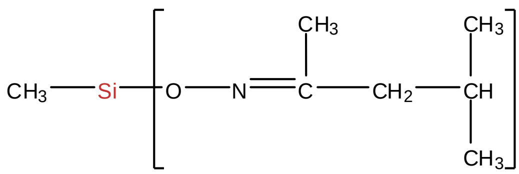
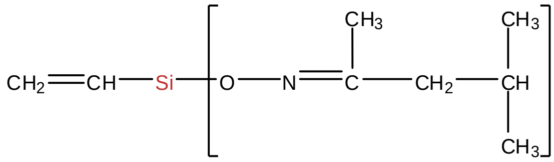
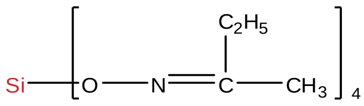
SiSiB® PC7133 [CAS 37859-57-7]
Methyltris(methylisobutylketoximino)silane



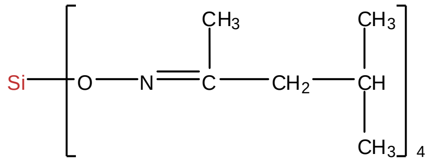
SiSiB® PC7530 [CAS 156145-64-1]
Vinyltris(methylisobutylketoximino)silane



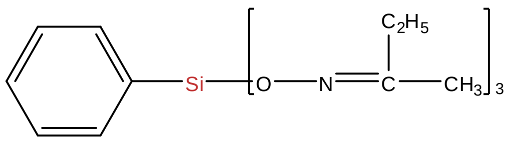
SiSiB® PC7400 [CAS 34206-40-1]
Tetra(methylethylketoxime)silane in toluene (TOS in toluene)



SiSiB® PC7410 [CAS 156145-62-9]
Tetra(methylisobutylketoximino)silane

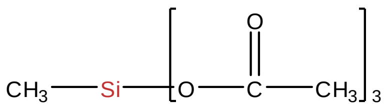


SiSiB® PC7600 [CAS 34036-80-1]
Phenyltris(methylethylketoxime)silane (POS)

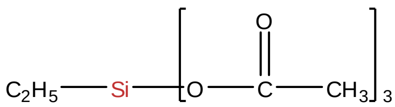


Complex Crosslinker
MOS/VOS, MOS/TOS, VOS/TOS with different ratio. MTA/ETA, MTA/PTA with different ratio

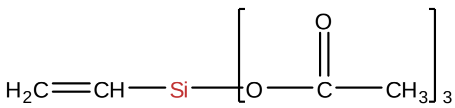
SiSiB® PC7930 [CAS 4253-34-3]
Methyltriacetoxysilane (MTA)



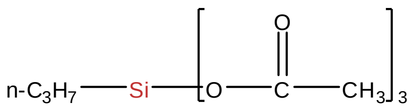
SiSiB® PC7950 [CAS 17689-77-9]
Ethyltriacetoxysilane (ETA)



SiSiB® PC7960 [CAS 4130-08-9]
Vinyltriacetoxysilane (VTA)



SiSiB® PC7970 [CAS 17865-07-5]
Propyltriacetoxysilane (PTA)



SiSiB® PC5131 [CAS 1185-55-3]

SiSiB® PC5132 [CAS 2031-67-6]

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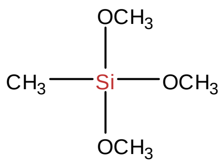
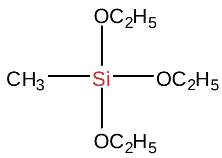
Methyltrimethoxysilane

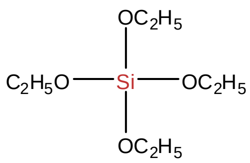


Methyltriethoxysilane



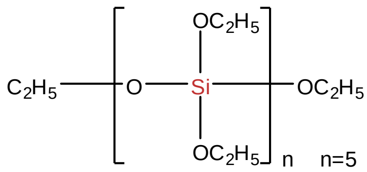
SiSiB® PC5420 [CAS 78-10-4]

Tetraethoxysilane



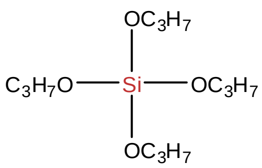
SiSiB® PC5424 [CAS 11099-06-2]

Ethyl polysilicate 40



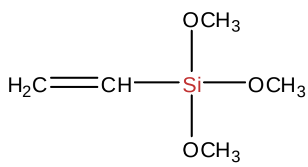
SiSiB® PC5430 [CAS 682-01-9]

Tetrapropoxysilane



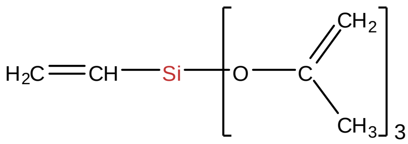
SiSiB® PC6110 [CAS 2768-02-7]

Vinyltrimethoxysilane



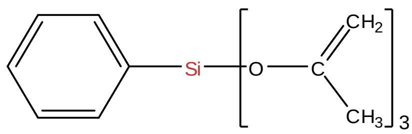
SiSiB® PC6151 [CAS 15332-99-7]

Vinyltris(isopropenyloxy)silane



SiSiB® PC8151 [CAS 52301-18-5]

Phenyltris(isopropenyloxy)silane



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