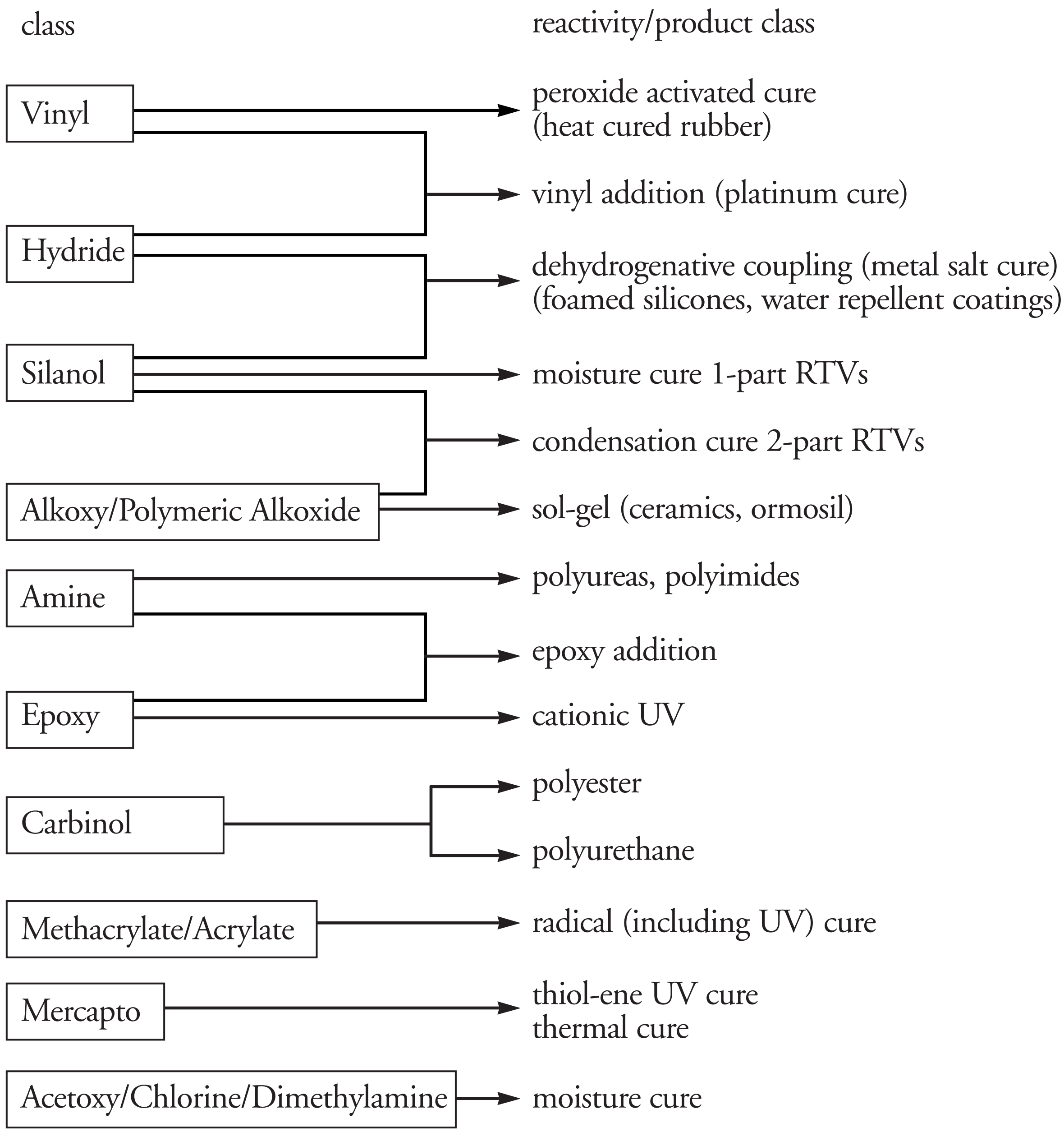
Functional Silicone Reactivity Guide



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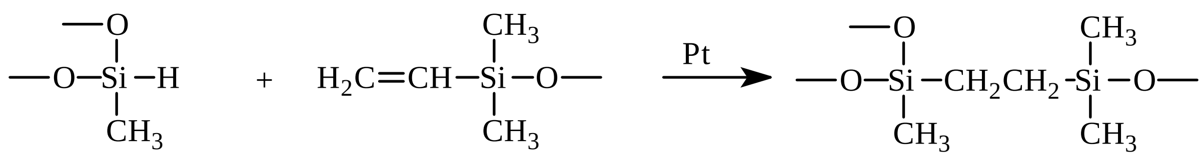
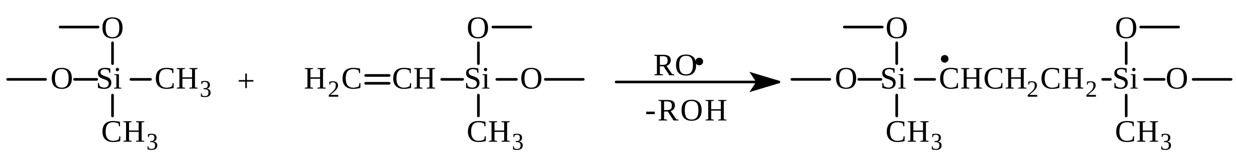
$Si-CH=CH_2$

Vinyl Functional Polymers

The reactivity of vinyl functional polymers is utilized in two major regimes. Vinyl terminated polymers are employed in **addition cure** systems. The bond forming chemistry is the platinum catalyzed hydrosilylation reaction which proceeds according to the following equation:



Vinylmethylsiloxane copolymers and vinyl T-structure fluids are mostly employed in **peroxide activated cure** systems which involve peroxide induced free radical coupling between vinyl and methyl groups. Concomitant and subsequent reactions take place among methyl groups and between crosslink sites and methyl groups. The initial crosslinking reaction is depicted in the following equation:



Addition Cure (Platinum Cure)

Addition cure chemistry provides an extremely flexible basis for formulating silicone elastomers. An important feature of the cure system is that no byproducts are formed, allowing fabrication of parts with good dimensional stability. Cures below 50°C, Room Temperature Vulcanizing (RTV), cures between 50° and 130°C, Low Temperature Vulcanizing (LTV), and cures above 130°C, High Temperature Vulcanizing (HTV) are all readily achieved by addition cure. The rheology of the systems can also be varied widely, ranging from dip-cures to liquid injection molding (LIM) and conventional heat-cure rubber (HCR) processing. Vinyl-terminated polydimethyl-siloxanes with viscosities greater than 200 cSt generally have less than 1% volatiles and form the base polymers for these systems. More typically, base polymers range from 1000 to 60,000 cSt. The crosslinking polymer is generally a methylhydrosiloxane-dimethylsiloxane copolymer with 15-50 mole % methylhydrosiloxane. The catalyst is usually a complex of platinum in alcohol, xylene, divinylsiloxanes or cyclic vinylsiloxanes. The system is usually prepared in two parts. By convention, the A part usually contains the platinum at a level of 5-10ppm, and the B part usually contains the hydride functional siloxane.

Formulation of addition cure silicones must address the following issues:

Strength- Unfilled silicones have extremely poor mechanical properties and will literally crumble under pressure from a fingernail. The most effective reinforcing filler is hexamethyldisilazane treated fumed silica. Alternatively, if clarity must be maintained, vinyl "Q" reinforcing resins are employed.

Hardness- Higher crosslink density provides higher durometer elastomers. Gels are weakly crosslinked systems and even contain substantial quantities of “free” fluids. In principal, molar equivalents of hydrides react with vinyls. See the section on hydride functional fluids for further information. Also, polymers with vinyl pendant on the chain rather than at chain ends are utilized to modify hardness and compression set.

Consistency- The viscosity of the base polymer and a variety of low surface area fillers ranging from calcium carbonate to precipitated silica are used to control the flow characteristics of silicone elastomers.

Temperature of Cure- Selection of platinum catalysts generally controls the preferred temperature of cure[1]. Platinum in vinyldisiloxanes is usually used in room temperature cures. Platinum in cyclic vinylsiloxanes is usually used in high temperature cures. See the Platinum listings in the catalyst section.

Work Time (Speed of Cure)- Apart from temperature, moderators (sometimes called retarders) and inhibitors are used to control work time. Moderators slow, but do not stop platinum catalysts. A typical moderator is tetravinyltetramethylcyclotetrasiloxane. Inhibitors stop or “shut-down” platinum catalysts and therefore are fugitive, i.e volatile or decomposed by heat or light (UV). Acetylenic alcohols such as methylisobutynol are volatile inhibitors. Patent literature shows that t-butylhydroperoxide is an effective inhibitor that breaks down at temperatures above 130°.

Low Temperature Properties, Optical Properties- The introduction of vinyl polymers with phenyl groups alters physical properties of elastomers. At levels of 3-4 mole%, phenyl groups improve low temperature properties. At higher levels, they are used to alter refractive index of elastomers, ranging from matching fillers for transparency to optical fiber applications. Unfortunately, increased phenyl substitution lowers mechanical properties of elastomers.

Shelf Life- A fully compounded elastomer is a complex system. Shelf-life can be affected by moisture, differential adsorption of reactive components by fillers and inhibitory effects of trace impurities. Empirical adjustments of catalyst and hydride levels are made to compensate for these effects.

Compounding- All but the lowest consistency elastomers are typically compounded in sigma-blade mixers, planetary mixers, two-roll mills or, for large scale production, twin-screw extruders.

Quick Start Formulation - Transfer and Impression Molding Elastomer

This low strength formulation is useful as a reproductive molding compound. It is presented here because it can be prepared without special equipment and is an instructive starting point for addition cure silicone elastomers.

DMS-V31	1000 cSt vinyl terminated polydimethylsiloxane	100 parts
SIS6962.0	hexamethyldisilazane treated silica	50 parts
HMS-301	methylhydrosiloxane-dimethylsiloxane copolymer	3-4 parts
SIP6830.0	platinum complex solution	150-200ppm

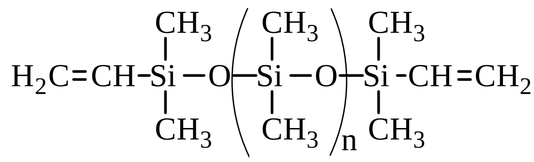
In small portions, work the DMS-V31 into the silica with a spatula. After a uniform dispersion is produced, work in the HMS-301. The blend may be stored in this form. Just prior to use add the platinum solution with an eyedropper and work it in rapidly. Working time is 5-10 minutes. The rate of cure can be retarded by adding tetravinyltetramethylcyclotetrasiloxane (SIT7900.0).

[1] L. Lewis et al, J. Molecular Catalysis A: Chem. *104*, 293, 1996; J. Inorg. Organomet. Polym., *6*, 123, 1996

Peroxide Activated Cure

Activated cure silicone elastomers are processed by methods consistent with conventional rubbers. These silicone products are referred to as HCRs (heat cured rubbers). The base stocks are high molecular weight linear polydiorganosiloxanes that can be converted from a highly viscous plastic state into a predominantly elastic state by crosslinking. Vinylmethylsiloxane-dimethylsiloxane copolymers of extremely high molecular weights are the typical base stocks for activated cure silicone elastomers. The base stocks are commonly referred to as gums. Gums typically have molecular weights from 500,000 to 900,000 with viscosities exceeding 2,000,000 cSt. Free radical coupling (cure) of vinyl and methyl groups is usually initiated by peroxides at process temperatures of 140°-160°. Generally, peroxide loading is 0.2-1.0%. Following the cure, a post-cure at 25-30° higher temperature removes volatile peroxide decomposition products and stabilizes polymer properties. The most widely used peroxides include dibenzoylperoxide (often as a 50% concentrate in silicone oil), dicumylperoxide (often 40% on calcium carbonate), 2,5-dimethyl-2,5-di-t-butylperoxyhexane and bis(dichlorobenzoyl)peroxide. The last peroxide is particularly recommended for aromatic-containing siloxanes. Terpolymer gums containing low levels of phenyl are used in low temperature applications. At increased phenyl concentrations, they are used in high temperature and radiation resistant applications and are typically compounded with stabilizing fillers such as iron oxide. Phenyl groups reduce cross-linking efficiency of peroxide systems and result in rubbers with lower elasticity. Fluorosilicone materials offer solvent resistance. Lower molecular weight vinylsiloxanes are frequently added to modify processability of base stocks.

While the use of peroxide activated cure chemistry for vinylmethylsiloxanes is well-established for gum rubber stocks, its' use is growing in new applications that are comparable to some peroxide cure acrylic systems. Relatively low viscosity vinylmethylsiloxanes and vinyl T-fluids are employed as grafting additives to EPDM elastomers in the wire and cable industry to improve electrical properties. They also form reactive internal lubricants for vulcanizeable rubber formulations. At low levels they are copolymerized with vinyl monomers to form surfactants for organosols.



Vinyl Terminated PolyDimethylsiloxanes

CAS: [68083-19-2] TSCA

Code	Viscosity	Molecular Weight	Wgt % Vinyl	Vinyl - Eq/kg	Density	Price/100g	Price/3kg	Price/16kg
DMS-V00	0.7	186	29	10.9	0.81	$52.00		
DMS-V03	2-3	500	10-12	3.6-4.3	0.92	$72.00		
DMS-V05	4-6	770	7-9	2.4-2.9	0.93	$28.00	$420.00	
DMS-V21	100	6000	0.8-1.2	0.33-0.37	0.97	$24.00	$166.00	$432.00
DMS-V22	200	9400	0.4-0.6	0.21-0.25	0.97	$16.00	$138.00	$360.00
DMS-V25	500	17,200	0.37-0.43	0.11-0.13	0.97	$19.00	$148.00	$384.00
DMS-V31	1000	28,000	0.18-0.26	0.07-0.10	0.97	$15.00	$124.00	$322.00
DMS-V33	3500	43,000	0.12-0.15	0.05-0.06	0.97	$19.00	$148.00	$384.00
DMS-V35	5000	49,500	0.10-0.13	0.04-0.05	0.97	$19.00	$148.00	$384.00
DMS-V41	10,000	62,700	0.08-0.12	0.03-0.04	0.97	$19.00	$148.00	$384.00
DMS-V42	20,000	72,000	0.07-0.09	0.025-0.030	0.98	$21.00	$154.00	$400.00
DMS-V46	65,000	117,000	0.04-0.06	0.018-0.020	0.98	$24.00	$166.00	$432.00
DMS-V52	165,000	155,000	0.03-0.04	0.013-0.016	0.98	$27.00	$166.00	$432.00

These materials are most often employed in 2-part addition cure silicone elastomers.

Fumed Silica Reinforced Vinyl Terminated Polydimethylsiloxane

Code	Viscosity	Base Fluid Viscosity	% Silica	Vinyl - Eq/Kg	Density	Price/100g	Price/3kg	Price/16kg
DMS-V31S15	300,000	1,000	15-18	0.06	1.1	$29.00	$226.00	$586.00

Precompounded base materials provide access to low durometer formulations without the need for special compounding equipment required to mix fumed silica. The following is a starting-point formulation.

Part A

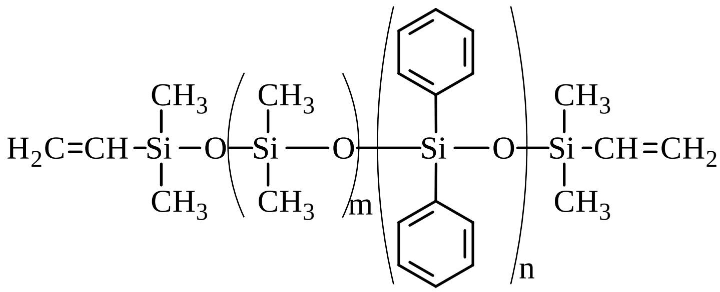
DMS-V31S15	Base	99.85%
SIP6831.0	Catalyst	0.15%

Part B

DMS-V31	Vinyl Silicone	90.0%
HMS-301	Crosslinker	10.0%

Prepare Part A and Part B separately. When ready to cure mix 3 parts A to 1 part B. The mix will cure over 4 hours at room temperature to give the following properties.

Hardness:	20-30 Shore A	Tensile Strength	3.5MPa (500psi)
Elongation	400-450%	Tear Strength	16N/mm (91ppi)



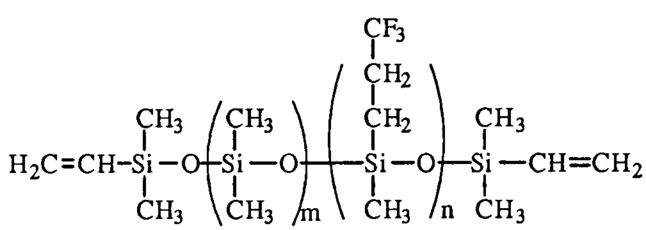
Vinyl Terminated Diphenylsiloxane-Dimethylsiloxane Copolymers CAS: [68951-96-2] TSCA

Code	Mole % Diphenylsiloxane	Viscosity	Molecular Weight	Refractive Index	Price/100 g	Price/3kg
PDV-0325	3.0-3.5	500	15,500	1.420	$38.00	$304.00
PDV-0331	3.0-3.5	1000	27,000	1.420	$35.00	$280.00
PDV-0341	3.0-3.5	10,000	62,000	1.420	$44.00	$352.00
PDV-0346	3.0-3.5	60,000	78,000	1.420	$49.00	$392.00
PDV-0525	4-6	500	14,000	1.430	$38.00	$304.00
PDV-0541	4-6	10,000	60,000	1.430	$44.00	$352.00
PDV-1625	15-17	500	9,500	1.465	$38.00	$304.00
PDV-1631	15-17	1000	19,000	1.465	$38.00	$304.00
PDV-1635	15-17	5,000	35,300	1.465	$38.00	$304.00
PDV-1641	15-17	10,000	55,000	1.465	$44.00	$352.00
PDV-2331	22-25	1000-1500	12,500	1.493	$110.00	
PDV-2335	22-25	4000-5000	23,000	1.493	$140.00	

Vinyl Terminated polyPhenylMethylsiloxane CAS: [225927-21-9]

Code	Mole % PhenylMethylsiloxane	Viscosity	Molecular Weight	Refractive Index	Density	Price/100 g
PMV-9925	99-100	300-600	2000-3000	1.533	1.11	$140.00

These materials are most often employed in 2-part addition cure silicone elastomers where special thermal or optical properties are required.

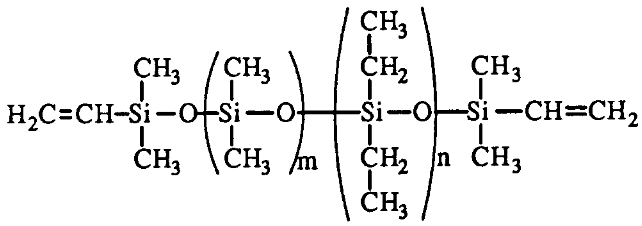


Vinyl Terminated TrifluoropropylMethylsiloxane - Dimethylsiloxane, Copolymer CAS: [68951-98-4] TSCA

Code	Mole % $CF_3CH_2CH_2MeSiO$	Viscosity	Molecular Weight	Specific Gravity	Price/100 g	Price/1kg
FMV-4031*	35-45	13,000-15,000	25,000-35,000	1.120	$110.00	$660.00

*R.I.: 1.386

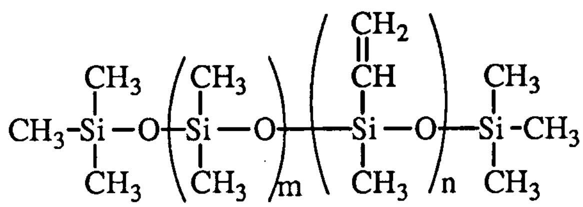
Trifluoropropylmethylsiloxane copolymers offer greater solvent resistance (lower hydrocarbon solubility) and lower refractive index than analogous dimethylsiloxane homopolymers.



Vinyl Terminated Diethylsiloxane -Dimethylsiloxane Copolymers

Code	Mole % Diethylsiloxane	Viscosity	Molecular Weight	Refractive Index	Specific Gravity	Price/100 g
EDV-2025	18-22	400-600	16,500-19,000	1.416	0.968	$160.00

Diethylsiloxane copolymers offer better hydrocarbon compatibility (greater solubility) and higher refractive index than analogous dimethylsiloxane homopolymers.



Vinylmethylsiloxane - Dimethylsiloxane Copolymers, trimethylsiloxy terminated

CAS: [67762-94-1] TSCA

Code	Mole % Vinylmethylsiloxane	Viscosity, cSt.	Specific Gravity	Price/100 g	Price/1kg
VDT-123	0.8-1.2	250-350	0.97	$21.00	$147.00
VDT-127	0.8-1.2	700-800	0.97	$36.00	$252.00
VDT-131	0.8-1.2	800-1200	0.97	$21.00	$147.00
VDT-153	0.3-0.7	200,000-400,000	0.98	$60.00	$420.00
VDT-431	4.0-5.0	800-1200	0.97	$26.00	$182.00
VDT-731	7.0-8.0	800-1200	0.96	$21.00	$147.00
VDT-954	11.0-13.0	300,000-500,000	0.98	$54.00	$378.00

Vinylmethylsiloxane - Dimethylsiloxane Copolymers, silanol terminated 4-8% OH

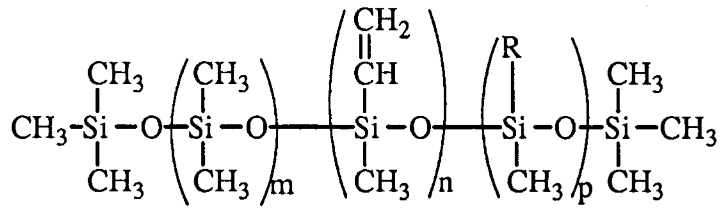
Molecular Weight: 550-650 CAS: [67923-19-7] TSCA

VDS-2513	25-30	25-40	0.99	$54.00	$378.00

Vinylmethylsiloxane - Dimethylsiloxane Copolymers, vinyl terminated CAS: [68083-18-1] TSCA

VDV-0131	0.3-0.4	800-1200	0.97	$80.00	$480.00

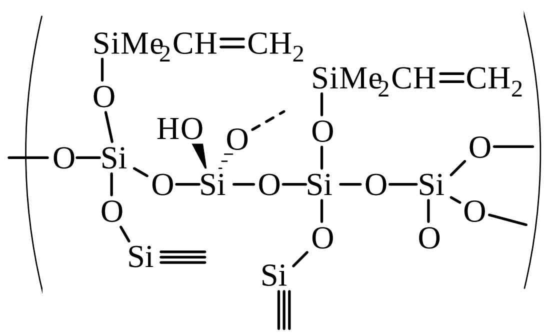
These materials are modifiers for addition cure and activated cure elastomers.



Vinyl Gums (balance dimethylsiloxane unless otherwise specified) TSCA

Code	Mole % Vinylmethylsiloxane	Comonomer %	Specific Gravity	Price/100 g	Price/1kg
VGM-021	0.2-0.3		0.98	$36.00	$120.00
VGP-061	0.1-0.2	6-7% Diphenylsiloxane	0.99	$36.00	$180.00
VGF-991	1.0-2.0%	98-9% Trifluoropropylmethylsiloxane	1.35	$64.00	$384.00
DGM-000*	0.0	100% dimethylsiloxane	0.98	$36.00	$120.00
* This gum is listed here for convenience. It contains no vinyl functionality					

These materials are base polymers for activated cure specialty silicone rubbers.

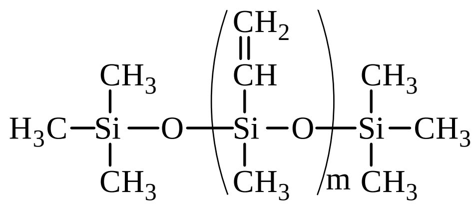


Vinyl Q Resins Dispersions CAS: [68584-83-8] TSCA

Code	Base	Viscosity	Vinyl Eq/kg	Refractive Index	Density	Price/100g	Price/3kg
VQM-135*	DMS-V41	4000-6000	0.2-0.3	1.405	1.02	$19.00	$285.00
VQM-146*	DMS-V46	60,000-70,000	0.18-0.23	1.406	1.02	$21.00	$315.00
VQX-221	50% in xylene		0.4-0.6		1.05	$21.00	$315.00

*20-25% Q-resin

Vinyl Q resins are clear reinforcing additives for addition cure elastomers.

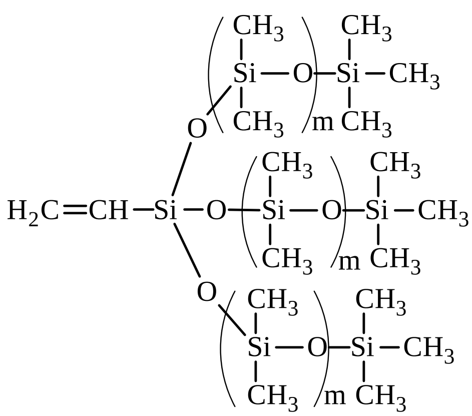


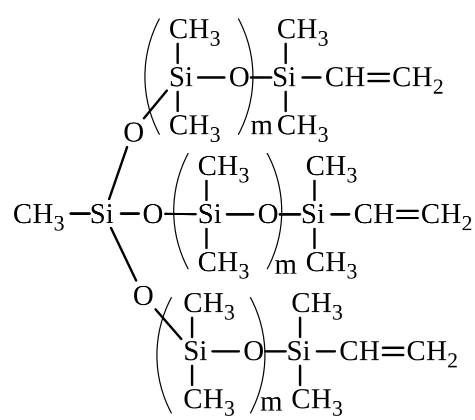
Vinylmethylsiloxane Homopolymers TSCA

Code	Description	Viscosity	Density	Price/100g	Price/3kg
VMS-005	cyclics	3-7	0.99	$45.00	$240.00
VMS-T11*	linear	7-15	0.96	$110.00	

*CAS: [68037-87-6]

These materials are reactive intermediates and monomers.



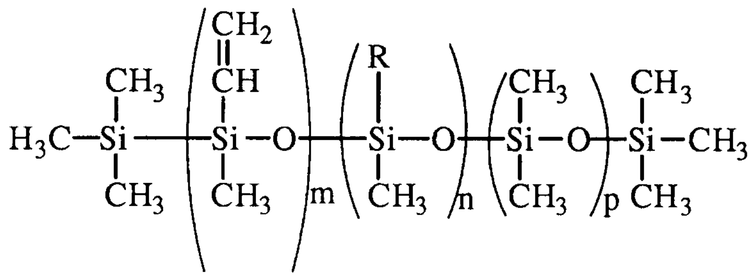


Vinyl T-structure Polymers

Code	Branch Point	Branch Terminus	Viscosity	Density	Price/100g
VTT-116*	Vinyl	Methyl	50-75	0.97	$48.00
MTV-124	Methyl	Vinyl	300-500	0.99	$110.00

*CAS: [126581-51-9] TSCA

These materials are additives and modifiers for addition cure and activated cure elastomers.



VinylMethylsiloxane Terpolymer

(3-5% Vinylmethylsiloxane)-(35-40% OctylmethylSiloxane)-(Dimethylsiloxane) terpolymer

Code	Viscosity	Molecular Weight	Density	Refractive Index	Price/100g	Price/1kg
VAT-4326	500-700	10,000-12,000	0.93	1.437	$39.00	$273.00

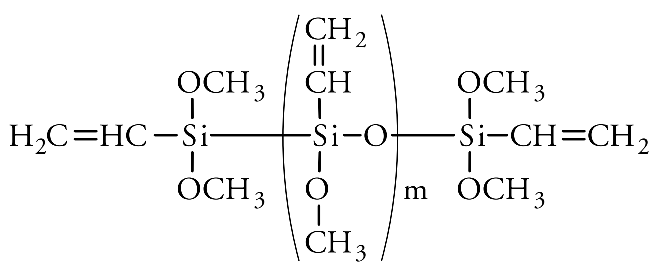
(3-5% Vinylmethylsiloxane)-(15-20% MethoxypolyethylenoxypropylMethylSiloxane)-(Dimethylsiloxane) terpolymer

Code	Viscosity	Molecular Weight	Density	Refractive Index	Price/100g	Price/1kg
VBT-1323	200-400	8000-12000	1.02	1.431	$39.00	$273.00

(3-5% Vinylmethylsiloxane)-(35-40% PhenylmethylSiloxane)-(Dimethylsiloxane) terpolymer

Code	Viscosity	Molecular Weight	Density	Refractive Index	Price/100g	Price/1kg
VPT-1323	250-350	2500-3000	1.03	1.467	$48.00	$336.00

Vinyl-alkyl terpolymers are used in hybrid organic polymer-silicone applications. Vinyl-polyethyleneoxy functional terpolymers reduce silicone hydrophobicity. Vinyl-phenyl terpolymers are used in refractive index match applications.



Vinylmethoxysiloxane Homopolymers CAS: [131298-48-1] TSCA

Code	Description	Viscosity	Density	Price/100g	Price/1kg
VMM-010*	oligomer	8 - 12	1.10	$36.00	$252.00

*R.I.: 1.428

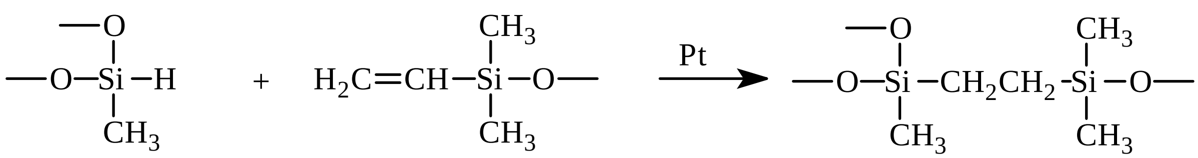
These materials are employed as crosslinking agents for neutral cure RTV's and as coupling agents in polyethylene for wire and cable applications.

$\equiv Si-H$

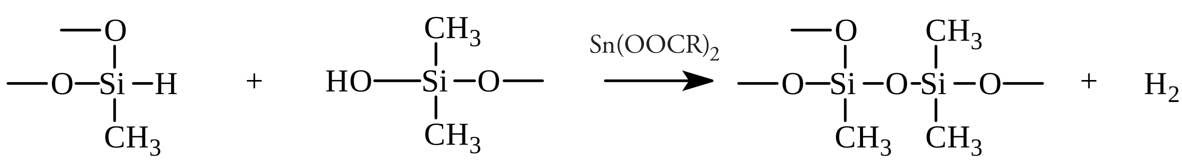
Hydride Functional Polymers

Hydride functional siloxanes undergo three main classes of reactivity: hydrosilylation, dehydrogenative coupling and hydride transfer.

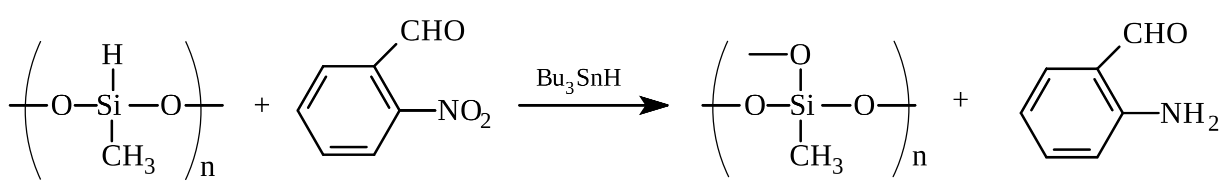
Hydrosilylation



Dehydrogenative Coupling



Reduction



Hydrosilylation - Addition Cure

The hydrosilylation of vinyl functional siloxanes by hydride functional siloxanes is the basis of addition cure chemistry used in 2-part RTVs and LTVs[1,2] . The most widely used materials for these applications are methylhydrosiloxane-dimethylsiloxane copolymers which have more readily controlled reactivity than the homopolymers and result in tougher polymers with lower cross-link density. The preferred catalysts for the reactions are platinum complexes such as SIP6830.0 and SIP6832.0 In principle, the reaction of hydride functional siloxanes with vinyl functional siloxanes takes place at 1:1 stoichiometry. For filled systems, the ratio of hydride to vinyl is much higher, ranging from 1.3:1 to 4.5:1. The optimum cure ratio is usually determined by measuring the hardness of cured elastomers at different ratios. Phenyl substituted

[1] E. Warrick et al, Rubber Chem. Tech., *52(3)*, 437, 1979

[2] O. Dolgov et al, Organosilicon Liquid Rubbers, Int'l Poly. Sci. & Techn., Monograph #1, RAPRA, 1975

hydrosiloxanes are used to crosslink phenylsiloxanes because of their greater solubility and closer refractive index match. The following chart gives some examples of starting ratios for common polymers and crosslinkers calculated at 1.5 Hydride to Vinyl ratio.

Starting Ratios of Hydride Functional Siloxanes (parts) to 100 parts of Vinylsiloxane*

Hydrosiloxane Vinylsiloxane	HMS-013	HMS-151	HMS-301
DMS-V31	80.8	4.2	2.1
DMS-V41	11.5	1.8	0.9
PDV-0341	11.9	1.9	0.9

* formulation is based on 1.5 Si-H to 1 CH_2=CH-Si; filled formulations may require up to 3x the amount listed

The hydrosilylation of olefins is utilized to generate alkyl and arylalkyl substituted siloxanes which form the basis of organic compatible silicone fluids. The hydrosilylation of functional olefins provides the basis for formation of silicone block polymers.

Dehydrogenative Coupling - Water Repellency, Foamed Silicones

Hydroxyl functional materials react with hydride functional siloxanes in the presence bis(2-ethyl-hexanoate)tin, dibutyldilauryltin, zinc octoate, iron octoate or a variety of other metal salt catalysts. The reaction with hydroxylic surface groups is widely used to impart water-repellency to glass, leather, paper and fabric surfaces and powders. A recent application is in the production of water-resistant gypsum board. Application is generally from dilute (0.5-2.0%) solution in hydrocarbons or as an emulsion. The coatings are generally cured at 110-150°C. Polymethylhydrosiloxane is most commonly employed. Polyethylhydrosiloxane imparts water-repellency, but has greater organic compatibility.

Silanol terminated polydimethylsiloxanes react with hydride functional siloxanes to produce foamed silicone materials. In addition to the formal chemistry described above, the presence of oxygen and moisture also influence cross-link density and foam structure.

Reduction

Polymethylhydrosiloxane is a versatile low cost hydride transfer reagent. It has a hydride equivalent weight of 60. Reactions are catalyzed by Pd^0 or dibutyltinoxide. The choice of reaction conditions leads to chemoselective reduction, e.g. allyl reductions in the presence of ketones and aldehydes.[3,4,5] Esters are reduced to primary alcohols in the presence of $Ti(OiPr)_4$.[6]

Physical Properties

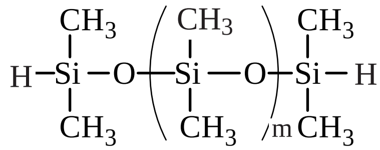
Polymethylhydrosiloxanes exhibit the highest compressibility of the silicone fluids, 9.32% at 20,000 psi and the lowest viscosity temperature coefficient, 0.50.

[3] J. Lipowitz et al, J. Org. Chem., *38,* 162, 1973

[4] E. Keinan et al, Israel. J. Chem., *24*, 82, 1984; J. Org. Chem., *48*, 3545, 1983

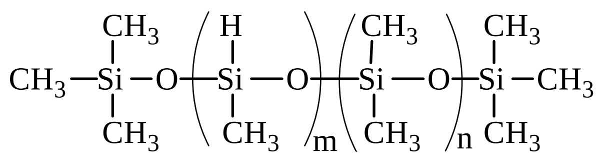
[5] T. Mukaiyama et al, Chemy Lett., 1727, 1983

[6] M. Reding et al, J. Org. Chem., *60*, 7884, 1995.



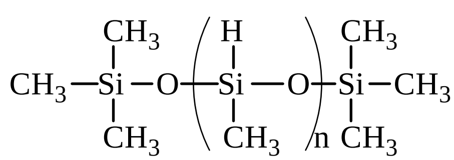
Hydride Terminated PolyDimethylsiloxanes CAS: [70900-21-9] TSCA

Code	Viscosity	Molecular Weight	% H	Specific Gravity	Refractive Index	Price/100g	Price/1 kg
DMS-H03	2 - 3	400-500	0.5	0.90	1.395	$39.00	$234.00
DMS-H21	100	6000	0.04	0.97	1.403	$68.00	
DMS-H25	500	17,200	0.01	0.97	1.403	$45.00	$270.00
DMS-H31	1000	28,000	0.007	0.97	1.403	$45.00	$270.00
DMS-H41	10,000	62,700	0.003	0.97	1.403	$45.00	$270.00



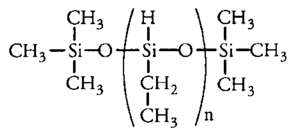
MethylHydrosiloxane - Dimethylsiloxane Copolymers CAS: [68037-59-2] TSCA

Code	Viscosity	Molecular Weight	Mole % (MeHSiO)	Specific Gravity	Refractive Index	Price/100g	Price/3 kg
HMS-013	6000-8000	55,000	0.5-1.0	0.97	1.404	$35.00	$385.00
HMS-031	25-35	1900-2000	3-4	0.97	1.401	$60.00	
HMS-064	9000-11000	62,000	5-7	0.97	1.403	$64.00	
HMS-071	25-35	1900-2000	6-7	0.97	1.401	$60.00	
HMS-151	25-35	1900-2000	15-18	0.97	1.400	$24.00	$192.00
HMS-301	25-35	1900-2000	25-30	0.98	1.399	$19.00	$148.00
HMS-501	10-15	900-1200	50-55	0.96	1.394	$24.00	$192.00



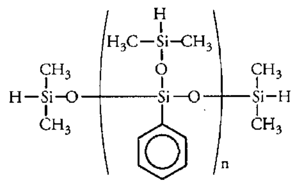
polyMethylHydrosiloxanes Tg: -119° V.T.C: 0.50 CAS: [63148-57-2] TSCA

Code	Viscosity	Molecular Weight	Mole % (MeHSiO)	Specific Gravity	Refractive Index	Price/100g	Price/3 kg
HMS-991	15-25	1500-1900	100	0.98	1.395	$14.00	$96.00
HMS-992	25-35	1900-2200	100	0.99	1.396	$24.00	$168.00



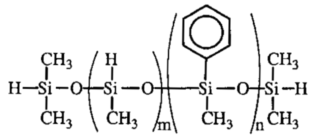
polyEthylHydrosiloxane CAS: [24979-95-1]

Code	Viscosity	Mole % (EtHSiO)	Specific Gravity	Refractive Index	Price/25g	Price/100g
HES-992	75-125	99-100	0.99	1.422	$37.00	$120.00



polyPhenyl - (DiMethylHydrosiloxy)siloxane, hydride terminated

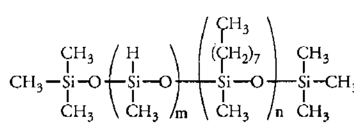
Code	Viscosity	Mole % [$(HMe_2SiO)(C_6H_5Si)O$]	Specific Gravity	Refractive Index	Price/25g	Price/100g
HDP-111	50-80	99-100	1.01	1.463	$74.00	$240.00



MethylHydrosiloxane - PhenylMethylsiloxane copolymer, hydride terminated CAS: [115487-49-5] TSCA

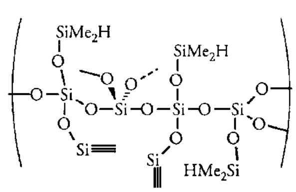
Code	Viscosity	Mole % (MeHSiO)	Specific Gravity	Refractive Index	Price/25g	Price/100g
HPM-502*	75-110	45-50	1.08	1.500	$50.00	$160.00

*unit MW: 200



MethylHydrosiloxane - OctylMethylsiloxane copolymer CAS: [68554-69-8] TSCA

Code	Viscosity	Mole % (MeHSiO)	Specific Gravity	Refractive Index	Price/25g	Price/100g
HAM-303	300-600	25-30	0.91	1.440	$60.00	$195.00

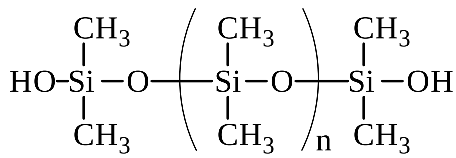


Hydride Q Resin

Code	Viscosity	Hydride Eq/kg	Specific Gravity	Refractive Index	Price/25g	Price/100g
HQM-105	3-6	7.6-9.2	0.94	1.410	$36.00	$117.00

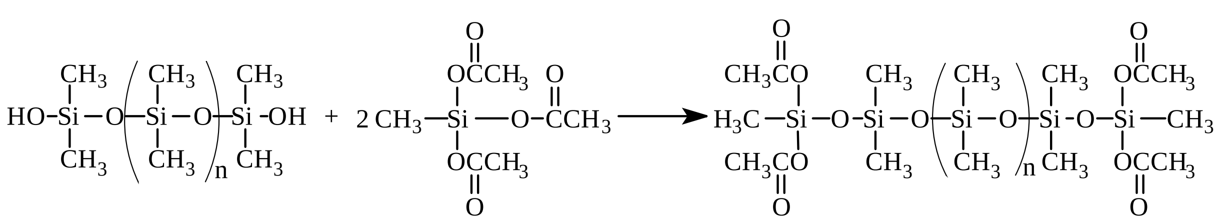
$\equiv Si-OH$

Silanol Functional Polymers



Terminal silanol groups render polydimethylsiloxanes susceptible to condensation under both mild acid and base conditions. They are intermediates for most room temperature vulcanizeable (RTV) silicones. Low molecular weight silanol fluids are generally produced by kinetically controlled hydrolysis of chlorosilanes. Higher molecular weight fluids can be prepared by equilibrating low molecular weight silanol fluids with cyclics, equilibrium polymerization of cyclics with water under pressure or methods of polymerization that involve hydrolyzeable end caps such as methoxy groups. Low molecular weight silanol fluids can be condensed to higher molecular weight silanol fluids by utilization of chlorophosphazene ($PNCl_2$) catalysts.

Condensation cure one-part and two-part RTV systems are formulated from silanol terminated polymers with molecular weights ranging from 15,000 to 150,000. One-part systems are the most widely used. One-part systems are crosslinked with moisture-sensitive multi-functional silanes in a two stage reaction. In the first stage, after compounding with fillers, the silanol is reacted with an excess of multi-functional silane. The silanol is in essence displaced by the silane. This is depicted below for an acetoxy system.



The silicone now has two groups at each end that are extremely susceptible to hydrolysis. The silicone is stored in this form and protected from moisture until ready for use. The second stage of the reaction takes place upon use. When the end groups are exposed to moisture, a rapid crosslinking reaction takes place.

The most common moisture cure systems are:

Acetoxy $\equiv Si-OH + CH_3\overset{O}{\overset{\|}{C}}O-Si\equiv \longrightarrow \equiv Si-O-Si\equiv + CH_3\overset{O}{\overset{\|}{C}}OH$

Enoxy $\equiv Si-OH + CH_3\overset{CH_2}{\overset{\|}{C}}O-Si\equiv \longrightarrow \equiv Si-O-Si\equiv + CH_3\overset{O}{\overset{\|}{C}}CH_3$

Oxime $\equiv Si-OH + (C_2H_5)(H_3C)C=NO-Si\equiv \longrightarrow \equiv Si-O-Si\equiv + (C_2H_5)(H_3C)C=NOH$

Alkoxy $\equiv Si-OH + CH_3O-Si\equiv \longrightarrow \equiv Si-O-Si\equiv + CH_3OH$

Amine $\equiv Si-OH + (CH_3)_2N-Si\equiv \longrightarrow \equiv Si-O-Si\equiv + (CH_3)_2NH$

The crosslinking reaction of alkoxy systems are catalyzed by titanates, frequently in combination with tin compounds and other metal-organics. Acetoxy one-part systems usually rely solely on tin catalysts. The tin level in one-part RTV systems is minimally about 50ppm with a ratio of ~2500:1 for Si-OR to Sn, but typical formulations have up to ten times the minimum. Other specialty crosslinking systems include benzamido and mixed alkoxyamino. The organic (non-hydrolyzeable) substituents on the crosslinkers influence the speed of cure. Among the widely used crosslinkers vinyl substituted is the fastest: vinyl > methyl > ethyl >> phenyl.

Two-part condensation cure silanol systems employ ethylsilicates (polydiethoxysiloxanes) such as PSI-021 as crosslinkers and dialkyltincarboxylates as accelerators. Tin levels in these systems are minimally 500ppm, but typical formulations have up to ten times the minimum. Two-part systems are inexpensive, require less sophisticated compounding equipment, and are not subject to inhibition.

The following is a starting point formulation for a two-part RTV.

10:1 ratio of A to B.

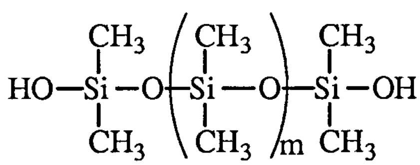
	Part A.			Part B	
DMS-S45	silanol fluid	70%	DMS-T21	100 cSt. silicone fluid	50%
SIS6964.0	silica powder	28%	SIS6964.0	silica powder	45%
PSI-021	ethylsilicate	2%	SND3260	DBTL tin catalyst	5%

This low tear strength formulation can be improved by substituting fumed silica for silica powder.

Incorporation of hydride functional (Si-H) siloxanes into silanol elastomer formulations results in foamed structures. The blowing agent is hydrogen which forms as a result of silanol condensation with hydrosiloxanes. Foam systems are usually two components which are compounded separately and mixed shortly before use.

Silanol terminated diphenylsiloxane copolymers are employed to modify low temperature properties or optical properties of silicone RTV's. They are also utilized as flow control agents in polyester coatings. Diphenylsiloxane homopolymers are glassy materials with softening points >120°C that are used to formulate coatings and impregnants for electrical and nuclear applications.

The reactivity of silanol fluids is utilized in applications other than RTV's. Low viscosity silanol fluids are employed as filler treatments and structure control additives in silicone rubber compounding. Intermediate viscosity, 1000-10,000 cSt fluids can be applied to textiles as durable fabric softeners. High viscosity silanol terminated fluids form the matrix component in tackifiers and pressure sensitive adhesives.

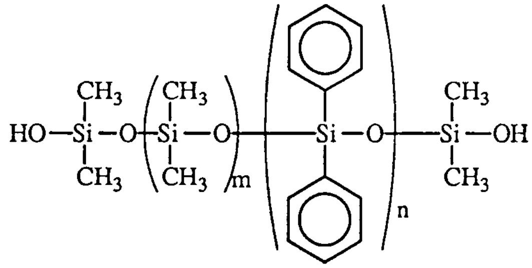


Silanol Terminated PolyDimethylsiloxanes

CAS: [70131-67-8] TSCA

Code	Viscosity	Molecular Weight	% (OH)	(OH) - Eq/kg	Specific Gravity	Refractive Index	Price/100g	Price/3kg	Price/16kg
DMS-S12	20-35	400-700	4.0-6.0	2.3-3.5	0.95	1.401	$19.00	$124.00	$496.00
DMS-S15	45-85	1500-2000	0.9-1.2	0.53-0.70	0.96	1402	$19.00	$124.00	$496.00
DMS-S21	90-120	4200	0.8-0.9	0.47-0.53	0.97	1.402	$14.00	$96.00	$240.00
DMS-S27	700-800	18,000	0.2	0.11-0.13	0.97	1.403	$14.00	$96.00	$240.00
DMS-S31	1000	26,000	0.1	0.055-0.060	0.98	1.403	$14.00	$96.00	$240.00
DMS-S32	2000	36,000	0.09	0.050-0.055	0.98	1.403	$14.00	$96.00	$240.00
DMS-S33*	3500	43,500	0.08	0.045-0.050	0.98	1.403	$14.00	$96.00	$240.00
DMS-S35	5000	49,000	0.07	0.039-0.043	0.98	1.403	$16.00	$110.00	$256.00
DMS-S38	8000	58,000	0.06	0.034-0.037	0.98	1.403	$16.00	$110.00	$256.00
DMS-S42	18,000	77,000	0.04	0.023-0.025	0.98	1.403	$19.00	$124.00	$296.00
DMS-S45	50,000	110,000	0.03	0.015-0.017	0.98	1.403	$19.00	$124.00	$296.00
DMS-S51	75,000-115,000	139,000	0.02	0.010-0.015	0.98	1.403	$34.00	$240.00	

*also available as an emulsion



Silanol Terminated Diphenylsiloxane - Dimethylsiloxane Copolymers

TSCA

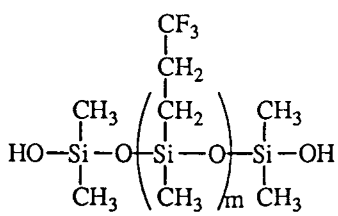
Code	Viscosity	Mole % Diphenylsiloxane	Molecular Weight	Refractive Index	% (OH)	Price/100 g	Price/3kg
PDS-0332*	2000-3000	2.5-3.5	35,000	1.420	0.7-1.3	$45.00	$380.00
PDS-1615**	50-60	14-18	900-1000	1.473	3.4-4.8	$39.00	$340.00

*CAS: [68951-93-9] **CAS: [68083-14-7]

Silanol Terminated PolyDiphenylsiloxane

Tm: 142-155°; contains cyclics CAS: [63148-59-4] TSCA

Code	Viscosity	Mole % Diphenylsiloxane	Molecular Weight	Refractive Index	% (OH)	Price/100 g	Price/1kg
PDS-9931	glassy solid	100	1000-1400	1.610	3.4-2.4	$64.00	$448.00



Silanol Terminated PolyTrifluoropropylMethylsiloxane

CAS: [68607-77-2] TSCA

Code	Viscosity	Mole % $CF_3CH_2CH_2MeSiO$	Molecular Weight	Refractive Index	% (OH)	Specific Gravity	Price/100 g
FMS-9921	40-150	100	550-800	1.379	5-7%	1.27	$160.00

Silanol-Trimethylsilyl Modified Q Resins

CAS: [56275-01-5] TSCA

Code	Wgt % Q resin	Molecular Weight	%(OH)	Base Resin	solvent	Price/100g	Price/3 kg
SQO-299	100	3000-4000	1.7-2.0			$39.00	$380.00
SQT-221	60	3000-4000			40% toluene	$19.00	$124.00
SQS-261	35-40	3000-4000		DMS-S61*	40% toluene	$29.00	$196.00

*300,000-400,000 MW silanol terminated polydimethylsiloxane

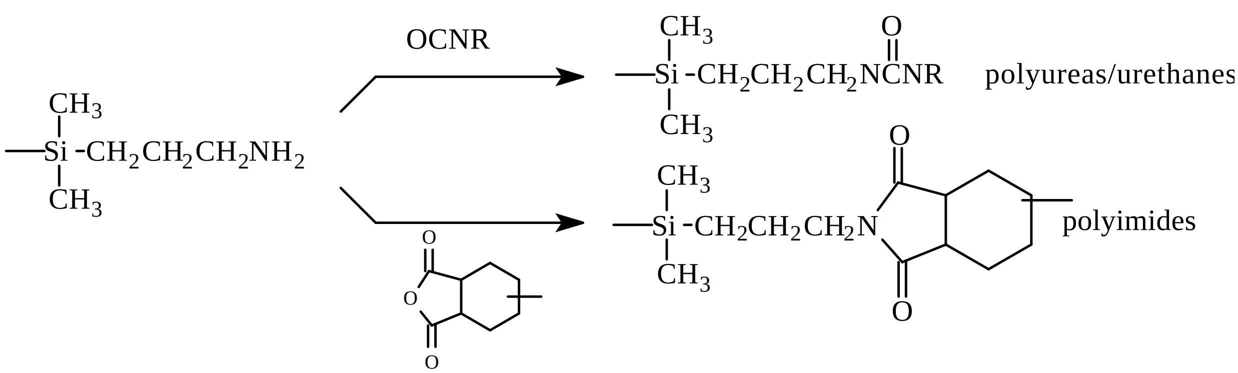
Silanol terminated vinylmethylsiloxane copolymers- see Vinylmethylsiloxane Copolymers

$$\equiv SiCH_2CH_2CH_2NH_2$$

Aminofunctional Silicones

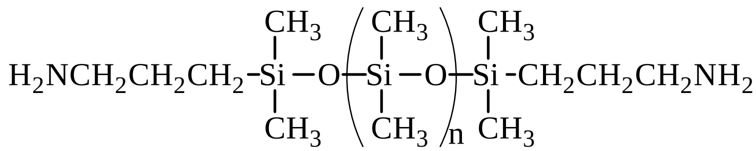
Aminoalkylfunctional silicones have a broad array of applications as a result of their chemical reactivity, their ability to form hydrogen bonds and, particularly in the case of diamines, their chelating ability. Additional reactivity can be built into aminoalkylgroups in the form of alkoxy groups. Aminoalkylsiloxanes are available in the three classes of structures typical for silicone polymers: terminated, pendant group and T-structure.

Aminopropyl terminated polydimethylsiloxanes react to form a variety of polymers including polyimides, polyureas and polyurethanes. Block polymers based on these materials are becoming increasingly important in microelectronic (passivation layer) and electrical (low-smoke generation insulation) applications. They are also employed in specialty lubricant and surfactant applications.



Amino functionality pendant from the siloxane backbone is available in two forms: (aminopropyl)-methylsiloxane-dimethylsiloxane copolymers and (aminoethylaminopropyl)-methylsiloxane-dimethylsiloxane copolymers. They are frequently used in modification of polymers such as epoxies and urethanes, internal mold releases for nylons and as lubricants, release agents and components in coatings for textiles and polishes.

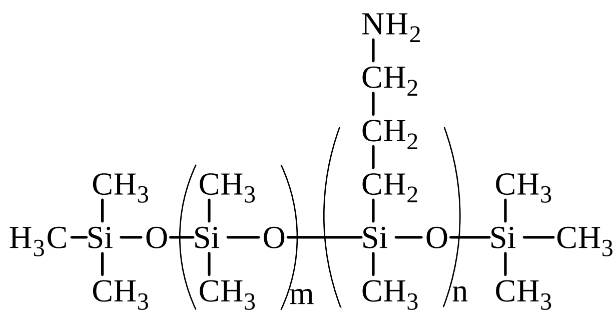
Aminoalkyl T-structure silicones are primarily used as surface treatments for textiles and finished metal polishes (e.g. automotive car polishes). The resistance to wash-off of these silicones is frequently enhanced by the incorporation of alkoxy groups which slowly hydrolyze and form crosslink or reactive sites under the influence of the amine.



Aminopropyl Terminated PolyDimethylsiloxanes

Tg: -123° CAS: [106214-84-0]

Code	Viscosity	Molecular Weight	% Amine (NH2)	Specific Gravity	Refractive Index	Price/100g	Price/1 kg
DMS-A11	10-15	850-900	3.2-3.8	0.98	1.412	$72.00	$432.00
DMS-A12	20-30	900-1000	3.0-3.2	0.98	1.411	$51.00	$306.00
DMS-A15	50-60	3000	1.0-1.2	0.97	1.408	$43.00	$258.00
DMS-A21	100-120	5000	0.6-0.7	0.98	1.407	$39.00	$234.00
DMS-A32	2000	27,000	0.08-0.09	0.98	1.404	$29.00	$174.00



AminopropylMethylsiloxane - Dimethylsiloxane Copolymers CAS: [99363-37-8] TSCA

Code	Viscosity	Molecular Weight	Mole % (Aminopropyl) MethylSiloxane	Specific Gravity	Refractive Index	Price/100g	Price/3 kg
AMS-132	80-100	4500-5500	2-3	0.96	1.404	$29.00	$174.00
AMS-152	120-180	7000-8000	4-5	0.97		$29.00	$174.00
AMS-162	80-120	4000-5000	6-7	0.97		$29.00	$174.00

AminoethylaminopropylMethylsiloxane - Dimethylsiloxane Copolymers CAS: [71750-79-3] TSCA

Code	Viscosity		Mole % (Diamino-propyl)MethylSiloxane	Specific Gravity	Refractive Index	Price/100g	Price/3 kg
AMS-233	1200-1500		2 - 4	0.98	1.407	$34.00	$238.00

AminoethylaminoisobutylMethylsiloxane - Dimethylsiloxane Copolymers CAS: [106842-44-8] TSCA

Code	Viscosity		Mole % (Diamino-isobutyl)MethylSiloxane	Specific Gravity	Refractive Index	Price/100g	Price/3 kg
AMS-242	120-150		3-5	0.97	1.404	$48.00	$336.00

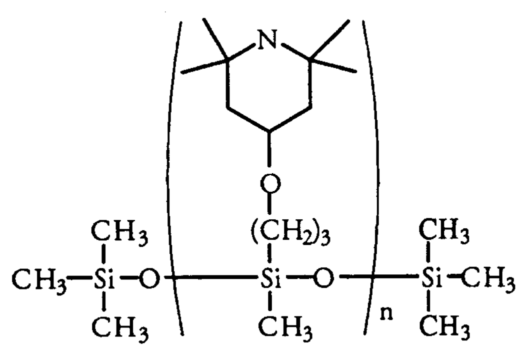
AminoethylaminopropylMethoxysiloxane - Dimethylsiloxane Copolymers with branch structure CAS: [67923-07-3] TSCA

Code	Viscosity		Mole % (Diamino-propyl)MethoxySiloxane	Specific Gravity		Price/100g	Price/3 kg
ATM-1112	100-200		0.5-1.5	0.97		$24.00	$144.00
ATM-1322*	200-300		2 - 4	0.97		$29.00	$174.00

*also available as an emulsion

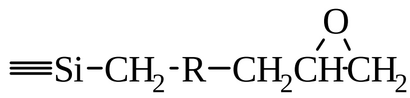
Hindered Amine Functional Siloxanes

Hindered Amine Light Stabilizers (HALS) may be incorporated into polysiloxane structures affording an ultraviolet light stabilizer system that is compatible with other stabilizers such as hindered phenolics and organophosphites and is strongly resistant to water extraction.



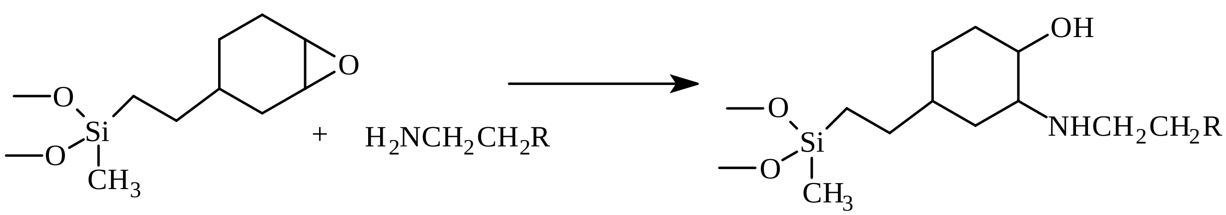
(Tetramethylpiperidinyl)oxypropylMethylsiloxane CAS: [182635-99-0] TSCA

Code	Viscosity	Molecular Weight	Specific Gravity	Price/100g
UBS-9912	15-25	1200-2400	1.00	$72.00



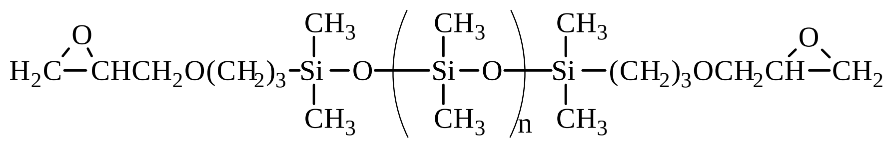
Epoxy Functional Silicones

Epoxy functional silicones undergo crosslinking reactions with amines. Properties of cured epoxy silicone oil coatings or finishes vary from hydrophilic to hydrophobic depending on the epoxy content, degree of substitution and ring-opening of epoxides to form diols. The primary application for these materials is for textile finishes and epoxies for electronics. The ring-strained epoxycyclohexyl group is more reactive than the epoxypropoxy group and undergoes thermally or chemically induced reactions with nucleophiles including protic surfaces such as cellulosics. Epoxycyclohexyl functional siloxanes can also polymerize on UV exposure in the presence of weak acid donor catalysts.



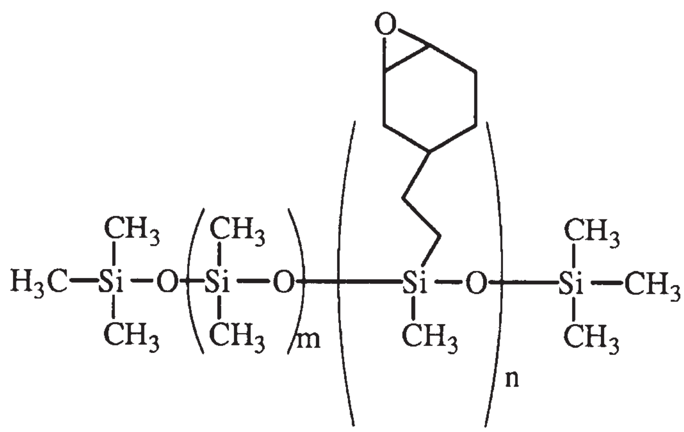
An aryliodonium UV initiator for cycloaliphatic epoxides is OMAN072 described in the Catalyst Section. Epoxy functional siloxane copolymers with polyalkyleneoxide functionality provide hydrophilic textile finishes.

Epoxy functional silsesquioxanes - see specialty silsesquioxanes.



Epoxypropoxypropyl Terminated PolyDimethylsiloxanes

Code	Viscosity	Molecular Weight	Epoxy - Eq/kg	Specific Gravity	Refractive Index	Price/100g
DMS-E01	1 - 2	363	5.5	0.99	1.446	$78.00
DMS-E12	20-30	900-1100	1.8 - 2.2	0.98	1.418	$120.00
DMS-E21	100-140	4500-5500	0.45 - 3.5	0.98	1.408	$120.00



(EpoxycyclohexylethylMethylsiloxane) Dimethylsiloxane Copolymers CAS: [6772-95-2] TSCA

Code	Viscosity	Molecular Weight	Mole % (Epoxycyclohexyl)-ethylMethylSiloxane	Specific Gravity	Price/100g	Price/ 1 kg
EMS-232	650-800	18,000	2-3	0.98	$29.00	$174.00
EMS-234	3000-5000	50,000	2-3	0.98	$56.00	$392.00

(2-3% EpoxycyclohexylethylMethylsiloxane)(10-15% MethoxypolyalkyleneoxyMethylSiloxane)-(Dimethylsiloxane) Terpolymer CAS: [69669-36-9] TSCA

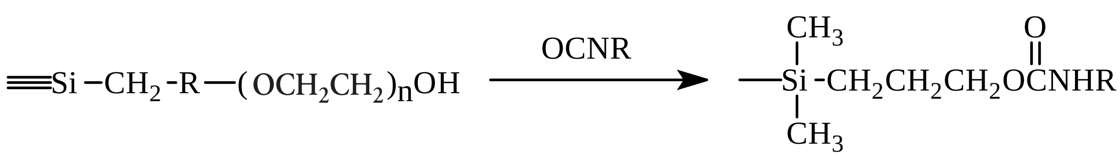
Code	Viscosity	Molecular Weight	Epoxy- Eq/kg	Specific Gravity	Price/100g	Price/ 1 kg
EBP-234	4000-5000	25,000-36,000	0.75-0.80	1.03	$29.00	$174.00

$$\equiv Si-CH_2-R-(OCH_2CH_2)_nOH$$

Carbinol Functional Silicones

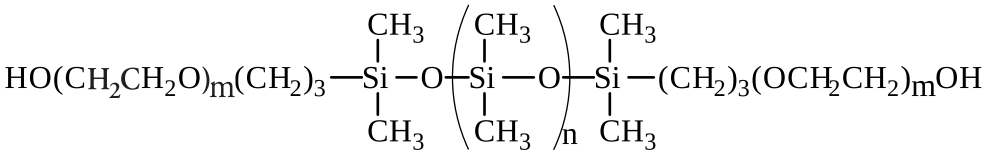
Carbinol (Hydroxy) Functional Siloxanes

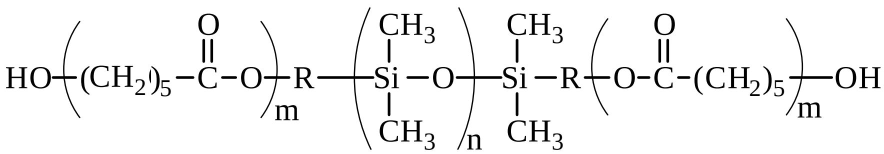
The term carbinol refers to a hydroxyl group bound to carbon (C-OH) and is frequently used in silicone chemistry to differentiate them from hydroxyl groups bound to silicon (Si-OH) which are referred to as silanols. Carbinol terminated siloxanes contain primary hydroxyl groups which are linked to the siloxane backbone by non-hydrolyzeable transition groups. Frequently a transition block of ethylene oxide or propylene oxide is used. Carbinol functional polydimethylsiloxanes may be reacted into polyurethanes, epoxies, polyesters and phenolics.



Applications include additives for urethane leather finishes and as reactive internal lubricants for polyester fiber melt spinning. They are also utilized as surfactants and blend agents.

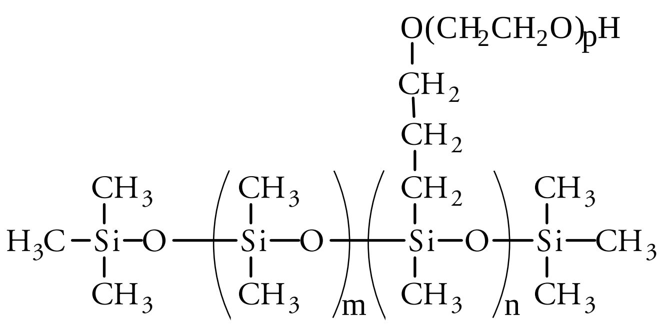
Polyethyleneoxide transition blocks are more polar than polypropyleneoxide blocks and maintain a broad range of liquid behavior. Carbinol terminated siloxanes with caprolactone transition blocks offer a highly polar component which enables compatibility in a variety of thermoplastic resins.





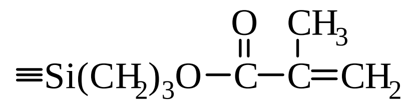
Carbinol (Hydroxyl) Terminated PolyDimethylsiloxanes

Code	Viscosity	Molecular Weight	Weight % Non-Siloxane	Specific Gravity	Refractive Index	Price/100g	Price/1kg
DMS-C15	30-50	1000	20	0.98	1.417	$140.00	
DMS-C21	110-140	4500-5500	4	0.98	1.407	$140.00	
DBE-C25*	400-450	3500-4500	60	1.07	1.450	$38.00	$228.00
DBL-C31**	mp 52-6	5700-6900	50	1.05		$48.00	$288.00
DBP-C22***	200-300	2500-3200	45-55	0.989	1.434	$42.00	$252.00
note: for DMS-C15 and DMS-C21 n =1 CAS: [156327-07-0]							
*A-B-A ethylene oxide - dimethylsiloxane - ethylene oxide block polymer CAS: [68937-54-2]							
**A-B-A caprolactone - dimethylsiloxane - caprolactone block polymer CAS: [120359-07-1]							
***A-B-A propylene oxide - dimethylsiloxane - propylene oxide block copolymer							



(Carbinol functional)Methylsiloxane-Dimethylsiloxane Copolymers

Code	Viscosity	Molecular Weight	Mole % Carbinol functional MethylSiloxane	Hydroxyl class	Specific Gravity	Price/100g	Price/1kg
CMS-626	550-650	4500-5500	40	primary	1.09	$42.00	$252.00
0.4 equivalents of hydroxyl/kg (ca. 2 hydroxyethyleneoxypropyl groups/chain)				65% non-siloxane		CAS: [68937-54-2] TSCA	
CMS-222	150-200	5500-6500	5	secondary	0.976	$36.00	$216.00
0.5 equivalents hydroxyl/kg (ca. 3 hydroxypropyleneoxypropyl groups/chain)				20% non-siloxane		CAS: [68957-00-6] TSCA	



Methacrylate and Acrylate Functional Siloxanes

Methacrylate and Acrylate functional siloxanes undergo the same reactions generally associated with methacrylates and acrylates, the most conspicuous being radical induced polymerization. Unlike vinylsiloxanes which are sluggish compared to their organic counterparts, methacrylate and acrylate siloxanes have similar reactivity to their organic counterparts. The principal applications of methacrylate functional siloxanes are as modifiers to organic systems. Upon radical induced polymerization, methacryloxypropyl terminated siloxanes by themselves only increase in viscosity. Copolymers with greater than 5 mole % methacrylate substitution crosslink to give non-flowable resins. Acrylate functional siloxanes cure at greater than ten times as fast as methacrylate functional siloxanes on exposure to UV in the presence of a photoinitiator such as ethylbenzoin. Oxygen is an inhibitor for methacrylate polymerization in general. The high oxygen permeability of siloxanes usually makes it necessary to blanket these materials with nitrogen or argon in order to obtain reasonable cures.

Methacryloxypropyl Terminated PolyDimethylsiloxanes

Code	Viscosity	Molecular Weight	Specific Gravity	Price/25g	Price/100g
DMS-R01	1 - 2	386	0.97	$54.00	$176.00
DMS-R05	4 - 6	550-700	0.98	$68.00	$220.00
DMS-R18	70-100	4500-5500	0.98	$68.00	$220.00
DMS-R22	200-300	10,000	0.98	$68.00	$220.00
DMS-R31	1000	25,000	0.98	$56.00	$180.00

Acryloxy Terminated PolyDimethylsiloxanes CAS: [128754-61-0]

Code	Viscosity	Molecular Weight	Specific Gravity	Price/25g	Price/100g
DMS-U22	180-250	1000-1200	1.00	$56.00	$180.00

(Methacryloxypropyl)methylsiloxane - Dimethylsiloxane Copolymers

CAS: [104780-61-2] TSCA

Code	Viscosity	Specific Gravity	Mole % (Methacryloxy-propyl)Methylsiloxane	Price/100g
RMS-044	8000-10,000	0.98	4 - 6	$86.00
RMS-033	1000-2000	0.98	2-4	$120.00
RMS-083	2000-3000	0.99	7 - 9	$110.00

(Acryloxypropyl)methylsiloxane - Dimethylsiloxane Copolymers

Code	Viscosity	Specific Gravity	Mole % (Acryloxy-propyl)Methylsiloxane	Price/100g
UMS-182	80-120	1.01	15-20	$140.00
UMS-992*	50-125	1.10	99-100	$110.00

*homopolymer Refractive Index: UMS-182 = 1.426; CAS: 158061-40-6; UMS-992 = 1.464

Methacryloxypropyl T-structure Siloxanes CAS: [67923-18-6] TSCA

Code	Viscosity	Molecular Weight	Specific Gravity	Price/100g
RTT-1011	10 - 20	570-620	0.95	$86.00

See also methacrylate functional macromers.

Selected Polymers with Non-Hydrolyzeable Functionality

$\equiv Si-CH_2CH_2CH_2SH$

Mercapto-functional Silicones

Mercapto-functional siloxanes strongly adsorb onto fibers and metal surfaces. High performance toner fluids for reprographic applications are formulated from mercapto-fluids. As components in automotive polishes they are effective rust inhibitors. They act as internal mold release agents for rubber and semi-permanent lubricants for automotive weather stripping. Mercapto-fluids are valuable additives in cosmetic and hair care products. They also undergo radical initiated (including UV) addition to unsaturated resins. Homopolymers are used as cross-linkers for vinylsiloxanes in rapid UV cure fiber optic coatings[1] .

(Mercaptopropyl)Methylsiloxane - Dimethylsiloxane Copolymers CAS: [102783-03-9] TSCA

Code	Viscosity	Molecular Weight	Mole % (Mercapto-propyl)MethylSiloxane	Specific Gravity	Refractive Index	Price/100g	Price/1kg
SMS-022	120-180	6000-8000	2 - 3	0.97	1.406	$21.00	$112.00
SMS-042	120-170	7200-8000	4 - 6	0.98	1.408	$21.00	$112.00
SMS-992*	75-150	4000-7000	99-100	0.97	1.496	$92.00	

* homopolymer, contains cyclics

$\equiv Si-CH_2CH_2CH_2Cl$

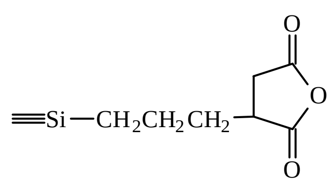
Chloropropyl-functional Silicones

Chlororopropyl-functional silicones are moderately stable fluids which are reactive with polysulfides and durable press fabrics. They behave as internal lubricants and plasticizers for a variety of resins where low volatility and flammability resistance is a factor.

ChloropropylMethylsiloxane - Dimethylsiloxane Copolymers CAS: [70900-20-8] TSCA

Code	Viscosity	Molecular Weight	Mole % (Chloro-propyl)MethylSiloxane	Specific Gravity	Refractive Index	Price/100g	
LMS-152	300-450	7500-10,000	14 - 16	1.01	1.420	$96.00	

$\equiv Si-CH_2CH_2CH_2COOH$



Carboxylate and Anhydride functional Silicones

Carboxylic acid functional siloxanes are excellent rheology and wetting modifiers for polyesters. When reacted with inorganic bases or amines, they perform as anti-static surfactants and lubricants. Anhydride functional siloxanes can be reacted directly with amines and epoxides or hydrolyzed to give dicarboxylic acid terminated siloxanes.

(Carboxyalkyl) Terminated PolyDimethylsiloxane

Code	Viscosity	Molecular Weight	Termination	Specific Gravity	Refractive Index	Price/100g	
DMS-B12*	15-30	1000	Carboxydecyl	0.96	1.421	$180.00	
DMS-B25*	450-550	10,000	Carboxydecyl	0.97	1.403	$160.00	
DMS-B31**	800-1200	28,000	Carboxypropyl	0.98		$160.00	

*CAS: [58130-04-4] ** CAS: [158465-59-9]

Succinic Anhydride Terminated PolyDimethylsiloxane

Code	Viscosity	Molecular Weight		Specific Gravity	Refractive Index	Price/25g	
DMS-Z11	75-100	600-800		1.06	1.436	$90.00	

Polydimethylsiloxanes with Hydrolyzeable Functionality

Polydimethylsiloxanes with hydrolyzeable functionality react with water to produce silanol terminated fluids of equivalent or higher degrees of polymerization. Polymers with this category of reactivity are almost never directly hydrolyzed. Chlorine and dimethylamine terminated fluids are usually employed in ordered chain extension and block polymer synthesis, particularly urethanes and polycarbonates. Acetoxy and dimethylamine terminated fluids can also be used as unfilled bases for rapid cure RTV's.

Polymers with Hydrolyzeable Functionality

Chlorine Terminated PolyDimethylsiloxanes CAS: [67923-13-1] TSCA

Code	Viscosity	Molecular Weight	Specific Gravity	Price/100g
DMS-K05	3 - 6	425-600	1.00	$64.00
DMS-K13	20-50	2000-4000	0.99	$120.00
DMS-K26	500-800	15,000-20,000	0.99	$94.00

Diacetoxymethyl Terminated PolyDimethylsiloxanes CAS: [70900-20-81] TSCA

Code	Viscosity	Molecular Weight	Specific Gravity	Price/100g
DMS-D33	2500-3500	36,000	0.99	$64.00

Dimethylamino Terminated PolyDimethylsiloxanes CAS: [67762-92-9] TSCA

Code	Viscosity	Molecular Weight	Specific Gravity	Price/100g
DMS-N05	3 - 6	450-600	0.93	$160.00

Methoxy Terminated PolyDimethylsiloxanes CAS: [68951-97-3] TSCA

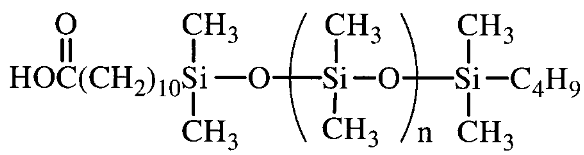
Code	Viscosity	Molecular Weight	Specific Gravity	Price/100g
DMS-X11	5-12	900-1000	0.94	$39.00
DMS-X25	400-600	17,000	0.98	$60.00

MethoxyMethylsiloxane-Dimethylsiloxane copolymer
methoxy terminated with branch structure CAS: [68440-84-6] TSCA

Code	Viscosity	Mole % Methoxy	Specific Gravity	Price/100g
XMS-5025	200-700	15-25	1.18	$46.00

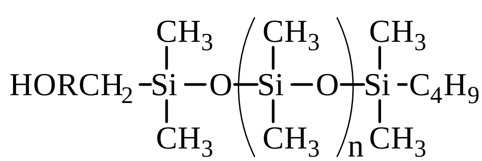
Macromers and Monofunctional Terminated Fluids

Macromers are monofunctional compounds with molecular weights high enough to be considered polymers. Copolymerization of macromers with traditional monomers offers a route to polymers with properties that are usually associated with grafting. Modification of organic polymers with silicon-containing macromers has led to new applications in coatings, synthetic leather, pigment vehicles and cosmetics. Low bleed gels can be formulated from monovinyl terminated siloxanes in addition cure systems.



MonoCarboxydecyl Terminated Polydimethylsiloxane

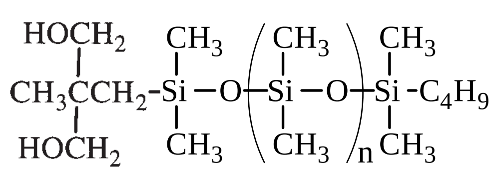
CODE	Viscosity	MW	Refractive Index	Specific Gravity	Price
MCR-B11	10	1000			100g/$180.00
MCR-B16	50-70	5000			100g/$180.00



MonoCarbinol Terminated PolyDimethylsiloxane

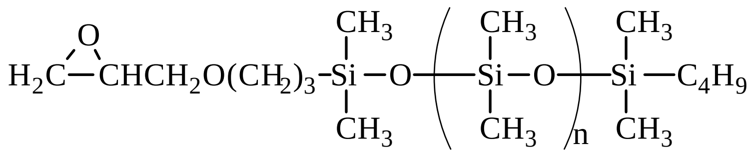
MCR-C12	15-20	1000	1.409	0.96	100g/$120.00
MCR-C13	35-40	550-650	(contains ~50% CH_2CH_2O)	1.02	100g/$60.00
MCR-C18	80-90	5000	1.405	0.97	100g/$140.00
MCR-C22	250	10,000	1.404	0.98	100g/$120.00

MCR-C12, MCR-C18, MCR-C22: hydroxyethoxypropyl terminated, CAS: [207308-30-3] TSCA
MCR-C13:hydroxy(polyethylenoxy)propyl terminated, CAS: [67674-67-3] TSCA



MonoDiCarbinol Terminated PolyDimethylsiloxane					
MCR-C62	100-125	5000	1.409	0.97	100g/$120.00

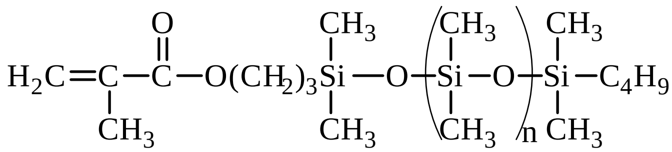
CODE	Viscosity	MW	Refractive Index	Density	Price



Mono-(2,3-Epoxy)Propylether Terminated PolyDimethylsiloxane

CAS: [127947-26-6]

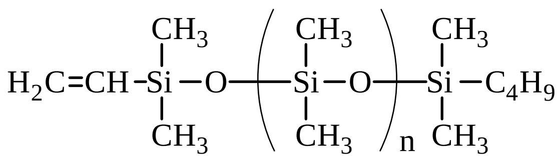
MCR-E11	10-15	1000	1.410	0.96	100g/$186.00
MCR-E21	120	5000	1.408	0.97	100g/$186.00



MonoMethacryloxypropyl Terminated PolyDimethylsiloxane

CAS: [146632-07-7] TSCA

MCR-M11	10	800-1000	1.405	0.96	100g/$110.00
MCR-M17	70-80	5000	1.406	0.97	100g/$180.00



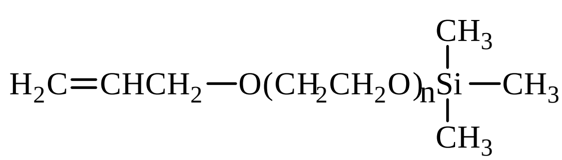
MonoVinyl Terminated PolyDimethylsiloxane

CAS: [68952-00-1]

MCR-V31*	800-1200	25,000-30,000		0.97	100g/$56.00
MCR-V41**	10,000	62,700	1.404	0.98	100g/$164.00

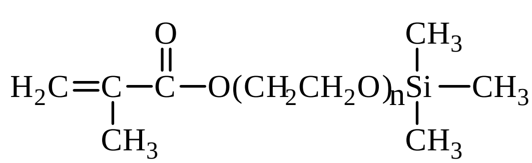
*MCRV31 is approximately 50% monovinyl terminated, with balance mixed divinyl and dimethyl terminated.

** MCRV41 is essentially 100% monovinyl terminated; non functional end is n-butyl terminated.



MonoAllyl-MonoTrimethylsiloxy Terminated Polyethylene Oxide

SIA0479.0		500		1.04	100g/$91.00



MonoMethacryloxy-MonoTrimethylsiloxy Terminated Polyethylene Oxide

SIM6485.9		400		1.02	100g/$96.00

Reactive Silicone Emulsions

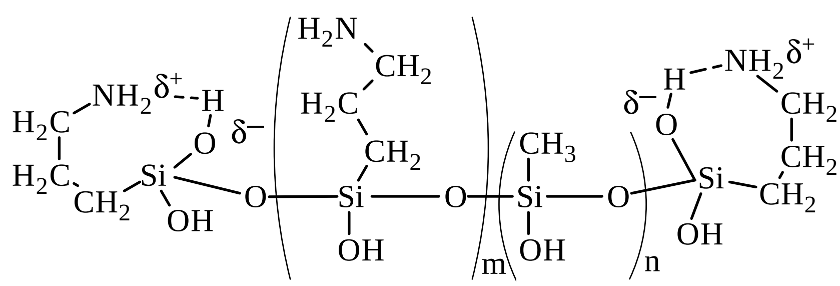
Emulsions of reactive silicones are playing an increasing role in formulation technology for water-borne systems. Primary applications for silicone emulsions are in textile finishes, release coatings and automotive polishes. Silanol fluids are stable under neutral conditions and have non-ionic emulsifiers. Aminoalkylalkoxysiloxanes are offered with cationic emulsifiers.

Reactive Silicone Emulsions

emulsifier content: 3-6% TSCA

Code	silicone class	base fluid viscosity	% solids	emulsion type	Price/100 g	Price/3kg
DMS-S33M50	silanol	3500	50	nonionic	$10.00	$96.00
ATM-1322M50*	diamino/alkoxy		50	cationic	$10.00	$96.00
*0.45mEq/g combined primary and secondary amine						

Water-borne Silsesquioxane Oligomers



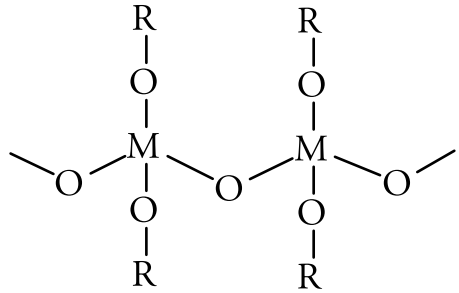
Water-borne silsesquioxane oligomers act as primers for metals, additives for acrylic latex sealants and as coupling agents for siliceous surfaces[1] . The offer both organic group and silanol functionality. These amphoteric materials are stable in water solutions and, unlike conventional coupling agents, have very low VOC's.

Water-borne Silsesquioxane Oligomers TSCA

Code	Functional Group	Mole %	Molecular Weight	Weight % in solution	Specific Gravity	Viscosity	pH	Price/100g	3kg
WSA-7011	Aminopropyl	65-75	250-500	25-28	1.10	5-15	10-10.5	$29.00	435.00
WSA-9911*	Aminopropyl	100	270-550	22-25	1.06	5-15	10-10.5	$24.00	360.00
WSA-7021	Aminoethylaminopropyl	65-75	370-650	25-28	1.10	5-10	10-11	$29.00	435.00

*CAS [29159-37-3]

[1] B. Arkles et al, in "Silanes & Other Coupling Agents," ed. K. L. Mittal, p91. VSP, Utrecht, 1992.



Polymeric Metal Alkoxides

Polymeric metal alkoxides fall into two main classes: oxo-bridged, which can be regarded as partially hydrolyzed metal alkoxides, and alkoxide bridged which can be regarded as organo diester alkoxides. Both classes have the advantages of high metal content and low volatility.

Polymeric metal alkoxides are used primarily as curing agents for 2-part RTV's and in the preparation of binders and coatings including investment casting resins and zinc-rich paints. The latter appplications can be considered as special examples of Sol-Gel technology. *Sol-Gel* is a method for preparing specialty metal oxide glasses and ceramics by hydrolyzing a chemical precursor or mixture of chemical precursors that pass sequentially through a solution state and a gel state before being dehydrated to a glass or ceramic.

Sol-Gel Process Technology and Chemistry

Preparation of metal oxides by the sol-gel route proceeds through three basic steps: 1) partial hydrolysis of metal alkoxides to form reactive monomers; 2) the polycondensation of these monomers to form colloid-like oligomers (sol formation); 3) additional hydrolysis to promote polymerization and cross-linking leading to a 3-dimensional matrix (gel formation). Although presented sequentially, these reactions occur simultaneously after the initial processing stage.

Monomer Formation (Partial Hydrolysis)

$$M(OR)_n + H_2O \longrightarrow (RO)_{n-1}MOH + ROH$$

$$\text{e.g.} \quad Si(OC_2H_5)_4 + H_2O \xrightarrow[\text{catalyst}]{\text{solvent}} (C_2H_5O)_3SiOH + C_2H_5OH$$

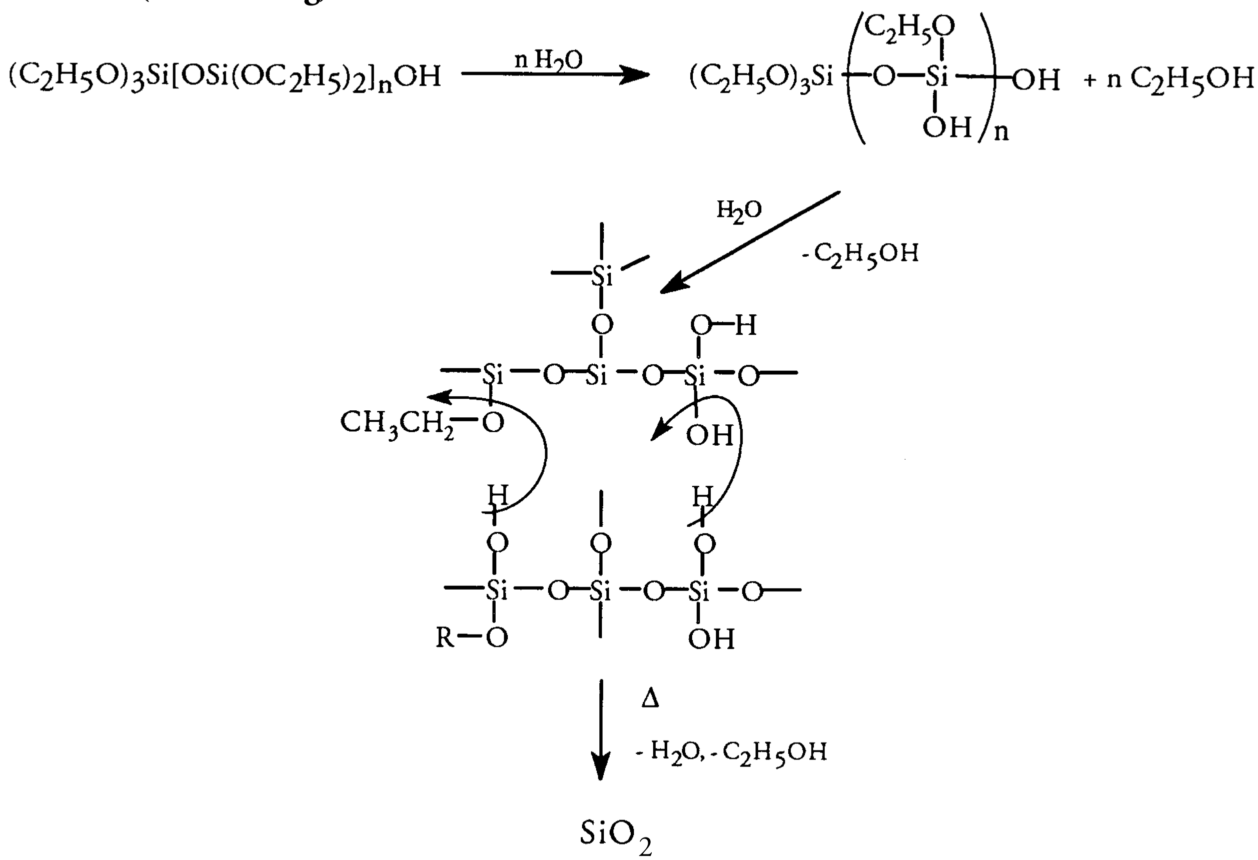
Sol Formation (Polycondensation)

$$2\ (RO)_{n-1}MOH \longrightarrow (RO)_{n-1}M\text{-}O\text{-}M(OR)_{n-2}OH + ROH$$

$$(RO)_{n-1}M\text{-}O\text{-}M(OR)_{n-2}OH \xrightarrow[\text{dimers}]{\text{monomers}} (RO)_{n-1}M\text{-}O\text{-}[M(OR)_{n-2}]_nOH + n\ ROH$$

$$\text{e.g.} \quad n\ (C_2H_5O)_3SiOH \longrightarrow (C_2H_5O)_3Si[OSi(OC_2H_5)_2]_nOH + n\ C_2H_5OH$$

Gelation (Crosslinking)



As polymerization and cross-linking progress, the viscosity of the sol gradually increases until the sol-gel transition point is reached. At this point the viscosity abruptly increases and gelation occurs. Further increases in cross-linking are promoted by drying and other dehydration methods. Maximum density is achieved in a process called densification in which the isolated gel is heated above its glass transition temperature. The densification rate and transition (sintering) temperature are influenced primarily by the morphology and composition of the gel.

REFERENCES

SOL-GEL TECHNOLOGY
C. J. Brinker, G. W. Scherer, Sol-Gel Science, Academic Press, 1990.

C. J. Brinker, D. E. Clark, D. R. Ulrich, Better Ceramics Through Chemistry
(Materials Research Society Proceedings 32) Elsevier, 1984

C. J. Brinker, D. E. Clark, D. R. Ulrich, Better Ceramics Through Chemistry II, III, IV (IV add'l ed. B. J. Zelinski)
(Materials Research Society Proceedings 73, 121, 180) Mat'l. Res. Soc., 1984, 1988, 1990.

L. L. Hench, D. R. Ulrich, Ultrastructure Processing of Ceramics, Glasses and Composites, Wiley, 1984.

L. L. Hench, D. R. Ulrich, Science of Ceramic Processing, Wiley, 1986

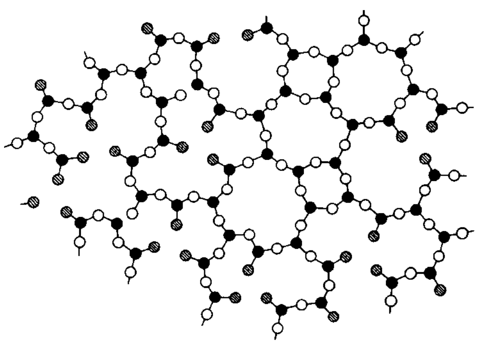
L. C. Klein. Sol-Gel Technology for Thin Films, Fibers, Preforms, and Electronics, Noyes, 1988

Polymeric Metal Alkoxides

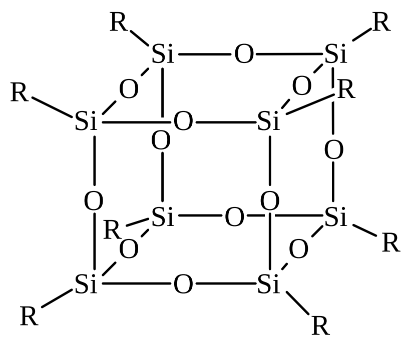
name	metal content	unit M.W.	viscosity, cSt	density
PSI-021				
Poly(DIETHOXYSILOXANE)	20.5-21.5% Si	134.20	4-5	1.05-1.07
[$(C_2H_5O)_2SiO$]	(40-42% SiO_2 equivalent)			
crosslinker for two-component condensation cure (silanol) RTV's.				
[68412-37-3] TSCA		100g/\$9.00	500g/\$28.00	
PSI-023				
Poly(DIETHOXYSILOXANE)	23.0-23.5% Si	134.20	4-5	1.05-1.07
[$(C_2H_5O)_2SiO$]	(48-52% SiO_2 equivalent)			
base for zinc-rich paints				
[68412-37-3] TSCA		100g/\$12.00	500g/\$48.00	
PSI-026				
Poly(DIMETHOXYSILOXANE)	26.0-27.0% Si	106.15	6-9	1.14-1.16
[$(CH_3O)_2SiO$]				
highest SiO_2 content precursor for sol-gel				
[25498-02-6] TSCA		100g/\$32.00	500g/\$128.00	
PSIAL-007				
DIETHOXYSILOXANE -s-BUTYLALUMINATE copolymer	7.5-8.5%Al			0.90-1.00
sol-gel intermediate for aluminum silicates[1].	6.6-7.6% Si			
1. J. Boilot in "Better Ceramics Through Chemistry III, p121				
[68959-06-8] TSCA		100g/\$38.00	500g/\$152.00	
PSITI-019				
DIETHOXYSILOXANE - ETHYLTITANATE copolymer	19.1-19.6% Si		10-25	
[$(C_2H_5O)_2SiO$][$(C_2H_5O)_2TiO$]	2.1-2.3% Ti			
employed in formation of titania-silica aerogels[1].				
1. J. Miller et al, J. Mater. Chem., 5, 1759, 1995				
		25g/\$40.00	100g/\$130.00	
PSIP0-019				
DIETHOXYSILOXANE - ETHYLPHOSPHATE copolymer	19.1-19.6% Si			
[$(C_2H_5O)_2SiO$][$(C_2H_5O)OPO$] hygroscopic	1.4-1.5% P			
[51960-53-3]		25g/\$40.00	100g/\$130.00	
PAN-040				
Poly(ANTIMONY ETHYLENE GLYCOXIDE)	39.8-40.4% Sb	303.55	solid	
	catalyst for transesterification			
[$C_6H_{12}O_6Sb_2$] TSCA		25g/\$12.00	100g/\$39.00	
PTI-023				
Poly(DIBUTYLTITANATE)	22.0-23.0% Ti	210.10	3200-3500	1.07-1.10
[$(C_4H_9O)_2TiO$]	stabilized with ~5% ethylene glycol			
[9022-96-2] TSCA		100g/\$24.00	500g/\$76.00	
PTI-008				
Poly(OCTYLENEGLYCOL-TITANATE)	7.5-7.6% Ti	482.54	1700	1.035
	contains ~5% free 2-ethyl-1,3-hexanediol, oligomeric			
[$OCH_2CHEt(CH_2)_4OTi(CH_2CHEt(CH_2)_4OH)_2$]$_n$		flashpoint: 50°C(122°F)		
[5575-43-9]		25g/\$20.00	100g/\$65.00	

PolySilsesquioxanes and T-Resins
$RSiO_{1.5}$

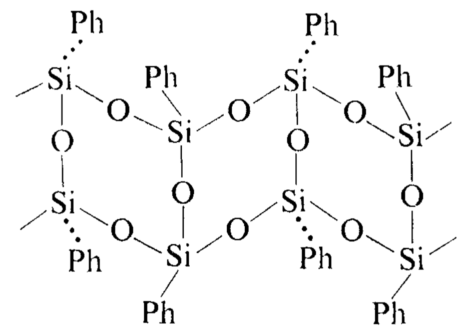
PolySilsesquioxanes and T-resins are highly crosslinked materials with the empirical formula $RSiO_{1.5}$. They are named from the organic group and a one and a half (sesqui) stoichiometry of oxygen bound to silicon. T-resin, an alternate designation, indicates that there are three (Tri-substituted) oxygens substituting the silicon. Both designations simplify the complex structures that have now come to be associated with these polymers. A variety of paradigms have been associated with the structure of these resins ranging from amorphous to cubes containing eight silicon atoms, sometimes designated as T_8 structures. Ladder structures have been attributed to these resins, but the current understanding is that in most cases these are hypothetical rather than actual structures.



Amorphous



T_8 cube



Hypothetical Ladder

Polysilsesquioxanes are used as matrix resins for molding compounds, catalyst supports and coating resins. As dielectric, planarization and reactive ion etch resistant layers, they find application in microelectronics. As abrasion resistant coatings they protect plastic glazing and optics. As preceramic coatings they convert to silicon dioxide, silicon oxycarbide, and silicon carbide depending on the oxidizing conditions for the high temperature thermal conversion.

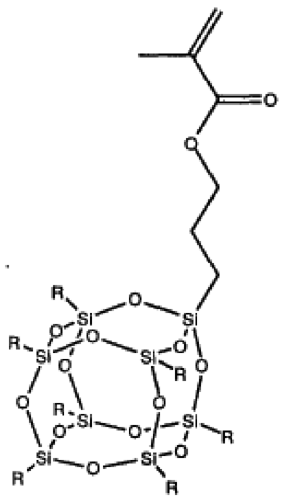
Polysilsesquioxane resins containing silanols (hydroxyls) can be cured at elevated temperatures. Formulation and catalysis is generally performed at room-temperature or below. At temperatures above 40°C most resins soften and become tacky, becoming viscous liquids by 120°C. The condensation of silanols leads to cure and the resins become tough binders or films. The cure is usually accelerated by the addition of 0.1-0.5% of a catalyst such as dibutyltindiacetate, zinc acetate or zinc 2-ethylhexanoate. The resins can also be dispersed in solvents such as methylethylketone for coating applications.

polySilsesquioxanes and T-resins

SST-1

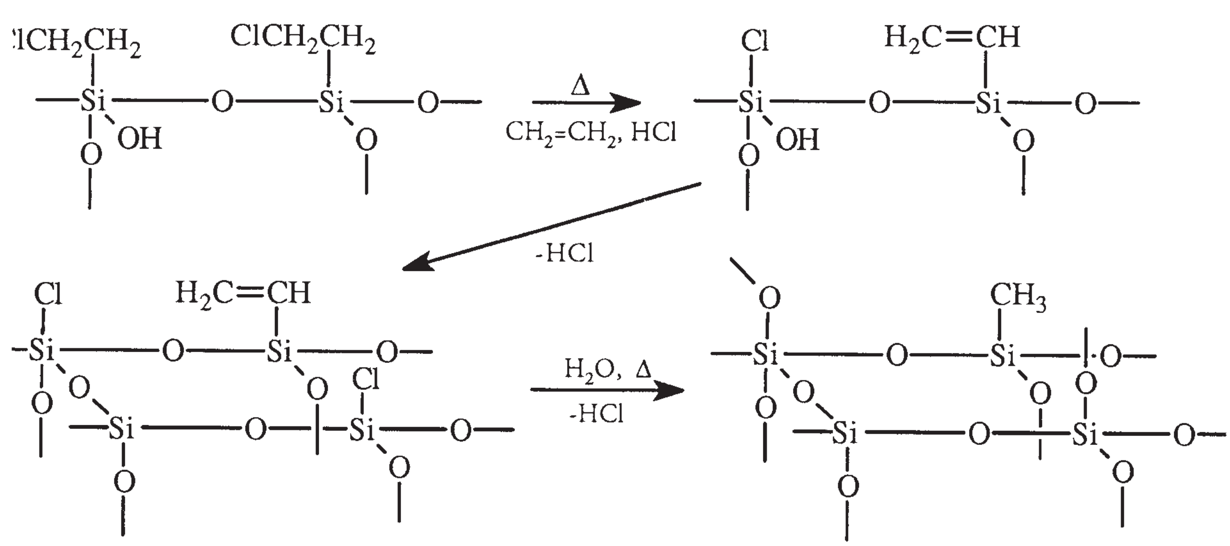
Code	Name	M.W. (approximate)	% (OH)	Refractive Index	Specific Gravity	Price/100g	Price/1kg
SST-3M01	poly(Methylsilsesquioxane)						
	100% Methyl	7000-8000	4.0-6.0	1.42			
	[68554-70-1] TSCA					$50.00	$350.00
SST-3M02	poly(Methylsilsesquioxane)						
	100% Methyl		2.5-4.0		1.08		
	[68554-70-1] TSCA					$22.00	$132.00
SST-3MH1	poly(Methyl-Hydridosilsesquioxane)						
	90% Methyl, 10% Hydride					$140.00	
SST-3P01	poly(Phenylsilsesquioxane)						
	100% Phenyl	1200-1600	4.5-6.5	1.56			
	[70131-69-0] TSCA					$72.00	
SST-3PM1	poly(Phenyl-Methylsilsesquioxane)						
	90% Phenyl, 10% Methyl			1.55			
	[181186-29-8]					$60.00	$420.00
SST-3PM2	(Phenylsilsesquioxane)-(Dimethylsiloxane) copolymer						
	70% Phenyl, 30% DiMethyl		3.0-5.0		1.08		
	[73138-88-2] TSCA					$22.00	$132.00
SST-3PM4	(Phenyl-Methylsilsesquioxane)-(Phenylmethylsiloxane) (Diphenylsiloxane) tetrapolymer						
	85% Silsesquioxane, 15% Siloxane		2.0-3.0		1.08		
	[181186-36-7] TSCA	1400-1600				$60.00	$420.00
SST-3PP1	poly(Phenyl-Propylsilsesquioxane)						
	70% Phenyl, 30% Propyl	1500-1800	3.5-5.5	1.54			
	[68037-90-1] TSCA	(equivalent weight: 400)				$19.00	$114.00
SST-3PV1	poly(Phenyl-Vinylsilsesquioxane)						
	90% Phenyl, 10% Vinyl	1000-1300				$86.00	

Specialty polysilsesquioxanes



Specialty polysilsesquioxanes can be utilized as models and precursors for silica surfaces and zeolites. If a silicon is removed from a T_8 cube, the open position of the remaining T_7 cube can be substituted with catalytically active metals[1]. T_7 cubes can be converted to functionalized T_8 cubes. Functionalized T_8 cubes are sometimes designated POSS (polyhedral oligomeric silsesquioxane) monomers. Methacrylate T_8 cubes can be copolymerized with a variety of monomers to form homopolymers and copolymers. The polymers may be viewed structurally as nanocomposites or hybid inorganic-organic polymers. The cube structures impart excellent mechanical properties and high oxygen permeability.[2] Hydride substituted T_8 cubes can be introduced into vinyl-addition silicone rubbers.[3] T_8 cubes in which all silicon atoms are substituted with hydrogen have demonstrated utility as flowable oxide precursors in microelectronics.

Silsesquioxanes containing β-chloroethyl groups can be converted to silicon dioxide via elimination and hydrolysis at low temperatures or under UV exposure.[4] The thermal reaction cascade for β-substituted silsesquioxanes leading to SiO_2-rich structures with a low level of carbon occurs at temperatures above 180°.



UV exposure results in pure SiO_2 films and suggests that patterning β-substituted silsesquioxane films can lead to direct fabrication of dielectric architectures.

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[1] F. Feher et al, J. Am. Chem. Soc., *111*, 1741, 1989.

[2] J. Lichtenhan et al, Macromolecules, *28*, 8435, 1995

[3] J. Lichtenhan, Comments Inorg. Chem., *17*, 115, 1995

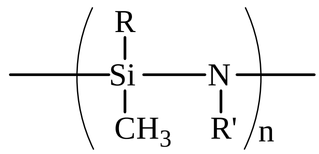
[4] B. Arkles, D. Berry, L. Figge, J. Sol-Gel Sci. & Technol., *8*, 465, 1997

Specialty polySilsesquioxanes

SST-2

Code	Name	M.W. (approximate)	% (OH)	Solubility	Price/1 g	Price/10g
SST-S7C61	poly(Cyclohexylsilsesquioxane), Silanol functional					
	>90% T7 cube	973.69	5.1-5.4	THF, pyridine		
	[4115-83-7]				$54.00	
SST-S7C51	poly(Cyclopentylsilsesquioxane), Silanol functional					
	[135225-24-0] >95% T7 cube	875.50	5.7-5.9	THF, pyridine	$32.00	$220.00
SST-E8C51	poly(Cyclopentylsilsesquioxane), Epoxypropyl substituted					
	T8 cube with polymerizeable functionality					
		957.64		THF, hexane	$52.00	$360.00
SST-H8C51	poly(Cyclopentylsilsesquioxane), Hydride substituted					
	T8 cube active in hydrosilylation reactions			THF, hexane		
		901.27			$39.00	$274.00
SST-R8C51	poly(Cyclopentylsilsesquioxane), Methacryloxypropyl substituted					
	T8 cube with polymerizeable functionality					
	[169391-91-7]	1027.73		THF, hexane	$39.00	$274.00
SST-H8H01	poly(Hydridosilsesquioxane) - T8 with all silicons hydride substituted					
	[137125-44-1]	424.75	17-20% in methylisobutylketone; density:		0.88	$120.00
SST-V8V01	poly(Vinylsilsesquioxane) - T8 with all silicons vinyl substituted					
	69655-76-1	633.04			$36.00	$256.00
Thermally & UV labile polysilsesquioxanes						
SST-BCE1	poly(2-Chloroethylsilsesquioxane) CAS: 188969-12-2					
	converts to SiO2 >300C	800-1400	3.0-5.5	methoxypropanol		$45.00
SST-BBE1	poly(2-Bromoethylsilsesquioxane)					
	converts to SiO2 by UV	1200-2000	2.0-4.0	methoxypropanol		$64.00

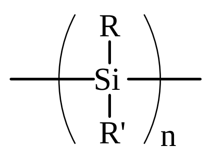
Polysilazanes and Polysilanes



polySILAZANES -(Si-N)-

Polysilazanes are preceramic polymers primarily utilized for the preparation of silicon nitride for thermal shock resistant refractories and dielectric coatings for microelectronics.

PSN-2M01
poly(1,1-DIMETHYLSILAZANE) telomer
[89535-60-4] Tg: -82° >50 cSt. M.W.: 500-900 D_4^{20}: 1.04 10g/$94.00
PSN-2M02
poly(1,1-DIMETHYLSILAZANE) crosslinked
>1000 cSt. % char, 700°: 15-20 10g/$94.00
PSN-2M11
poly(1,2-DIMETHYLSILAZANE)
500-800 cSt. D_4^{20}: 0.99 10g/$96.00



polySILANES -(Si-Si)-

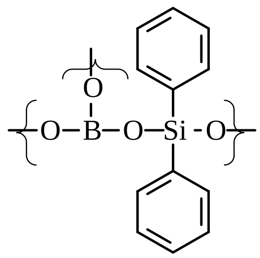
Polysilanes have applications as preceramic polymers and photolabile coatings. Applications for polysilanes with methyl and phenyl group substitution are usually limited to silicon carbide precursors.

PSS-1M01
poly(DIMETHYLSILANE)
[28883-63-8] TSCA Tm: 648° (substantial degradation before mp) 10g/$32.00

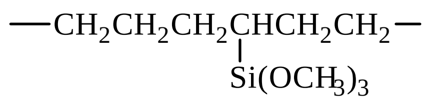
PSS-1P01
(50% DIMETHYLSILANE)(50% PHENYLMETHYLSILANE) copolymer
[70158-17-6] solid 10g/$68.00

PSS-1P11
poly(PHENYLMETHYL)SILANE
Tg: 112-122° 10g/$94.00

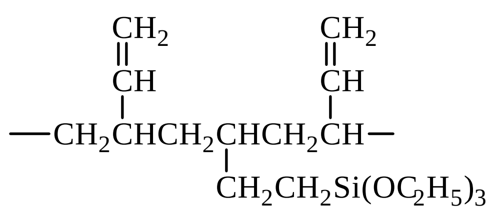
Specialty Silicon Containing Polymers



SSP-040
POLY(BORODIPHENYLSILOXANE) solid, Tg: 95-100°, Tm: 140-1°
employed in preparation of ceramic fibers[1].
1. S. Yajima et al, Nature, 266, 521, 1977
[70914-15-7] TSCA HMIS: 2-0-0-X 25g/$72.00 100g/$234.00



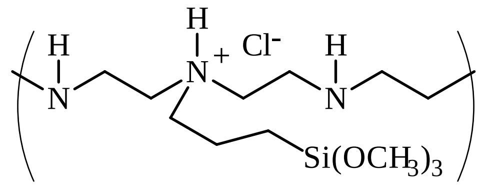
SSP-050
TRIMETHOXYSILYL MODIFIED POLYETHYLENE
0.5-1.2 mole % vinyltrimethoxysilane- ethylene copolymer
melt process temp: 170-200° density: 0.927
moisture crosslinkable thermoplastic
[35312-82-4] TSCA HMIS: 1-1-0-X 100g/$36.00 2kg/$432.00



SSP-055
TRIETHOXYSILYL MODIFIED POLY-1,2-BUTADIENE, 50% in toluene
viscosity: 100-200 cSt. M.W.: 3500-4500 density: 0.90
coupling agent for EPDM resins
[72905-90-9] TSCA HMIS: 2-4-0-X 100g/$60.00 2kg/$780.00

SSP-056
TRIETHOXYSILYL MODIFIED POLY-1,2-BUTADIENE, 50% in volatile silicone
viscosity: 125-175 cSt. M.W.: 3500-4500 density: 0.93
primer coating for silicone rubbers
[72905-90-9] TSCA HMIS: 2-3-0-X 100g/$68.00

SSP-058
DIETHOXYMETHYLSILYL MODIFIED POLY-1,2-BUTADIENE, 50% in toluene
viscosity: 75-150 cSt. M.W.: 3500-4500 density: 0.90
water-tree resistance additive for crosslinkable HDPE cable cladding
HMIS: 2-4-0-X 100g/$86.00



SSP-060

TRIMETHOXYSILYLPROPYL MODIFIED (POLYETHYLENIMINE) 50% in isopropanol

visc: 125-75 cSt density: 0.92

employed as a coupling agent for polyamides[1].

1. B. Arkles et al, SPI 42nd Composite Inst. Proc., 21-C, 1987

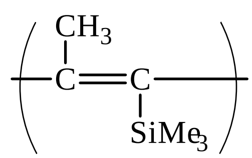
[75132-84-2] TSCA HMIS: 2-4-1-X 100g/$42.00 2kg/$546.00

SSP-065

DIMETHOXYMETHYLSILYLPROPYL MODIFIED (POLYETHYLENIMINE) 50% in isopropanol

visc: 100-200 cSt density: 0.92

[1255441-88-5] TSCA HMIS: 2-4-1-X 100g/$42.00 2kg/$546.00



SSP-070

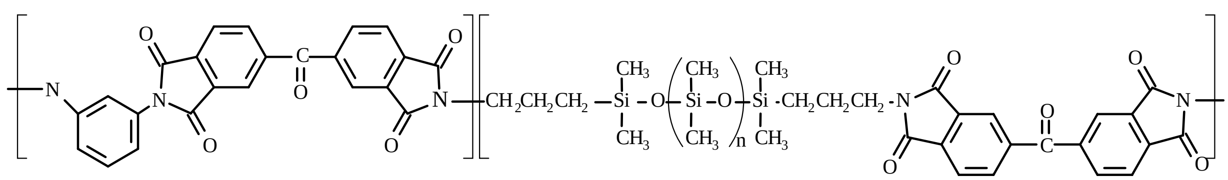
POLY(TRIMETHYLSILYL)PROPYNE

forms viscous 5% solutions in toluene/tetrahydrofuran

high oxygen permeability[1]; PO_2/PN_2 = 1.7

1. T. Masuda et al, J. Am. Chem. Soc., *105*, 7473, 1983

[87842-32-8] HMIS: 1-1-0-X 10g/$190.00



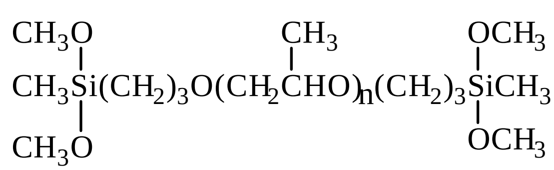
SSP-085

POLY(DIMETHYLSILOXANE)ETHERIMIDE

(35-45% polydimethylsiloxane)phenylenediaminepolyetherimide

thermoplastic; tensile strength: 4000psi Tg: 168°C density: 1.18

[99904-16-2] TSCA HMIS: 1-1-0-X 100g/$120.00



SIB1660.0

BIS[3-METHYLDIMETHOXYSILYL)PROPYL]POLYPROPYLENE OXIDE

visc: 15-20 cSt. M.W. 600-800 density: 1.00

base resin for tin catalyzed moisture-cure RTV's

HMIS: 3-1-1-X 100g/$39.00

Platinum Catalysts for Vinyl-Addition Silicone Cure

The recommended starting point for platinum catalysts is 20ppm platinum or 0.05-0.1 parts of platinum complex per 100 parts of vinyl-addition silicone formulation.

SIP6829.0
PLATINUM CARBONYL CYCLOVINYLMETHYLSILOXANE COMPLEX
3-3.5% platinum concentration in vinylmethylcyclicsiloxanes
catalyst for Si-H addition to olefins. silicone vinyl addition cure catalyst
employed in elevated temperature curing silicones
[73018-55-0] TSCA 2-2-0-X 5.0g/$49.00 25g/$196.00

SIP6830.0
PLATINUM - DIVINYLTETRAMETHYLDISILOXANE COMPLEX
3-3.5% platinum concentration in vinyl terminated polydimethylsiloxane, neutral
catalyst for Si-H addition to olefins. silicone vinyl addition cure catalyst
employed in room temperature curing silicones
[68478-92-2] TSCA 2-2-0-X 5.0g/$39.00 25g/$156.00

SIP6831.0
PLATINUM - DIVINYLTETRAMETHYLDISILOXANE COMPLEX in xylene
2.1-2.4% platinum concentration flashpoint: 38°C (100°F)
“hot” catalyst employed in room temperature curing silicones
[68478-92-2] TSCA 2-3-0-X 5.0g/$39.00 25g/$156.00

SIP6831.1
PLATINUM - DIVINYLTETRAMETHYLDISILOXANE COMPLEX in xylene - LOW COLOR
2.1-2.4% platinum concentration flashpoint: 38°C (100°F)
[68478-92-2] TSCA 2-3-0-X 10.0g/$100.00

SIP6832.0
PLATINUM - CYCLOVINYLMETHYLSILOXANE COMPLEX
3-3.5% platinum concentration in cyclic methylvinylsiloxanes, neutral
catalyst for Si-H addition to olefins. silicone vinyl addition cure catalyst
employed in moderate elevated temperature curing silicones
[68585-32-0] TSCA 2-2-0-X 5.0g/$39.00 25g/$156.00

SIP6833.0
PLATINUM-OCTANALDEHYDE/OCTANOL COMPLEX
2.0-2.5% platinum concentration in octanol
catalyst for Si-H addition to olefins. silicone vinyl addition cure catalyst
increases flammability resistance of silicones
[68412-56-6] TSCA 2-3-0-X 5.0g/$35.00 25g/$140.00

Poisons for platinum catalysts used in vinyl-addition crosslinking must be avoided. Examples are:
Sulfur compounds (mercaptans, sulfates, sulfides, sulfites, thiols
and rubbers vulcanized with sulfur will inhibit contacting surfaces)
Nitrogen compounds (amides, amines, imides, nitriles)
Tin compounds (condensation-cure silicones, stabilized PVC)

Modifiers for Vinyl Addition Silicones

The following are the most common materials employed to modify aspects of platinum-cured vinyl-addition silicones. Other materials are found in the Gelest Metal-Organics, Silane and Silicones catalog.

Inhibitors and Moderators of Hydrosilylation

Product Code	M.W.	b.p.	density	R.I.
SID4613.0 1,3-DIVINYLTETRAMETHYLDISILOXANE $C_8H_{18}OSi_2$	186.40	139° (-99°)mp	0.811	1.4123
	TOXICITY- orl rat, LD50 >12,500mg/kg flashpoint: 24°C(76°F)			
[2627-95-4] TSCA HMIS: 2-4-0-X	50g/$20.00		500g/$140.00	

Product Code	M.W.	b.p.	density	R.I.
SIT7900.0 1,3,5,7-TETRAVINYL-1,3,5,7-TETRA-METHYLCYCLOTETRASILOXANE $C_{12}H_{24}O_4Si_4$	344.66	110°/10 (-43°)mp	0.998	1.4342
	flashpoint: 112°C (234°F) viscosity: 3.9 cSt			
[27342-69-4] TSCA HMIS: 2-1-0-X	25g/$19.00		100g/$62.00	

Adhesion Promoters

Product Code	M.W.	b.p.	density	R.I.
SIA0540.0 ALLYLTRIMETHOXYSILANE $C_6H_{14}O_3Si$	162.26	146-8°	0.963^{25}	1.4036^{25}
	flashpoint: 46°C(115°F)			
[2551-83-9] TSCA HMIS: 3-2-1-X	10g/$24.00		50g/$96.00	

Special Crosslinkers

Product Code	M.W.	b.p.	density	R.I.
SID4582.0 1,3-DIPHENYL-1,1,3,3-TETRAKIS(DIMETHYL-SILOXY)DISILOXANE 95% $C_{20}H_{38}O_5Si_6$	527.03	95-6°/0.25		1.4367
	flashpoint: >110°C(>230°F)			
crosslinker for medium refractive index vinyl addition silicone elastomers				
[66817-59-2] TSCA HMIS: 2-1-1-X		5.0g/$24.00	25g/$72.00	

Diluent Fluids for Gel Hardness and Tactile Response

Product Code		
DMS-T31 polyDIMETHYLSILOXANE, 1000 cSt.	100g/$10.00	3kg/$96.00
ALT-143 polyOCTYLMETHYLSILOXANE, 600-1000 cSt.	100g/$24.00	1kg/$168.00

Crosslinking Agents for Condensation Cure Silicones

Acetoxy Crosslinkers

Code M.W. density

SID2790.0
DI-t-BUTOXYDIACETOXYSILANE 292.40 1.0196
SILICON DI-t-BUTOXIDE DIACETATE (-4°)mp
$C_{12}H_{24}O_6Si$ flashpoint: 95°C (203°F)
adhesion promoter for silicone RTV's
[13170-23-5] TSCA HMIS: 3-2-2-X 50g/$19.00 250g/$76.00

SIE4899.0
ETHYLTRIACETOXYSILANE 243.28 1.143
$C_8H_{14}O_6Si$ (7-9°)mp
flashpoint: 106°C(223°F)
liquid crosslinker for silicone RTV's
[17689-77-9] TSCA HMIS: 3-1-1-X 25g/$12.00 250g/$78.00

SIM6519.0
METHYLTRIACETOXYSILANE, 95% 220.25 1.175
$C_7H_{12}O_6Si$ (40°)mp
vapor pressure, 94°: 9mm flashpoint: 85°C(185°F)
most common cross-linker for condensation cure silicone RTV's
[4253-34-3] TSCA HMIS: 3-2-1-X 50g/$21.00 500g/$148.00

SIM6519.2
METHYLTRIACETOXYSILANE-
ETHYLTRIACETOXYSILANE 80:20 BLEND
liquid crosslinker blend for silicone RTV's
[4253-34-3] 100g/$24.00 1kg/$168.00

SIV9098.0
VINYLTRIACETOXYSILANE 232.26 1.167
$C_8H_{12}O_6Si$ flashpoint: 88°C (190°F)
[4130-08-9] TSCA HMIS: 3-2-1-X 100g/16.00 500g/$64.00

Alkoxy Crosslinkers

SIB1817.0
BIS(TRIETHOXYSILYL)ETHANE 354.59 0.957
HEXAETHOXYDISILETHYLENE
$C_{14}H_{34}O_6Si_2$
additive to formulations that enhances adhesion
[16068-37-4] TSCA HMIS: 3-1-1-X 25g/$22.00 100g/$72.00

SIM6555.0
METHYLTRIETHOXYSILANE 178.30 0.8948
$C_7H_{18}O_3Si$ TOXICITY- oral rat, LD50: 12,500mg/kg
[2031-67-6] TSCA HMIS: 1-3-1-X 25g/$10.00 2.0kg/$100.00

SIM6560.0
METHYLTRIMETHOXYSILANE 136.22 0.955
$C_4H_{12}O_3Si$ (-78°)mp
TOXICITY- oral rat, LD50: 12,500mg/kg
CAUTION: VAPORS CAN CAUSE CORNEAL DAMAGE
viscosity: 0.50 cSt flashpoint: 8°C(46°F)
[1185-55-3] TSCA HMIS: 3-4-1-X 25g/$10.00 2.0kg/$64.00

Code M.W. density

SIT7110.0
TETRAETHOXYSILANE 208.33 0.9335
TETRAETHYLORTHOSILICATE TEOS (-77°)mp
$C_8H_{20}O_4Si$ TOXICITY - oral rat, LD50: 6270mg/kg
flashpoint 46°C (116°F)
vapor pressure, 20°: 11.8mm viscosity: 0.8 cSt
[78-10-4] TSCA HMIS: 2-1-1-X 100g/$10.00 3kg/$56.00

SIT7777.0
TETRA-n-PROPOXYSILANE 264.44 0.9158
$C_{12}H_{28}O_4Si$ (<-80°)mp
flashpoint: 95°C (203°F) viscosity: 1.66 cSt
[682-01-9] TSCA HMIS: 2-2-1-X 100g/$14.00 1.5 kg/$130.00

SIV9220.0
VINYLTRIMETHOXYSILANE 148.23 123° 0.970
$C_5H_{12}O_3Si$ TOXICITY- oral rat, LD50: 11,300mg/kg
VAPORS DANGEROUS TO EYES
viscosity: 0.6 cSt flashpoint: 23°C (73°F)
[2768-02-7] TSCA HMIS: 3-4-1-X 25g/$10.00 1.5kg/$96.00

Oxime Crosslinkers

SIM6590.0
METHYLTRIS(METHYLETHYLKETOXIMINO)- 301.46 0.982
SILANE *METHYLTRIS(2-BUTANONEOXINO)SILANE*
$C_{13}H_{27}N_3O_3Si$ TOXICITY- oral rat, LD50: 2000-3000mg/kg
flashpoint: 90°C (194°F)
neutral crosslinker for condensation cure silicones
[22984-54-9] TSCA HMIS: 2-2-1-X 100g/$15.00 2kg/$160.00

SIV9280.0
VINYLTRIS(METHYLETHYLKETOXIMINO)- 313.47 0.982
SILANE
$C_{14}H_{27}N_3O_3Si$
[2224-33-1] TSCA HMIS: 3-3-1-X 50g/$15.00 1.5kg/$180.00

Enoxy (Acetone) Crosslinkers

SIV9209.0
VINYLTRIISOPROPENOXYSILANE 226.35
$C_{11}H_{18}O_3Si$
[15332-99-7] HMIS: 3-1-1-X 10g/$40.00 50g/$160.00

Amino and Benzamido Crosslinkers

SIB1610.0
BIS(N-METHYLBENZAMIDO)ETHOXYMETHYL- 356.50
SILANE, 90%
$C_{19}H_{24}N_2O_3Si$
[16230-35-6] TSCA HMIS: 2-1-1-X 25g/$23.00 100g/$75.00

SIT8710.0
TRIS(CYCLOHEXYLAMINO)METHYLSILANE 337.62
$C_{19}H_{39}N_3Si$ flashpoint: 110°C(230°F)
[15901-40-3] TSCA HMIS: 3-2-1-X 25g/$54.00 100g/$176.00

Tin Catalysts for Silicone Condensation Cure RTV's

name M.W. d^{20}

SNB1100
BIS(2-ETHYLHEXANOATE)TIN 95% 405.11 1.28
TIN II OCTOATE contains free 2-ethylhexanoic acid
$C_{16}H_{30}O_4Sn$ TOXICITY - orl rat, LD50: 5,810 mg/kg
catalyst for two-component condensation RTV's
highest activity, short pot life,
does not cause silicone reversion
use level: 0.1-0.3%
[301-10-0] TSCA HMIS: 2-1-1-X 100g/$10.0 1 kg/$54.00

SNB1101
BIS(2-ETHYLHEXANOATE)TIN, 50% 405.11 1.12
in polydimethylsiloxane *TIN II OCTOATE*
$C_{16}H_{30}O_4Sn$
predilution results in better compatibility with silicones
[301-10-0] TSCA HMIS: 2-1-1-X 100g/$12.00 1kg/$84.00

SNB1710
BIS(NEODECANOATE)TIN 85% 461.23 1.16
TIN II NEODECANOATE contains free neodecanoic acid
$C_{20}H_{38}O_4Sn$ dark viscous liquid
catalyst for two-component condensation RTV's
slower than SNB1100
does not cause reversion
use level: 0.2-0.4%
[49556-16-3] TSCA HMIS: 2-1-0-X 50g/$19.00 250g/$76.00

SND2930
DI-n-BUTYLBIS(2-ETHYLHEXYL-
MALEATE)TIN 687.46 1.145
DIBUTYLTIN DIISOOCTYLMALEATE
$C_{32}H_{56}O_8Sn$
catalyst for one-component RTV's
good adhesion to metal substrates
[25168-21-2] TSCA HMIS: 2-2-0-X 50g/$10.00 250g/$40.00

SND2950
DI-n-BUTYLBIS(2,4-PENTANEDIONATE)TIN 431.13 1.2
$C_{18}H_{32}O_4Sn$ flashpoint: 91°C (196°F)
stable tin^{+4} catalyst with reduced reversion
can be used in conjunction with SND3260
catalyst in silicone RTV cures[1,2].
1. T. Lockhardt et al, US Pat. 4,517,337, 1985
2. J. Wengrovius, US Pat. 4,788, 170, 1988
[22673-19-4] TSCA HMIS: 2-2-1-X 25g/$24.00 100g/$78.00

SND3110
DI-n-BUTYLBUTOXYCHLOROTIN, 95% 341.48
$C_{12}H_{27}ClOSn$
catalyst for two-component condensation cure silicone RTV's[1].
1. R. Chadho et al, US Pat. 3,574,785, 1971
[14254-22-9] TSCA HMIS: 3-2-1-X 25g/$24.00 100g/$78.00

name M.W. d^{20}

SND3160
DI-n-BUTYLDIACETOXYTIN, 95% 351.01 1.320
DIBUTYLTINDIACETATE (-10°)mp
$C_{12}H_{24}O_4Sn$ TOXICITY - oral mus, LD50: 109.7mg/kg
flashpoint: 143°C (290°F)
high activity catalyst for one-component condensation RTV's
suitable for acetoxy cure and neutral alkoxy cure
use level 0.1-0.3%
[1067-33-0] TSCA HMIS: 3-1-1-X 25g/$10.00 500g/$78.00

SND3260
DI-n-BUTYLDILAURYLTIN 631.55 1.066
DIBUTYLTIN DILAURATE
TOXICITY-orl rat, LD50: 175-1600mg/kg
$C_{32}H_{64}O_4Sn$ flashpoint: 231°C (448°F)
viscosity, 25°: 31-4 cSt
widely used catalyst for two-component condensation RTV's
moderate activity, longer pot life, employed in silicone emulsions
FDA allowance as curing catalyst for silicones- 21CFR121.2514
use level: 0.2-0.6%
[77-58-7] TSCA HMIS: 2-1-1-X 100g/$11.00 1kg/$58.00

SND4220
DIMETHYLDINEODECANOATETIN, 95% 491.26 1.136
DIMETHYLTIN DINEODECANOATE
TOXICITY- oral rat, LD50: 1470mg/kg
$C_{22}H_{44}O_4Sn$ flashpoint: 153°C (307°F)
catalyst for one- and two-component condensation RTV's
use level: 0.5-0.8%
[68928-76-7] TSCA HMIS: 2-1-0-X 50g/$12.00 250g/$44.00

SND4240
DIMETHYLHYDROXY(OLEATE)TIN 85% 447.23 1.15
$C_{20}H_{40}O_3Sn$ viscous liquid
TOXICITY - oral rat, LD50: 800mg/kg
elevated temperature catalyst for condensation cure silicones
use level: 0.8-1.2%
[43136-18-1] TSCA HMIS: 2-1-0-X 25g/$12.00 100g/$40.00

SND4430
DIOCTYLDILAURYLTIN 95% 743.76 0.998
DIOCTYLTINDILAURATE
TOXICITY - oral rat, LD50: 6450mg/kg
$C_{40}H_{80}O_4Sn$ flashpoint: 70°C (158°F)
low toxicity tin catalyst
moderate activity, longer pot life
applications in silicone emulsions and solvent based adhesives
use level: 0.8-1.3%
[3648-18-8] TSCA HMIS: 2-2-1-X 25g/$14.00 100g/$46.00

Titanate Catalysts for Alkoxy and Oxime Neutral Cure RTV's

name	MW	b.p./mm(m.p.)	d^{20}	n^{20}

AKT853
TITANIUM DI-n-BUTOXIDE (BIS-2,4-PENTANEDIONATE) 73% in n-butanol — 392.32 — 0.995
flashpoint: 33°C(91°F)
$C_{18}H_{32}O_6Ti$
[16902-59-3] TSCA HMIS: 2-3-1-X — 100g/$30.00 — 500g/$120.00

AKT853.2
TITANIUM DI-n-BUTOXIDE (BIS-2,4-PENTANEDIONATE) 70% in polydimethylsiloxane — 392.32 — 1.00
$C_{18}H_{32}O_6Ti$ compatible with acetoxy and oxime cure silicones
[16902-59-3] TSCA HMIS: 2-2-1-X — 100g/$34.00 — 500g/$136.00

AKT855
TITANIUM DIISOPROPOXIDE(BIS-2,4-PENTANEDIONATE) 75% in isopropanol — 364.26 — 0.992 — 1.4935
TOXICITY- oral rat, LD50: 2,870mg/kg
$C_{16}H_{28}O_6Ti$ *TIACA*
flashpoint: 12°C (54°F)
miscible: aqueous acetone, most organics
viscosity, 25°: 8-11 cSt
[17927-72-9] TSCA HMIS: 2-3-1-X — 100g/$10.00 — 500g/$29.00

AKT865
TITANIUM DIISOPROPOXIDE BIS(ETHYLACETOACETATE) 95% — 452.02 — 1.05
TOXICITY - oral rat, LD50: 23,020 mg/kg
$C_{18}H_{32}O_8Ti$ 11.0 - 11.2% Ti
viscosity, 25°: 45-55 cSt
flashpoint: 27°C (80°F)
[27858-32-8] TSCA HMIS: 2-3-1-X — 100g/$12.00 — 500g/$48.00

AKT867
TITANIUM 2-ETHYLHEXOXIDE — 564.79 — 194°/0.25 — 0.937 — 1.482
TETRAOCTYLTITANATE 8.4-8.6% Ti
viscosity, 25°: 120-130 cSt.
$C_{32}H_{68}O_4Ti$
flashpoint: 60°C (140°F)
catalyst for silicone condensation RTV's
[3061-42-5] TSCA HMIS: 2-2-1-X — 100g/$10.00 — 2kg/$60.00

AKT889
TITANIUM TRIMETHYLSILOXIDE — 404.66 — 110°/10 — 0.900 — 1.4278
TETRAKIS(TRIMETHYLSILOXY)TITANIUM
flashpoint: 51°C (124°F)
$C_{12}H_{36}O_4Si_4Ti$
[15990-66-6] HMIS: 2-2-1-X — 25g/$32.00 — 100g/$104.00

Peroxide Catalysts for Heat-Cured Silicone Rubber

SID3352.0
2,4-DICHLOROBENZOYL PEROXIDE, — MW: 380.00 — density: 1.26
50% in polydimethylsiloxane paste consistency
silicone compounding temp. <50°; cure temp. >90°; recommended cure temp: 105-120°
[133-14-2] TSCA HMIS: 3-4-1 — 100g/$34.00 — 500g/$136.00

SID3379.0
DICUMYL PEROXIDE, 25% — MW: 259.29
in polydimethylsiloxane, 40% w/ calcium carbonate, 35%
silicone compounding temp. <60°; cure temp. >125°; recommended cure temp: 155-175°
$C_{18}H_{11}O_2$
[80-43-3] TSCA HMIS: 2-3-2-X — 100g/$37.00 — 500g/$148.00

Pigments and Coloration

Pigment concentrates in silicone oil are readily dispersed in all silicone cure systems. Pigments are generally mixed at 1-4 parts per hundred with the A part of two part vinyl addition silicones. Silicone coatings generally employ 2-6 parts per hundred.

Pigment Concentrates (dispersed in silicone)

Code	Color	Concentration	Price/100g	Price/1kg
PGWHT01	White	45%	$30.00	$180.00
PGRED01	Red	50%	$30.00	$180.00
PGORR01	Orange-Red	45%	$30.00	$180.00
PGYLW01	Yellow	55%	$30.00	$180.00
PGGRN01	Green	55%	$30.00	$180.00
PGBLU01	Blue	45%	$30.00	$180.00
PGFLS01	Flesh	60%	$30.00	$180.00
PGBRN01	Brown	55%	$30.00	$180.00
PGBLK01	Black - nonconductive	55%	$30.00	$180.00
PGBLK02	Black - conductive	45%	$30.00	$180.00

Dyes in silicone oils provide coloration without compromising transparency. The fluids may be used directly in applications such as gauges or as tints for silicone elastomers.

DMS-T21BLU (Blue dye in 100cSt. silicone) 1kg/$64.00
DMS-T21RED (Red dye in 100cSt. silicone) 1kg/$64.00

Fillers and Reinforcements

Hexamethyldisilazane treated silica is the preferred filler for silicones. The material is very fine and hydrophobic. Enclosed high-shear compounding equipment is required for adequate dispersion.

Product Code	M.W.	density

SIC2050.0
CALCIUM METASILICATE 116.16 2.9
WOLLASTONITE hardness: 4.5-5
CaO_3Si
weakly reinforcing filler for silicone rubbers- suitable for putty
[13983-17-0] TSCA HMIS: 1-0-0-X 500g/$15.00 2.5kg/$30.00

SIS6962.0
SILICON DIOXIDE, AMORPHOUS 60.09 2.2
HEXAMETHYLDISILAZANE TREATED
FUMED SILICA, HMDZ TREATED surface area, 200m^2/g
SiO_2 ultimate article size: 0.02m
reinforcing filler for high tear strength silicone rubbers
[68909-20-6] TSCA HMIS: 2-0-0-X 500g/$24.00 2kg/$78.00

SIS6964.0
SILICON DIOXIDE, CRYSTALLINE 60.09 2.65
QUARTZ POWDER TOXICITY- oral- rat, LD50: 3160mg/kg
SiO_2 hardness: 7.0
[7631-86-9] TSCA HMIS: 1-0-0-X 500g/$10.00