ADVANCED TECHNOLOGIES –
OPTOELECTRONICS AND ELECTRONICS
PRODUCT GUIDE

avantor™ | NuSil™

Optoelectronics and electronics silicones

Silicones that are sharper, brighter and pure

SUPERIOR PERFORMANCE FROM SILICONE INDUSTRY LEADERS

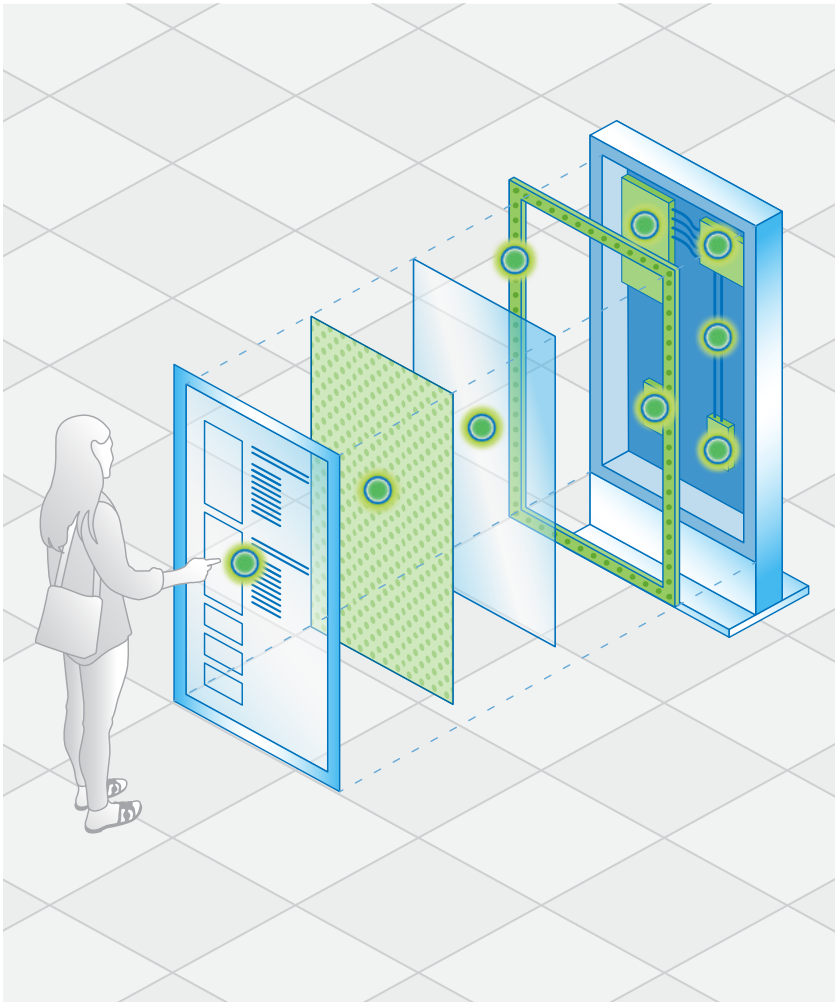
As one of the original pioneers in silicones for LEDs, NuSil® has served customers for decades with formulations for demanding environments and applications. We continue to develop silicones to meet the increasing demands for cutting-edge solutions, including optically clear, temperature-resistant and high-purity products, in the optoelectronics and electronics industry.

Customers can rely on our deep experience to provide highly customized solutions to each project's unique specifications. Our ability to customize allows us to design silicones that fit customers' processes, rather than forcing them to adapt to our products. This translates into solutions that are rapidly and economically scalable to accelerate time to market.

Applications

From smartphones to stadium screens, NuSil® brand silicones are ideal for a wide range of uses. Leading applications for our broad portfolio of standard and customized silicones include:

- Next-generation displays
- General electronics assembly
- Sensors
- Gaskets



CUSTOMIZATION MASTERED

NuSil customers can rely on our proven expertise and extensive support systems to meet their unique needs throughout the entire commercialization process. With tested processes, proprietary equipment and over 3000 products available for customization, we guide customers to the right silicone for their application. We work with manufacturers to seamlessly integrate our silicones into their processes.

NUSIL SUPPORT

We develop our silicones to meet or exceed industry and international quality, reliability and consistency standards with comprehensive, documented systems. NuSil is ISO 9001 certified to ensure consistent manufacturing processes and quality standards. We also support customers with testing and documentation for RoHS and REACH compliance.

Silicones for optoelectronics and electronics

HIGH-PURITY SILICONES THAT BRING CLARITY TO DEVICES & SUBASSEMBLIES

As end-users demand better reliability and longer operating life from optoelectronic and electronic devices, our customers need high-purity silicones refined to virtually eliminate common impurities. Our chemists develop silicones that absorb stress while allowing greater light output and viewing angles. NuSil® silicones can also improve the ruggedness of displays used in challenging environments.

For applications that require optically clear materials, we have developed specialty silicones in a wide range of refractive indices for displays. Our optically clear silicones enable displays that are sharper, brighter and more durable.

Leading optoelectronics and electronics manufacturers use our comprehensive line of high-purity silicones to reliably protect sensitive components while improving performance and extending their life.

OPTICALLY CLEAR MATERIALS

From bigger, brighter displays to wearable devices, our silicones are optimized for applications that require greater light output and optical stability.

POTTING AND ENCAPSULATING

The size of electronics continues to shrink even as they grow in complexity. Our encapsulants provide a reliable, low-stress alternative for electronic packaging.

ADHESIVES AND SEALANTS

From precise bond line control to minimal cleanup, our adhesives and sealants bond to a wide variety of substrates and are engineered to boost manufacturing throughput.

ELECTRICALLY CONDUCTIVE AND THERMALLY CONDUCTIVE

Whether optoelectronic and electronic devices need protection from static accumulation and discharge or thermal management, NuSil silicones safeguard sensitive components.

FLUOROSILICONES

Engineered to reliably operate in a broad temperature range, our fluorosilicones protect components, even under prolonged exposure to damaging solvents, like fuel.

Optically clear materials

Description

Optical clarity is essential when manufacturing LEDs, LCDs and other displays that will be viewed from multiple angles and in varying light conditions. NuSil® helps manufacturers by offering one of the industry's widest ranges of Refractive Index (RI) silicones, from 1.38 to 1.54. These options allow engineers to increase viewing angle and brightness to reduce power consumption.

Applications

Our optically clear materials, which include molding elastomers, adhesives and other formulations, are commonly used in a wide variety of displays, such as next-generation screens that are thinner and brighter.

OPTICALLY CLEAR MATERIALS

MOLDING ELASTOMERS

PRODUCT NUMBER	REFRACTIVE INDEX at 589 nm	DUROMETER TYPE A	VISCOSITY (cP/mPa·s)	TENSILE psi (mPa)	ELONGATION %	SPECIAL FEATURES
LS1-6140	1.41	50	3200	900 (6.2)	90	For casting, low compression molding and dispensing. Low volatility and requires heat to cure.
LS1-6941	1.41	50	62500	750 (5.2)	305	For liquid-injection molding and casting. Requires heat to cure.
LS-8941	1.41	80	21500	1250 (8.6)	65	For liquid-injection molding, compression molding and casting. Requires heat to cure.

ADHESIVES & SEALANTS - TWO-PART

PRODUCT NUMBER	REFRACTIVE INDEX at 589 nm	VISCOSITY (cP/mPa·S)	LAP SHEAR psi (mPa)	DUROMETER TYPE A	TENSILE psi (mPa)	ELONGATION %	WORK TIME	SPECIAL FEATURES
LS2-6140	1.41	3000	390 (2.7)	47	940 (6.5)	125	> 8 h	Primerless adhesion and tested per UL 94 and passed V-0 at 3.7 mm. Low volatility for use in high-temperature environments.
LS-6943	1.43	5400	–	40	900 (6.2)	120	~ 2 h	Broad operating temperature, optically robust
LS-6946	1.46	37500	510 (3.5)	30	675 (4.7)	275	2 h	Tough elastomer that index matches fused glass

POTTING & ENCAPSULATING GELS

PRODUCT NUMBER	REFRACTIVE INDEX at 589 nm	VISCOSITY (cP/mPa·s)	PENETRATION (mm) DUROMETER	WORK TIME	SPECIAL FEATURES
LS-3238	1.38	1500	15 (00)	11 h	Firm fluorosilicone gel. Resistant to hydrocarbon solvents.
GEL-8136	1.40	450	13 mm	2 h	RTV or cures rapidly with heat. High tack.
LS4-3441	1.40	500	35 (00)	5 h	Optically robust in harsh environments, low viscosity, very firm
LS-3441	1.40	14500	0.3 mm	24 h	–
LS1-3443	1.43	650	8 mm	2 h	Optically robust, recommended for high-temperature environments
LS-3246	1.46	1000	10 (00)	8 h	Index matches fused glass
LS1-3252	1.52	425	25 (00)	~ 3 h	Index matches borosilicate-crown glass (BK7)
LS-3354	1.54	8000	75 (000)	~ 2 h	Low permeability and high refractive index
LS3-3354	1.54	8000	75 (000)	~ 2 h	Designed to have improved adhesion

POTTING & ENCAPSULATING ELASTOMERS

PRODUCT NUMBER	REFRACTIVE INDEX at 589 nm	VISCOSITY (cP/mPa·s)	DUROMETER TYPE A	TENSILE psi (mPa)	ELONGATION %	WORK TIME	MIX RATIO	SPECIAL FEATURES
LS-6140	1.41	3125	50	850 (5.9)	90	3 h	1:1	Low volatility
LS1-6140	1.41	3200	50	900 (6.2)	90	> 8 h	1:1	Low volatility and requires heat to cure. Designed for dispensing.
R-2613	1.41	5500	45	1140 (8.0)	150	2 h	10:1	RTV or cures rapidly with heat within 48 hours. Tested to UL 94 V-0.
LS-6941	1.41	5800	50	1300 (9.0)	95	5 h	10:1	Heat not required to cure

Potting and encapsulating

Description

NuSil silicones protect optoelectronic and electronic components from damaging elements, such as moisture, contaminants, shock and heat. For electronics with more complex geometries, our low modulus gels and lightweight foams protect components from warping and wire bonds from shearing. We also provide elastomers for stability and surface protection as well as conformal coatings that extend the operating life of circuit boards.

Applications

Potting and encapsulation materials are found in a wide range of assemblies, such as general assembly and sensors as well as vehicle and avionics equipment. They are also suitable for modules, relays and a variety of AC/DC converters, including high-power and planar packages.

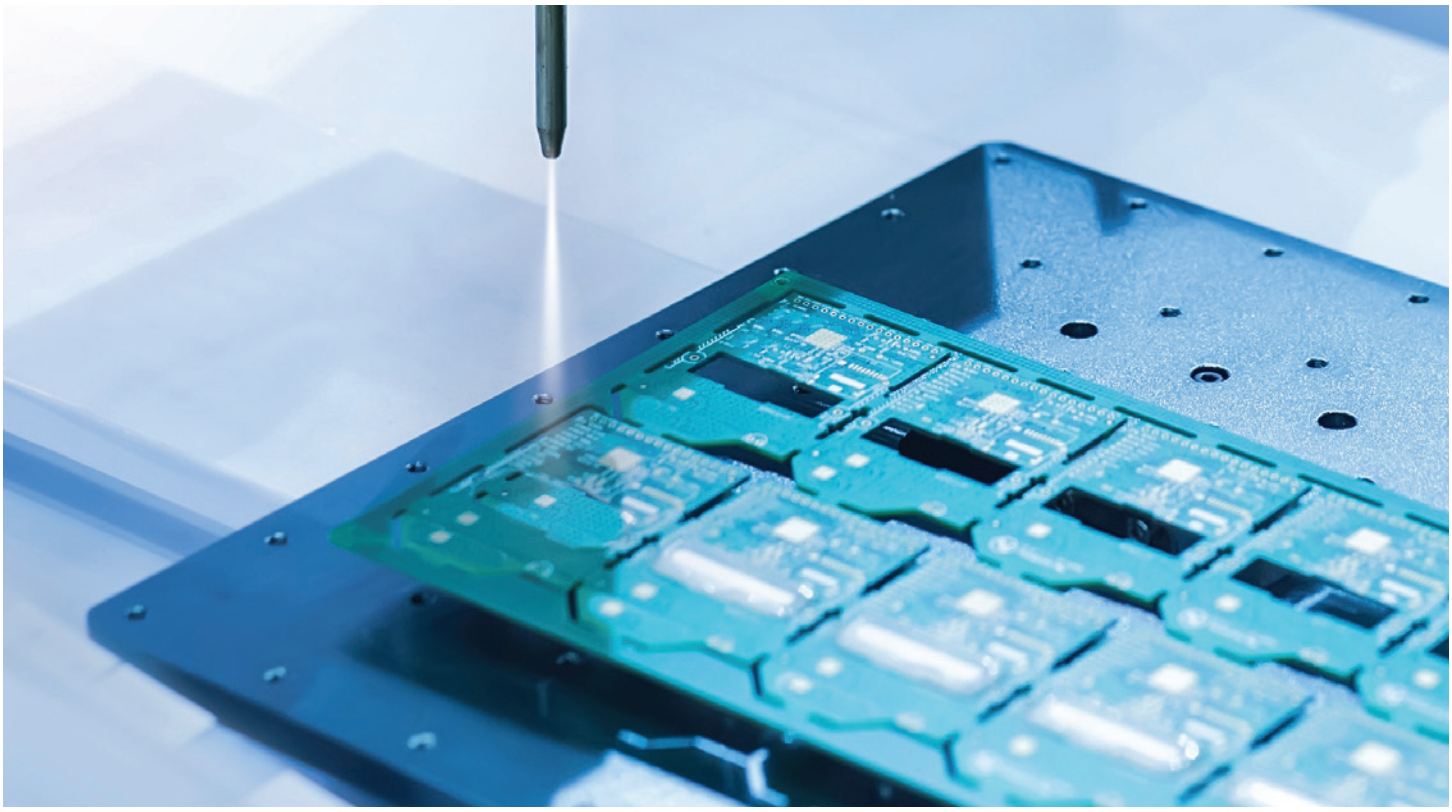
POTTING & ENCAPSULATING MATERIALS

GELS

PRODUCT NUMBER	VISCOSITY (cP/mPa·s)	PENETRATION (mm)	WORK TIME	SPECIAL FEATURES
GEL-8136	450	13	2 h	RTV or cures rapidly with heat. High tack.
GEL-8150	500	5	4 h	Cures with heat
GEL8-8150	500	5	1.5 h	RTV in 48 hours or cures rapidly with heat
GEL-8100	535	9	> 24 h	Very soft, flows when cured
GEL-8111	535	10	> 24 h	Low volatility, very soft
GEL-8170	600	8	6 h	-
LS1-3443	650	8	2 h	RTV, or cures rapidly with heat, high tack gel with broad operating temperature.
GEL1-8155	14500	0.4	24 hr	Very firm

ELASTOMERS

PRODUCT NUMBER	APPEARANCE	VISCOSITY (cP/mPa·s)	DUROMETER TYPE A	TENSILE psi (mPa)	ELONGATION %	WORK TIME	MIX RATIO	SPECIAL FEATURES
R-2613	Clear	4000	45	1140 (7.9)	140	6.5 h	10:1	RTV or cures rapidly with heat within 48 hrs. Tested per UL 94 and passed V-0 at 4.6 mm.
R-2615	Clear	5300	50	1300 (9.0)	100	4 h	10:1	Pourable and RTV or cures rapidly with heat
R21-2615	Clear	25000	75	1200 (8.3)	65	2 h	1:1	Requires minimum 40° C to cure
R-2188	Translucent	11000	20	475 (3.3)	350	> 8 h	1:1	Excellent dielectric properties for medium- and low-power electronics. Flexible cure. Tested to UL 94 V-1.
CF19-2186	Translucent	75000	25	1100 (7.6)	600	15 m	1:1	Excellent dielectric properties for actuators
R-2560	Red	31000	55	700 (4.8)	125	1 h	100:0.5	Resists breakdown at high temperatures. Not recommended for deep section cures.
R-2160	Red	250000	20	750 (5.2)	625	50 m	10:1	Flowable, high-performance elastomer at elevated temperatures
R-2175	Black	2100	50	525 (3.5)	130	1 h	1:1	Flowable. RTV. 0.4 W/m·K. Fast cure version available.
R-2165	Gray	4000	60	500 (3.4)	100	10 m	1:1	Flowable. RTV. 0.6 W/m·K. Fast cure and white version available.



COATINGS							
PRODUCT NUMBER	CURE SYSTEM	VISCOSITY (cP/mPa·s)	DUROMETER TYPE A	PERCENT SOLIDS %	TENSILE psi (mPa)	ELONGATION %	SPECIAL FEATURES
R-2180	Platinum	3075	40	20	1700 (11.7)	1050	High-strength coating, requires heat to cure
R-1008-0	Oxime	1300	20	70	235 (1.6)	220	Suitable for dip casting into thin films without further dilution
EPM-2850	Oxime	7400	16	100	80 (0.6)	200	Low volatility. Solventless coating. For applications requiring a broader operating temperature range. RTV or cures rapidly with heat.

FOAMS						
PRODUCT NUMBER	FOAM DENSITY lbs/ft³ (g/cm³)	VISCOSITY (cP/mPa·s)	WORK TIME	COLOR	MIX RATIO	SPECIAL FEATURES
R-2360	12 (0.2)	40000	2 m	White	1:1	Tough
SFM5-2350	25 (0.4)	55000	20 m	Gray	1:1	Tested per UL 94 and passes V-0 at 4.8 mm
CF3-2350	25 (0.4)	100000	20 m	Black	1:1	–

All foams are platinum cure

Processing tips

Blend both components of the material into a homogenous mixture and de-air, if necessary, to remove bubbles. Foams do not require a de-airing process. Gels may need to be mixed longer and more aggressively compared to other silicone systems due to their low viscosity.

Note: Heat can easily be generated during the mixing process, which can cause an adverse effect on pot life.

Adhesives and sealants

Description

From next-generation adhesives to traditional liquid adhesives, our silicones are developed to maximize manufacturing throughput, so products go to market faster. We work closely with customers to identify the right silicone adhesive for their application, balancing competing factors like energy consumption, weight reduction, longer operating life and high operating temperatures.

Applications

Manufacturers rely on our silicone adhesives — from assemblies in the development stage to devices in mass production — for a variety of applications. We develop products that are ideal for general electronics assembly and complex components or those used in harsh environments.

ADHESIVES & SEALANTS

ONE-PART

PRODUCT NUMBER	APPEARANCE	CURE SYSTEM	VISCOSITY (cP/mPa·s) EXTRUSION RATE (g/minute)	LAP SHEAR psi (mPa)	DUROMETER TYPE A	TENSILE psi (MPa)	ELONGATION %	TACK-FREE TIME	SPECIAL FEATURES
R-1130	Translucent	Oxime	Thixotropic	485 (3.3)	35	850 (5.9)	325	25 m	Recommended for polycarbonate (PC) substrates
R-1600	Translucent	Oxime	80 g/minute	205 (1.4)	50	545 (3.8)	240	25 m	For applications requiring a broader operating temperature range

TWO-PART

PRODUCT NUMBER	MIX RATIO	VISCOSITY (cP/mPa·s) EXTRUSION RATE (g/minute)	ADHESION LAP SHEAR psi (mPa)	DUROMETER TYPE A	TENSILE psi (mPa)	ELONGATION %	WORK TIME	COLOR	PRIMERLESS ADHESION	SPECIAL FEATURES
LS2-6140	1:1	3000	390 (2.7)	47	940 (6.5)	125	> 8 h	Clear	•	Low volatility and tested per UL 94 and passed V-0 at 3.7 mm
R32-2186	1:1	80000	130 (0.9)	15	850 (5.9)	800	15 h	Translucent	•	Long pot life, requires minimum 80° C to cure
R31-2186	1:1	82000	110 (0.8)	20	1000 (6.9)	775	15 m	Translucent	•	RTV or cures rapidly with heat. Tested per UL 94 and passed V-0 at 4.8 mm.
R33-2186	1:1	83000	100 (0.7)	20	1015 (7.0)	740	2 h	Translucent	•	RTV or cures rapidly with heat, available in white. Tested per UL 94 and passed V-1 at 4.7 mm.
R-2141	1:1	90000	350 (2.4)	40	650 (4.5)	250	1.5 h	Translucent	•	Tested per UL 94 and passed V-1 at 4.8 mm
R34-2186	1:1	520 g/minute	150 (1.0)	45	800 (5.5)	400	> 8 h	Translucent	•	Minimum 60° C to cure. Adheres to plastic films such as PET. Tested per UL 94 and passed V-1 at 4.7 mm.
R-2145	1:1	295 g/minute	560 (3.9)	45	1050 (7.2)	400	15 m	Dark gray	•	Fast cure
R1-2145	1:1	285 g/minute	540 (3.7)	45	1000 (6.9)	400	1 h	Dark gray	•	Tough and RTV or cures rapidly with heat
EPM1-2412	1:1	0.1 g/minute	–	40	900 (6.2)	440	5 m	Translucent	•	Low volatility. Designed for forming gaskets in place, 0.8 aspect ratio, dispensable through 21-gauge needle tip. Tested per UL 94 and passed V-1 at 5.0 mm.
R-2187	10:1	23000	–	42	790 (5.4)	175	6 h	Translucent		Broad operating temperature
R-2160	10:1	250000	–	20	750 (5.2)	625	50 m	Red		Recommended for high-temperature applications

Processing tips

For the best bond, ensure the substrate is thoroughly clean. Activating and/or priming the surface can also improve adhesion. When working with silicone adhesives, it is important to consider the solvents, chemicals or substrates they may contact in their uncured state. Certain chemical elements and compounds can retard or inhibit the adhesive's curing.

Next-generation adhesives

Curable silicone film adhesives from NuSil® serve as an alternative to traditional liquid silicone adhesives. They offer reliable bond line control in a peel-and-stick format that is simple to use and doesn't require mixing.

Customization

We put our extensive customization experience to work for customers, ensuring they have the right silicone for their device, display or assembly. From developing precise thickness options to creating silicones tuned to adhere to specific substrates, we can formulate a solution for any optoelectronics or electronics application.

ALTERNATIVE ADHESIVES

PRESSURE-SENSITIVE ADHESIVES

PRODUCT NUMBER	180° PEEL STRENGTH ppi (kN/m)	VISCOSITY (cP/mPa·s)	SOLIDS CONTENT %	SOLVENT	SPECIAL FEATURES
PSA-1180	5.0 (0.9)	3500	70	Ethyl acetate	For applications requiring higher cohesive strength, 2.8 lb (12 N) tack
PSA-1170	3.75 (0.7)	300	50	Ethyl acetate	–
PSA-1270	3.5 (0.6)	1700	50	Naphtha	1.43 RI

FILM ADHESIVES

PRODUCT NUMBER	ADHESION LAP SHEAR psi (mPa)	THICKNESS	CURE SYSTEM	SPECIAL FEATURES
R1-2680-4	-	0.004 in (0.1 mm)	Platinum	Compatible with a variety of activators
R-2682-12	100 (0.7)	0.012 in (0.12 mm)	Platinum	Contains reinforcing mesh

REMOVABLE FORM-IN-PLACE GASKETS

PRODUCT NUMBER	WORK TIME	DUROMETER TYPE A	NOMINAL BEAD ASPECT RATIO	COLOR	SPECIAL FEATURES
EPM-2412	20 m	30	0.8	Translucent	Low volatility. Dispenses easily with consistent aspect ratio. RTV or cure can be accelerated with heat.

PRIMERS

PRODUCT NUMBER	% SOLIDS	SOLVENT	SPECIAL FEATURES
SP-120	4	Naphtha	General, all-purpose primer. Recommended for polyphthalamide (PPA). Use with platinum or tin catalyzed silicones.
SP-121	3	Naphtha	SP-120 with red pigment to identify where primer has been applied
SP-142	15	Naphtha	Recommended for increasing adhesion to plastics, such as polycarbonate (PC) and polyurethane (PU)
CF1-135	4	Naphtha	Recommended for platinum cure silicones where there is slight cure inhibition
CF6-135	9	Naphtha	Increased adhesion to polysulfone (PSU) and substrates where severe platinum inhibition is of concern
CF1-136	4	Naphtha	Contains red pigment to identify where primer has been applied. Designed to use where slight platinum inhibition is of concern.
CF2-137	7	Naphtha	CF1-135 with UV-light-detectable dye for inspections
CF1-141	6	IPA	SP-126 with red pigment to identify where primer has been applied
SP-270	15	Naphtha	Improved adhesion to polyimide (PI) and composite materials. Compatible with platinum cure fluorosilicones.
SP-272	9	Tert-butyl acetate	Contains red pigment to identify where primer has been applied. Improved adhesion to polyimide (PI) and composite materials. Compatible with fluorosilicones.
SP-273	9	Naphtha	Designed for platinum cure fluorosilicones to reduce risk of cure inhibition

Electrically and thermally conductive materials

Description

Electrically and thermally conductive silicones are formulated to safeguard sensitive electronics at the component level. Thermally conductive silicones manage heat transfer between components and can also be formulated to be electrically insulating. To protect electronics against static accumulations and discharge, we've developed electrically conductive silicones that allow the material to safely dissipate static.

Applications

Available in flowable and non-flowable options, our thermally conductive materials are used across a variety of applications, including heat sinks and electric bridges. Common applications for our electrically conductive silicones include grounding connections as well as RFI and EMI shielding.

ELECTRICALLY CONDUCTIVE MATERIALS

PRODUCT NUMBER	VOLUME RESISTIVITY ohm·cm	VISCOSITY (cP/mPa·s) EXTRUSION RATE (g/minute)	CURE SYSTEM	DUROMETER TYPE A	TENSILE psi (mPa)	ELONGATION %	WORK TIME	COLOR	SPECIAL FEATURES
R-2634	0.001	160 g/minute	Alkoxy	80	250 (1.7)	90	3 h	Gray green	Broad operating temperature
EPM-2462	0.005	160000	Platinum	85	450 (3.1)	85	3 h	Tan	Low volatility
R-2637	0.006	Thixotropic	Platinum	60	210 (2.1)	275	4 h	Tan	-
R-2630	6	11700	Platinum	60	690 (4.7)	95	15 h	Black	Self-leveling
R-1505	8	Thixotropic	Oxime	75	525 (3.6)	25	-	Black	One-part, broad operating temperature
R-2631	70	100 g/minute	Platinum	45	615 (4.2)	275	-	Black	Moldable
EPM-2461	535	675000	Platinum	30	500 (3.4)	350	1 h	Black	Low volatility

THERMALLY CONDUCTIVE

PRODUCT NUMBER	THERMAL CONDUCTIVITY W/(mK)	VISCOSITY (cP/mPa·s) EXTRUSION RATE (g/minute)	CURE SYSTEM	DUROMETER TYPE A	TENSILE psi (mPa)	ELONGATION %	WORK TIME	COLOR	SPECIAL FEATURES
EPM-2490	1.49	3700000	Platinum	75	200 (1.4)	30	2 h	White	Low volatility
R-2930	1.46	Thixotropic	Platinum	80	260 (1.7)	20	3 h	White	-
EPM1-2493	0.95	36000	Platinum	65	180 (1.2)	50	13 h	White	Low volatility. Recommended for bondlines 5 micron or greater. Tested per UL 94 and passed V0.
R-2940	0.84	Thixotropic	Platinum	90	700 (4.8)	35	5 h	Gray	-
R-2949	0.75	75000	Platinum	75	270 (1.8)	50	3.5 h	White	For applications requiring a broader operating temperature range
R-2939	0.75	70000	Platinum	70	300 (2.1)	70	4 h	White	-
R-2165	0.50	4000	Platinum	60	500 (3.4)	100	10 m	Gray	Self-leveling, available in white
R-2175	0.40	3000	Platinum	50	525 (3.5)	130	1 h minimum	Black	Self-leveling

Processing tips for thermally conductive materials

To ensure a homogenous blend, individually mix part A and B prior to combining. De-airing may be required to ensure a bubble-free product. For thermally conductive materials, thinner bond lines will result in lower thermal resistance.

For optimum adhesion, it is recommended to use NuSil brand primers prior to applying these conductive coatings.

Fluorosilicones

Description
Our fluorosilicones offer protection from common solvents and fuels that standard silicones simply cannot. These optimized formulations resist degradation while offering a broad operating temperature to protect sensitive electronics. NuSil® has one of the most diverse fluorosilicone lines in the industry, allowing engineers to find the right fit for their application.

Applications
Fluorosilicones are ideal for gaskets, seals, rings and O-rings used in many applications such as automotive, where the presence of oil and gasoline can harm electronic components or sensors.

FLUOROSILICONES

ADHESIVES & SEALANTS - TWO-PART

PRODUCT NUMBER	VISCOSITY (cP/mPa·s) EXTRUSION (g/minute)	ADHESION LAP SHEAR psi (mPa)	DUROMETER TYPE A	TENSILE psi (mPa)	ELONGATION %	WORK TIME	COLOR	SPECIAL FEATURES
CF1-3510	70000	-	20	210 (1.5)	135	4 h	Red	High-temperature, 100% fluoro
FS9-3521	50 g/minute	280 (1.9)	29	750 (5.2)	300	3 h	Brown	High-temperature, 100% fluoro and available in dual-cartridge packaging

MOLDING ELASTOMER

PRODUCT NUMBER	EXTRUSION RATE (g/minute)	DUROMETER TYPE A	TENSILE psi (mPa)	ELONGATION %	WORK TIME	COLOR	SPECIAL FEATURES
FS-3511	40	30	1150 (7.9)	335	> 8 h	Translucent	100% fluoro for hydrocarbon resistance

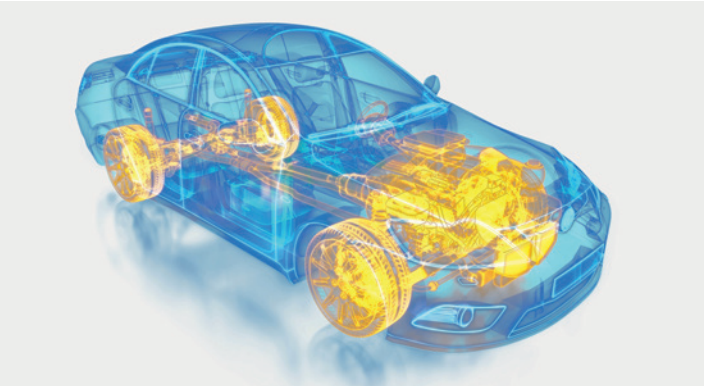
THERMALLY CONDUCTIVE

PRODUCT NUMBER	THERMAL CONDUCTIVITY (W/mK)	VISCOSITY (cP/mPa·s)	CURE SYSTEM	DUROMETER TYPE A	TENSILE psi (mPa)
CF1-3800	1.25	Thixotropic	Platinum	50	125 (0.9)

GELS

PRODUCT NUMBER	VISCOSITY (cP/mPa·s)	DUROMETER TYPE 00	WORK TIME	APPEARANCE	SPECIAL FEATURES
LS-3238	1500	15	11 h	Clear	100% fluoro
GEL-3500	11250	50	12 h	Translucent	-

All curable materials are platinum catalyzed



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