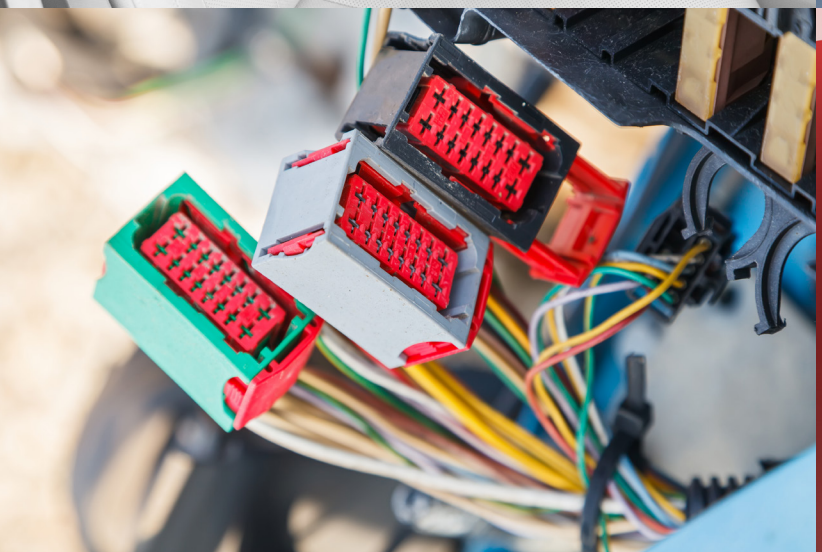
MOBILITY AND TRANSPORTATION

Silicone elastomers for electric vehicles

North American product selection guide

DOW®



The silicone difference.

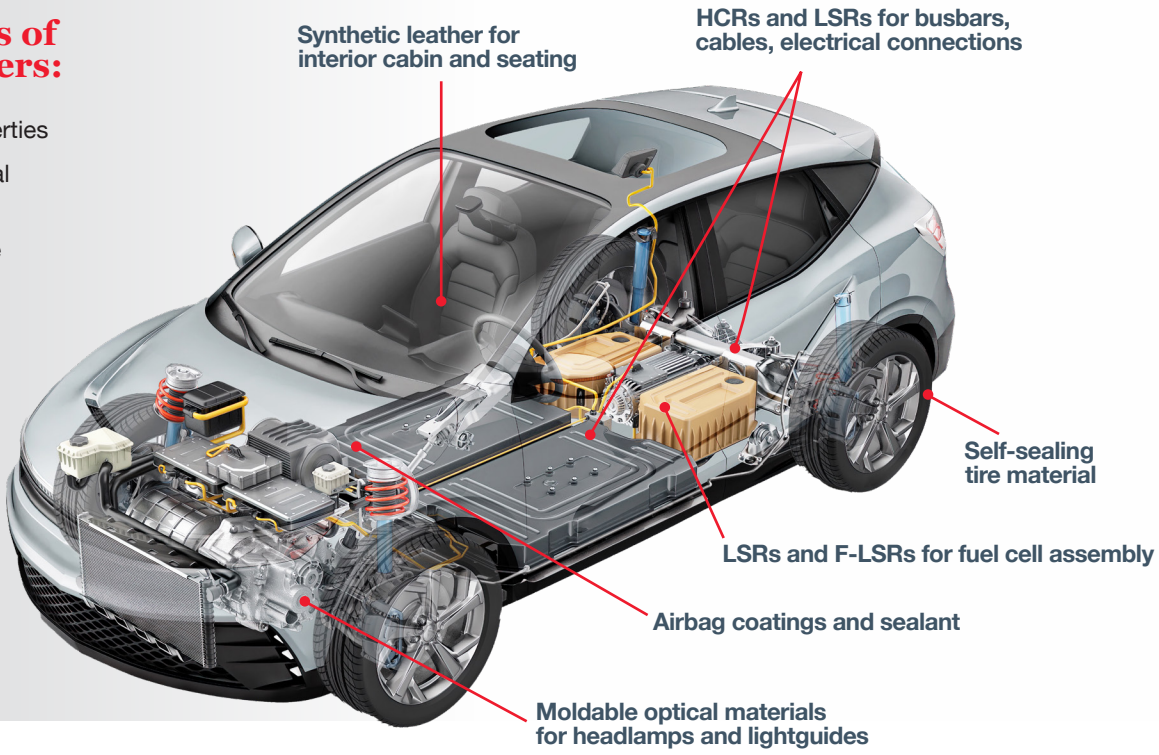
With materials engineered to offer high strength, rapid curing, UL-ratings, and other critical properties, Dow continues to offer innovative products that address the challenges of the rapidly changing electric vehicle (EV) landscape.

Dow silicone elastomer materials have decades of successful performance in a wide range of automotive applications. These innovative materials are helping to make electric vehicle components safer while offering options to challenges in protection and assembly, and continue to support advancements associated with xEV component and lithium-ion battery designs and production. At Dow, we're dedicated to sustainability in our materials engineering, and our global footprint helps EV component manufacturers and OEMs worldwide create new innovations in transportation.

This guide will be helpful in determining which elastomers are best suited for your specific application. We've identified materials and technologies in seven EV applications, and we'll look at some of the products' features and benefits to help narrow your selection. Note that the products in this brochure are available in North America only, and are just a sampling of our product portfolio as there are many products available globally. In addition, our specialists are continuously working on new product development. If you need different product specifications or have a specific challenge, contact your Dow technical support representative.

Inherent benefits of silicone elastomers:

- Robust mechanical properties
- Exceptional environmental and thermal resistance
- Wide service temperature (-40°C to 200°C typical)
- Excellent flexibility and resistance to cracking
- Tunable processing parameters
- Electrically insulating
- Pigmentable



SILASTIC™ High Consistency Silicone Rubber (HCR) for flame resistant and ceramifying applications in electric vehicles.

Breakthrough technologies are driving notable innovation in electric vehicle powertrain systems. In addition to increased performance, key design trends include targeted improvements in safety, efficiency, component durability, driving experience, and enhanced reliability.

SILASTIC™ HCR materials can help you address these challenges with a wide range of targeted materials to help to drive next-generation electric vehicle design.

Range of high-performance silicone materials

Silicone elastomers are versatile materials that utilize a variety of fabrication processes for many applications within an electric vehicle. These materials can be formulated to address specific performance and/or process requirements. With excellent dielectric properties coupled with resistance to extreme heat, cold, and aggressive fluids, SILASTIC™ HCR has shown to be an effective design option in a wide range of electric vehicle powertrain applications.

Application	Design need / HCR solution
High-voltage EV conductors	• High-temperature resistance • Excellent electrical properties • Excellent mechanical properties (i.e. tear resistance) • Multiple cure systems to meet fabrication processes
Battery seals	• Robust mechanical properties • Minimal compression set • Good thermal and flame resistance
Hoses	• Withstand wide range of service conditions • High mechanical strength • Options for co-extrusion and calendering

Applications for SILASTIC™ HCR exist throughout the EV battery enclosure

For example:

Thermal and seal/valve: Management and control of gases inside the battery enclosure; up to and including flame and gases from a thermal event.

Thermal barrier: Offers robust, flexible barriers between various critical battery components, (eg. between battery cells, near connectors).

Busbar coating: Insulation of high-voltage conductors, reduces arcing; offers electrical insulation before, during, and after a thermal event.

Hose protection: Offers robust, flexible protection around cooling lines within the battery enclosure; provides thermal insulation before, during, and after a thermal event.

Connection cover: Insulation of high-voltage components; can offer flame barrier and/or electrical insulation before, during, and after a thermal event.

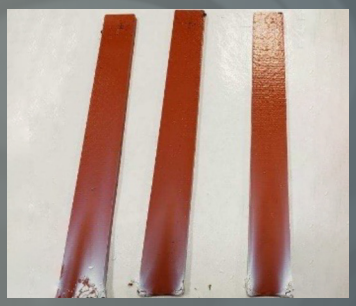
HCR for EV Battery fire protection

Product	Application	Need	Spec gravity ASTM D792	Durometer [Shore A] ASTM D2240	Tensile strength [MPa] ASTM D412	Elongation [%] ASTM D412
SILASTIC™ HCM 50-1339 FR Silicone Rubber RED	Thermal and seal/valve	Flame resistant***	1.2	49	7.7	439
SILASTIC™ HCM 60-1359 EV FR Silicone Rubber RED	Thermal valve/thermal barrier	Flame resistant***	1.4	63	6.2	222
SILASTIC™ HCC 67-1347 FR Silicone Rubber RED	Thermal barrier	Flame resistant***	1.3	67	10.6	511
SILASTIC™ HCx 67-1352 EV FR Silicone Rubber ORG	Busbar coating	Ceramifying	1.4	71*/68**	7.7	455*/493**
SILASTIC™ HCE 60-1335 FR Silicone Rubber RED	Hose protection	Ceramifying	1.3	59	8.5	484
SILASTIC™ HCC 67-1347 FR Silicone Rubber RED	Connection cover	Flame resistant***	1.3	67	10.6	511
SILASTIC™ HCC 65-1351 EV FR Silicone Rubber RED		Ceramifying	1.7	65	2.7	235

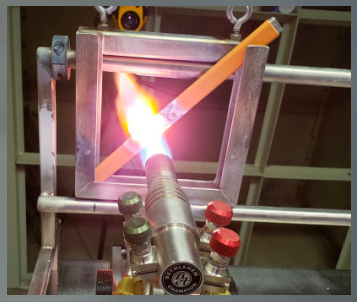
ASTM: American Society for Testing Materials

* Molding ** Extrusion ***All FR materials designed to meet UL94V0 requirements

These are typical properties, not to be construed as specifications.



UL 94 flame bars, showing vertical burn orientation.



High-temperature torch exposure performed on HCR coated busbar test part.

FLAME RESISTANT HIGH CONSISTENCY RUBBERS

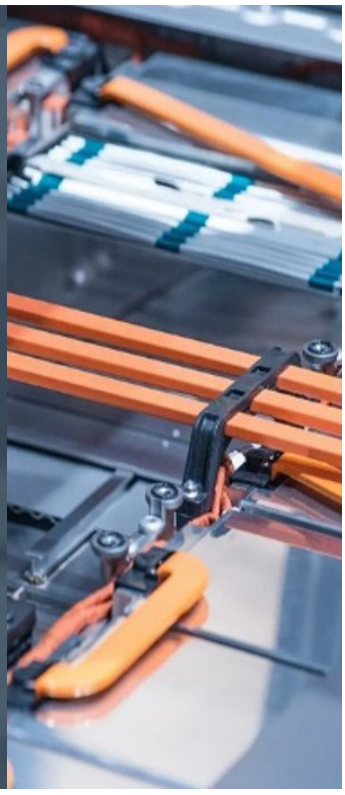
SILASTIC™ HCR materials offer a barrier to flame and hot gases during a thermal event:

- Maintain electrical and physical properties across wide temperature range and exposure durations, and thermal events
- Preferred fabrication methods include molding, extrusion, calender + die cut

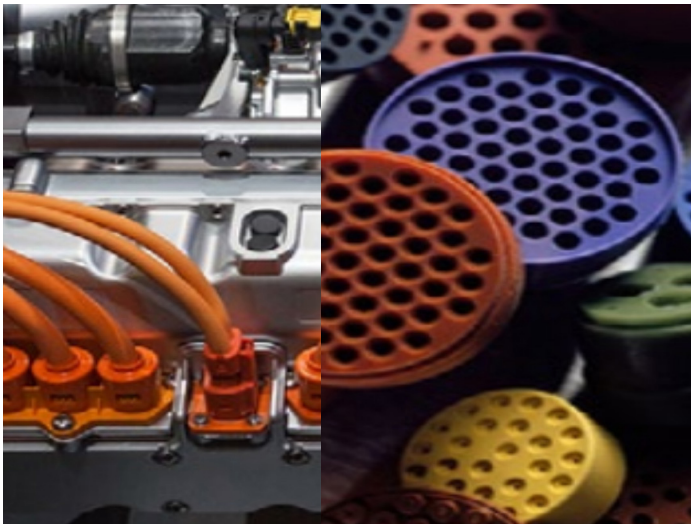
CERAMIFYING HIGH CONSISTENCY RUBBERS

SILASTIC™ HCR materials offer a barrier to flame and ceramify during thermal event:

- Robust dielectric strength before and after ceramification
- Maintain physical properties across wide temperature range and exposure durations
- Preferred fabrication methods include molding, extrusion, calender + die cut



Silicone elastomers for electrical cable connectors seals.



Electrical connectors are critical for maintaining connectivity and power throughout the vehicle. Connector seals offer electrical and environmental insulation at these junctions throughout the powertrain and auxiliary locations.

High consistency rubber (HCR) and liquid silicone rubbers (LSRs) from Dow offer excellent sealing performance in electrical connectors for automotive applications. These distinct materials offer consistent sealing performance at high and low temperature conditions, with low compression set, a wide range for hardness and modulus, and options to offer self-lubrication to ease the assembling process. In addition, they can be specially formulated to meet the emerging demand for enhanced thermal resistance, and compatibility with corrosive flame retardants.

High consistency rubber for electrical connector seals

- 1-part, fully formulated, ready to use
- Low modulus material suitable for direct wire insertion
- Compression and injection moldable
- Custom colors available

Product	Oil level	Recommended seal type	Special attributes	Shore A hardness ASTM D2240	Tensile strength (MPa) ASTM D412	Elongation (%) ASTM D412	Tear strength (kN/m) ASTM D792 DIE C
XIAMETER™ 23077-V Silicone Rubber	Low	Perimeter seal	Peroxide cure	37	5.5	758	-
XIAMETER™ 23084-V Silicone Rubber	Medium	Perimeter seal	Peroxide cure	26	5.8	717	18
XIAMETER™ 23023-V Silicone Rubber	High	Perimeter seal	Peroxide cure	28	7.5	752	19
XIAMETER™ 23010-V Silicone Rubber	Medium	Mat seal	Peroxide cure	18	4.4	868	15
XIAMETER™ HCM 18-1303 Silicone Rubber	Medium	Mat seal	Reduced mold fouling	21	3.3	650	19
SILASTIC™ HCM 20-1324-SL Silicone Rubber	Medium	Mat seal	Platinum cure	21	3.3	1021	16*

ASTM: American Society for Testing Materials.
All specimens cured for 10 minutes at 177°C. Cure conditions denote parameters used to test rubber properties and do not reflect actual cure time in the injection-molding process.
*ASTM D792 Die B
These are typical properties, not to be construed as specifications.

HCR Compounds

SILASTIC™ HCR compounds can be formulated for specific performance or processing requirements. These HCRs are fully compounded with ready-to-use, heat-curable blends of HCR bases, fillers, modifiers, catalysts, and color pigments.

Custom compounding

Request a product designed to your specific needs. Visit dow.com/elastomers or simply scan the QR code to be taken directly to the custom compound request page.

With a wide range of attractive features and user benefits, SILASTIC™ HCR compounds are used in a wide range of diverse applications.

Liquid silicone rubber for electrical connector seals

- 2 part, 1:1 mix ratio
- Fast cure profile, no byproducts
- Liquid injection moldable
- Third stream pigmentable
- Compatible with standard primer technologies
- Special grades for adhesion, high temperature resistance, and compatibility with flame retardants available

Product	Oil level	Special attributes	Shore A hardness ASTM D2240	Tensile strength (MPa) ASTM D412	Elongation (%) ASTM D412	Tear strength (kN/m) ASTM D792 DIE C	Compression set (%) ASTM D395[2]
SILASTIC™ RBL-9200-20 LSR	None	• Low viscosity • Excellent flow behavior	37	5.5	758	21	59/18[3]
SILASTIC™ RBL-9200-30 LSR	None		26	5.8	717	17	53/17[3]
SILASTIC™ RBL-9200-40 LSR	None		28	7.5	752	40	56/14[3]
SILASTIC™ RBL-9200-50 LSR	None		18	4.4	868	42	55/15[3]
XIAMETER™ RBL-2004-20 LSR	None	• Good NPC properties • High hot tear strength • UL recognized component	20	6.5	900	24	24
XIAMETER™ RBL-2004-30 LSR	None		30	8.3	650	16	21
XIAMETER™ RBL-2004-40 LSR	None		40	9.5	740	35	16
XIAMETER™ RBL-2004-50 LSR	None		50	10.0	680	43	19
SILASTIC™ LTC 9400-40 LSR	None	• Low viscosity • Low temperature cure • Deep section cure	40	9.7	510	30	None
SILASTIC™ LTC 9400-50 LSR	None		50	8.9	450	40	None
SILASTIC™ LTC 9402-50 LSR	2%		30	6.7	620	40	21
SILASTIC™ LC30-9001 LSR[1]	2%	• Low viscosity • Good NPC properties	28	7.7	757	31	None
SILASTIC™ 9205-30 LSR	5%		30	6.7	620	23	15[4]
SILASTIC™ LC40-9422 LSR[1]	2%		38	10.1	781	31	26
SILASTIC™ 9202-50 LSR	2%		50	6.7	390	44	24[4]
SILASTIC™ 9212-50 LSR	2%	• Compatible with FR Plastic	53	8.6	512	43	21[4]
SILASTIC™ SA 9940-30 LSR	None	• Low viscosity • Instant unprimed adhesion to PA and PBT • Suitable for two-shot or insert molding • 12 months shelf life	30	6.6	635	34	48
SILASTIC™ SA 9940-40 LSR	None		40	6.2	570	30	49
SILASTIC™ SA 9940-50 LSR	None		50	7.4	500	44	49
SILASTIC™ SA 9942-30 LSR	2%		30	6.2	670	32	48
SILASTIC™ SA 9942-40 LSR	2%		40	6.4	570	30	53
SILASTIC™ SA 9942-50 LSR	2%		50	7.0	490	39	49

ASTM: American Society for Testing Materials.

Cure conditions denote parameters used to test rubber properties and do not reflect actual cure time in the injection-molding process.

All properties except for compression set are generated by curing the materials at 10 minutes at 120°C except otherwise specified.

(1) 5 minutes at 150°C.

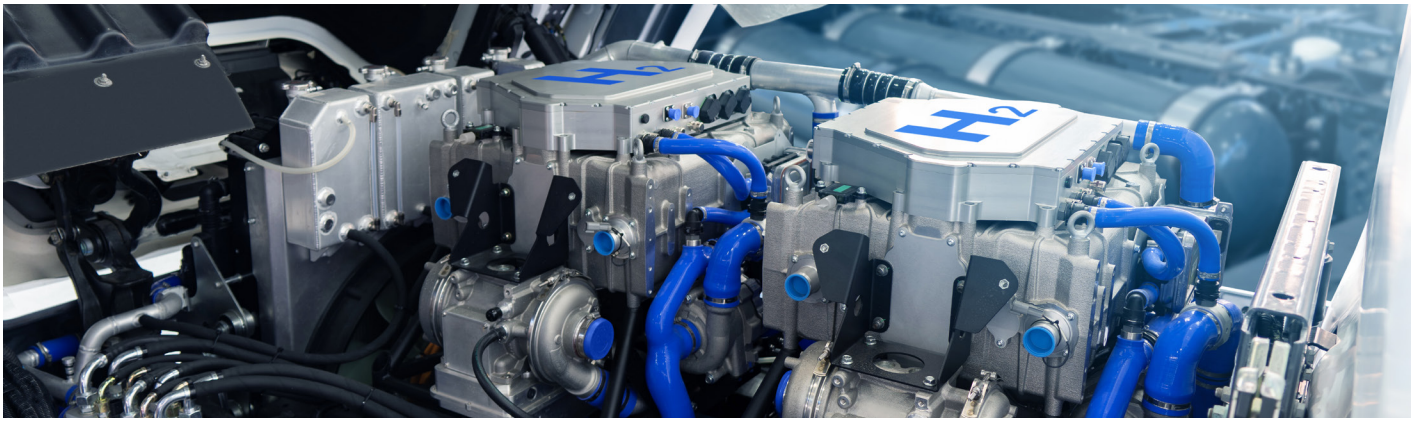
(2) In accordance to ASTM D395, Method B, type 2, 22 hours at 175°C. Specimens cured at 10 minutes at 175°C unless otherwise specified.

(3) 10 minutes at 175°C + 4 hours at 200°C.

(4) 15 minutes at 175°C.

These are typical properties, not to be construed as specifications.

SILASTIC™ LSRs for fuel cell sealing applications.



The landscape of Proton Exchange Membrane (PEM) fuel cell technology has taken shape in parallel to the growth of electric vehicles. As fabrication methods and operating environments become better defined, Dow silicone elastomer materials have been formulated to address the performance, processing, and productivity demands to realize the broad implementation of fuel cell vehicles.

Silicone elastomers are suitable materials for sealing of PEM fuel cell stack, primary fuel cell housing, and its auxiliary units. The exceptional sealing force retention properties of silicone elastomers in the PEM operating environments support long-term performance of the unit. The wide range of properties and processing parameters of SILASTIC™ LSR and FLSR products support the freedom to select the best combination of material and fabrication methods for the specific fuel cell design.

Benefits of using silicone elastomers in fuel cell sealing

Properties

- Long-term compressive stability supports demanding static sealing applications
- Stable against standard coolant fluids and can be modified to withstand harsher chemical environments
- Thermally stable to maintain robust performance during unit start-up and operation (-70°C to 200°C)

Processes

- Wide range of cure and rheology profiles offer freedom to leverage a variety of fabrication methods
- Formulated to achieve unprimed adhesion on a variety of materials including metals and low surface energy thermoplastics
- Compatible with standard surface treatment and primer technologies to improve adhesion

Product	Recommended fabrication method	Special attributes	Cure condition[1]	Shore A hardness ASTM D2240	Tensile strength (MPa) ASTM D412	Elongation (%) ASTM D412	Tear strength (kN/m) ASTM D792 DIE B
SILASTIC™ RBL-9694-30P LSR	Robotic dispensing	Adhesion to metals and polyamide	1	32	7.2	820	14
SILASTIC™ RBL-9694-45M LSR	Robotic dispensing	Adhesion to metals and polyamide	1	45	7.3	600	45
SILASTIC™ 4-2010 LSR	Screen printing, injection molding	Adhesion to standard stack plate materials	2	53	5.3	249	57*
SILASTIC™ SA 9940-50 LSR	Injection molding	Adhesion to PA and PBT	3	50	7.4	500	44
SILASTIC™ LTC 9400-50 LSR	Injection molding	Low temperature cure for thermally sensitive substrates	3	50	8.9	450	40
SILASTIC™ FL 40-9201 F-LSR	Injection molding	Fluorosilicone highly resistant against acids and hydrocarbon fuels, oils, solvents	3	40	9.2	470	16

ASTM: American Society for Testing Materials.

[1]Cure conditions denote parameters used to test rubber properties and do not reflect actual cure time in the injection-molding process.
(1) 5 minutes at 150°C, (2) 5 minutes at 175°C, (3) 10 minutes at 120°C, (4) 5 minutes at 176°C

*ASTM D792 Die C

These are typical properties, not to be construed as specifications.

We're driving innovation to support impact protection and occupant safety.

While the trend towards connectivity and electrification of passenger vehicles has improved safety through the development of sophisticated Advanced Driver Assistance Systems (ADAS), passive safety features such as seat belts and airbags continue to be critical elements of an integrated auto safety concept.

Airbag module requirements related to performance, weight, and total cost continue to challenge suppliers to provide innovative options, while offering reliable performance across the range of conditions in which safety components are tested.

Liquid silicone rubber remains a preferred successful option, offering the necessary pressure retention across a wide temperature range, coating adhesion, and low flammability, with ease of application at an acceptable cost in use. Within our SILASTIC™ elastomer portfolio we offer materials engineered for coating cut and sewn (CSS) and one-piece woven (OPW) fabrics as well as a friction-reducing topcoat for coated OPW airbags and a successful silicone elastomer seam sealant for use on CSS airbags.

SILASTIC™ LSR Coating for airbag

Typical Application	Product	Key Features
Flat fabric airbag coating	**SILASTIC™ LCF 3600 Coating**	• Unprimed adhesion to polyamide and polyester • Low coefficient of friction
	SILASTIC™ LCF 3600 LV LSR	• Low TVOC • Unprimed adhesion to polyamide and polyester • Low coefficient of friction • Suitable for initial impact OPW
	SILASTIC™ LCF 3609 LSR	• Low TVOC • Good flammability at lower coat weight • Low folding stiffness
Seam sealant for cut-and-sewn airbags	**SILASTIC™ SE 6777 LSR**	• Excellent adhesion to silicone-coated fabric • Low folding stiffness • High elongation • Room temperature cure
	SILASTIC™ NS9000 Seam Sealant	• Excellent adhesion to silicone-coated fabric • Heat curable sealant • Low folding stiffness
OPW airbag coating	**SILASTIC™ LCF 3760 LSR**	• Very High Elongation • Unprimed adhesion to polyamide and polyester • Low coat weights
OPW top coat	**SILASTIC™ LCF 3715 Topcoat**	• Reduces coefficient of friction on coated fabric

LuxSense™ Silicone Synthetic Leather Material.

LuxSense™ is the world's **first silicone-based luxury synthetic material** that is addressing transportation seats and interiors specifications, as well as the needs in furniture, fashion, smart wearable devices, and consumer electronics with exceptional features like **soft touch feeling** and **no odor**.

Applications:

- Dashboards and seats
- Trim and door panels
- Other interior surfaces

Suitable for:

- Automotive
- Marine
- Aviation

Features:

- Hand feeling
- UV resistance
- Anti-soiling
- Low stiffness
- Anti-abrasion
- Low VOC

Key benefits:

Sense of sight

- Easy to clean and abrasion resistant
- Excellent weatherability and long-lasting performance
- Ability to achieve a broad color palette and high flexibility for more complex geometries

Sense of smell

- Odorless and low VOC, meeting auto regulation
- Inherently flame resistant
- Liquid silicone rubber technology, avoiding DMF and plasticizer usage

Sense of touch

- Soft touch and skin-friendly
- Non-tacky
- Customizable surface texture, can be perforated

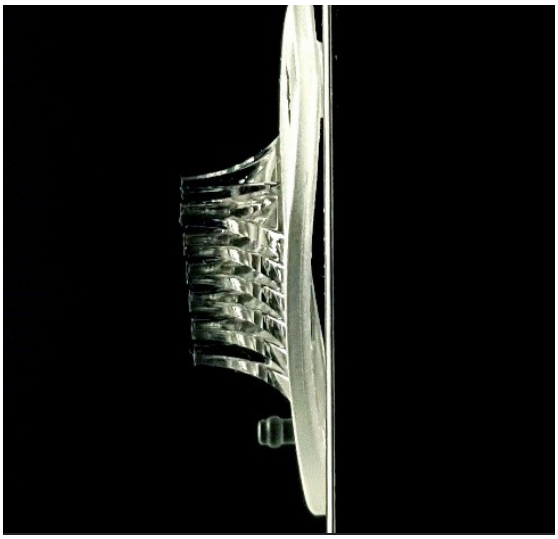
Sense of sustainability

- Lower carbon footprint vs. natural leather
- Support user sustainability initiatives
- Safer materials – no plasticizers; DMF-free fabrication process

Offering innovative automotive lighting design, enhancing driver safety.

As the pioneers of moldable optical silicones, Dow scientists have been engineering materials to support and enhance some of the most complex automotive lighting designs available, such as Adaptive Drive Beam (ADB) systems.

SILASTIC™ Moldable Optical Silicones are award-winning materials well suited for electric vehicle lighting. They can help increase LED efficiency and allow for more design flexibility (form factor, undercuts, optical features). Moreover, they are easy to process and are durable against environmental and thermal factors; and are lightweight compared to traditional glass or plastic. SILASTIC™ Moldable Optical Silicones can create complex lightguides and lenses for various automotive lighting needs and are an excellent choice for electric vehicles requiring enhanced safety and weight reduction.



Optical materials for adaptive drive beam lighting system

Product	Features	Durometer [Shore A] ASTM D2240	Tensile strength [12.0 MPa] ASTM D412	Elongation [%] ASTM D412	Luminous transmittance [%] at 10 mm*
SILASTIC™ MS-1001 Moldable Silicone**	Controlled volatility	87	12	50	92
SILASTIC™ MS-1002 Moldable Silicone**	Industry leading for complex geometry	72	11.2	80	90
SILASTIC™ MS-1003 Moldable Silicone	Higher elongation and flexibility	51	5.5	325	92

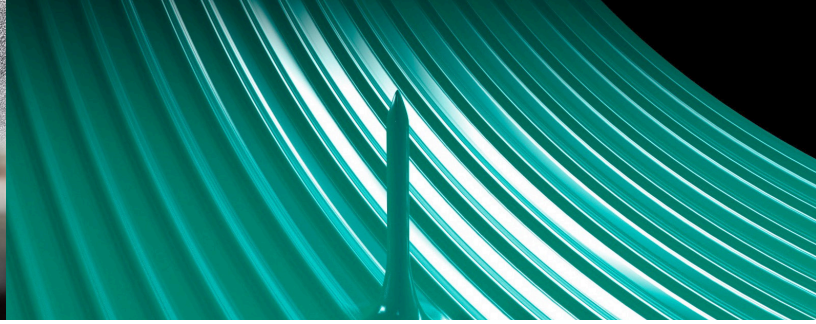
*Weighted total transmittance between 360 and 780 nm according to CIE Colorimetry 15:2004

**AMECA certified

These are typical properties, not to be construed as specifications.

For more information on this award please visit https://edisonawards.com/past-winners/

For more information on this award please visit https://edisonawards.com/2023-winners/



The world's first silicone self-sealing tire, designed for recycling

Electric vehicles are heavier weight thanks to the batteries inside, and designers are challenged with lightweighting and safety innovations in materials selections. Dow's award winning, recyclable SILASTIC™ Self Sealing Silicone removes the need for a spare tire, reducing overall vehicle weight, improving range and fuel efficiency, offering more design freedom.

An exceptional option at all stages — from process, use, and end of life — while addressing OEM performance requirements, Dow's ambient curing silicone elastomer forms a self-sealing layer on the inner surface of a tire, offering excellent sealing performance following puncture, allowing long distance driving without loss of tire pressure, keeping you safely on the road to your destination.

This distinct silicone elastomer can be applied in a fast mass-producible process, and effectively separated from the tire at end of life supporting efficient recycling, leading the industry's transition to a more sustainable future.

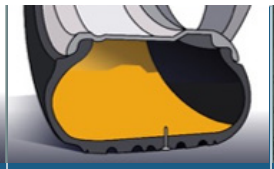
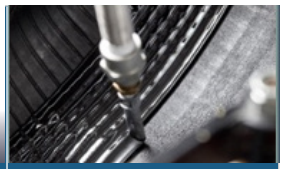
For more information on this award please visit https://edisonawards.com/2023-winners/

For more information on this award please visit https://sealawards.com/sustainability-award-2024/

Innovative, self-sealing silicone designed to be recyclable

Product	Durometer [Shore OOO] ASTM D2240	Elongation [%] ASTM C1135
SILASTIC™ SST-2650 Self-Sealing Silicone	29	740

Typical values, not to be construed as specifications. Users should confirm results by their own tests.

Performance	 Spare	 Run flat	 Butyl	 SILASTIC™ SST-2650 Silicone
Light weight	🔴	🟡	🔵	🔵
Space saving	🔴	🔵	🔵	🔵
Larger tires (EV/SUV)	🔴	🔴	🟡	🔵
Miles after puncture	🟡	🟡	🔵	🔵
Low temperature	🔵	🔵	🔴	🔵
Processability	🔵	🟡	🔴	🔵
Recyclability	🔵	🔵	🔴	🔵

Typical values, not to be construed as specifications.

At Dow, we prioritize sustainability in everything we do, and we have decades of success implementing silicone products that are effective and designed for sustainability.

Globally integrated, we're engineering innovative silicone elastomer materials that enhance the rapidly changing mobility landscape, and support significant growth in the electric vehicle industry.

How can we help with your latest innovations?

Learn more at **dow.com/elastomers**

MobilityScience™

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