Electropren™

Next-Gen Materials for Sustainable High-Voltage Future

Low Temperature Performance
Material Technology

MOMENTIVE®
SOLUTIONS FOR A SUSTAINABLE WORLD™

Global Leader in Silicone Infrastructure Market

Driving Performance in Energy & Infrastructure with Advanced Silicone Solutions

The global energy and infrastructure markets are evolving under the influence of advanced technological requirements, regulatory changes, and heightened performance expectations. For over 30 years, Momentive has delivered dependable silicone elastomers to the transmission and distribution sector, supporting the production of high- and medium-voltage cable joints, terminations, connectors, composite insulators, and surge arrestors.

Momentive's Electropren™ Technology portfolio features the industry-first patented Low Temperature Catalyst (LTC) technology, enabling sustainable processing through reduced curing temperatures and faster cure times. This innovation enhances productivity and reduces energy consumption, all while preserving the high-performance and reliability standards that define Momentive's materials.

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Why Choose Momentive's Infrastructure/Energy Elastomers?

Silicone Elastomers: Reliability for Tomorrow's Energy Systems

In today's demanding energy landscape, infrastructure components must withstand extreme conditions without compromising performance. Silicone elastomers provide exceptional durability and consistency, making them the material of choice for high-voltage, grid, and energy applications worldwide. Their unique balance of mechanical flexibility, superior electrical insulation, and long-term resistance to weathering and environmental stress ensures reliable operation over decades of service.

Exceptional Electrical Insulation

Silicone elastomers offer outstanding dielectric properties across a wide temperature range, making them ideal for use in cable accessories, bushings, insulators, and surge arresters.
Their high volume resistivity, high surface resistivity and the resistance to electrical tracking ensure long-term performance in high-voltage environments.

Weather & UV Resistance

Engineered to endure decades of exposure to sunlight, rain, pollution, and temperature cycling, silicone elastomers maintain their mechanical and insulating integrity in harsh outdoor conditions. This translates to fewer failures, reduced maintenance, and lower lifecycle costs.

Hydrophobicity

Silicone's unique hydrophobic and hydrophobicity-recovering properties limit water film formation and prevent flashover in wet or contaminated environments. This is essential for outdoor insulators and cold shrink terminations operating in polluted or coastal regions.

Thermal Stability

Withstanding temperatures from -60°C to over 200°C, silicone elastomers remain flexible, tough, and functional under extreme thermal loads. This makes them ideal for sealed components, joints, and encapsulants in power generation, distribution, and renewable energy systems.

Mechanical Flexibility & Structural Integrity

Silicone elastomers combine high tear strength and elongation with long-term dimensional stability. This makes them effective in vibration-damping, sealing, and protective applications, particularly in underground and high-density urban energy networks.

Design Versatility

Silicone elastomers are compatible with a range of manufacturing methods in addition to supporting complex geometries, automation, and integration into modern smart grid components.

Applications Across the Grid

- High-voltage insulators
- Transformer bushings
- Encapsulation and sealing systems
- Cold shrink and push-on cable accessories
- Surge arresters and switchgear components

Key Application Performance Characteristics

Application	Ease of Processing	High Elongation/ Elasticity/Tear	Dielectric Strength	Volume & Surface Conductivity	Tracking and Erosion Resistance	UV Weathering Resistance	Hydrophobicity
Surge Arrestors/ Composite Insulators	✓		✓		✓	✓	✓
Push-On Cable Joints	✓	✓	✓	✓			
Push-On Cable Terminations	✓	✓	✓	✓	✓	✓	✓
Cold-Shrink Cable Joints	✓	✓✓	✓	✓			
Cold-Shrink Cable Terminations	✓	✓✓	✓	✓	✓	✓	✓
T-Connectors/Elbow Connectors/ Switchgears	✓	✓	✓	✓			

*1 ✓ indicates that the requirement is critical for the application, while 2 ✓ indicates that the requirement is highly critical and essential for safe and reliable operation.

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LSR Grades Featuring the New Electropren^{TM} Low Temperature Cure Catalyst

Electropren Grades	Electropren 242-3	Electropren 2030	Electropren 2050	Electropren 2640
Viscosity A @ 10 1/s [Pas]	190	430	530	350
Viscosity B @ 10 1/s [Pas]	210	390	490	310
Reactivity T60 @ 110°C [min]	0.6	0.7	0.7	0.7
Hardness Shore A	43	29	48	42
Tensile Strength [MPa]	9	9.4	8.9	9.5
Elongation at break [%]	600	820	600	590
Tear ASTM 624-B [N/mm]	32	14	42	36
Volume resistivity [ohm.cm]	$5x10^{15}$	$5x10^{15}$	$3x10^{15}$	$2x10^{15}$
Dielectric Strength [kV/mm]	25	22	23	23
Dielectric Constant	2.7	2.7	2.7	2.7
Tracking Resistance IEC 60587	1A4.5	n.a.	n.a.	n.a.

Platinum-Catalyzed Silicone Elastomer Technology – "The Science Behind the Innovation"

Platinum-catalyzed silicone elastomers, also known as addition-cure or addition-type silicones, are a class of high-performance silicone rubbers that cure (or crosslink) via a hydrosilylation reaction. This reaction is facilitated by a platinum catalyst, and it forms a durable, three-dimensional silicone network without generating byproducts.

How It Works: The Chemistry Behind Platinum-Catalyzed Curing

Platinum curing involves a chemical addition reaction between two key components:

- Vinyl-functional silicones (with –$CH=CH_2$ groups)
- Silicone hydride crosslinkers (containing –Si–H groups)

In the presence of a platinum catalyst, typically a platinum complex such as Karstedt's catalyst, the Si–H groups react with the vinyl groups through a hydrosilylation reaction.

The Reaction:

This results in a permanent, three-dimensional elastomeric network without producing any volatile byproducts.

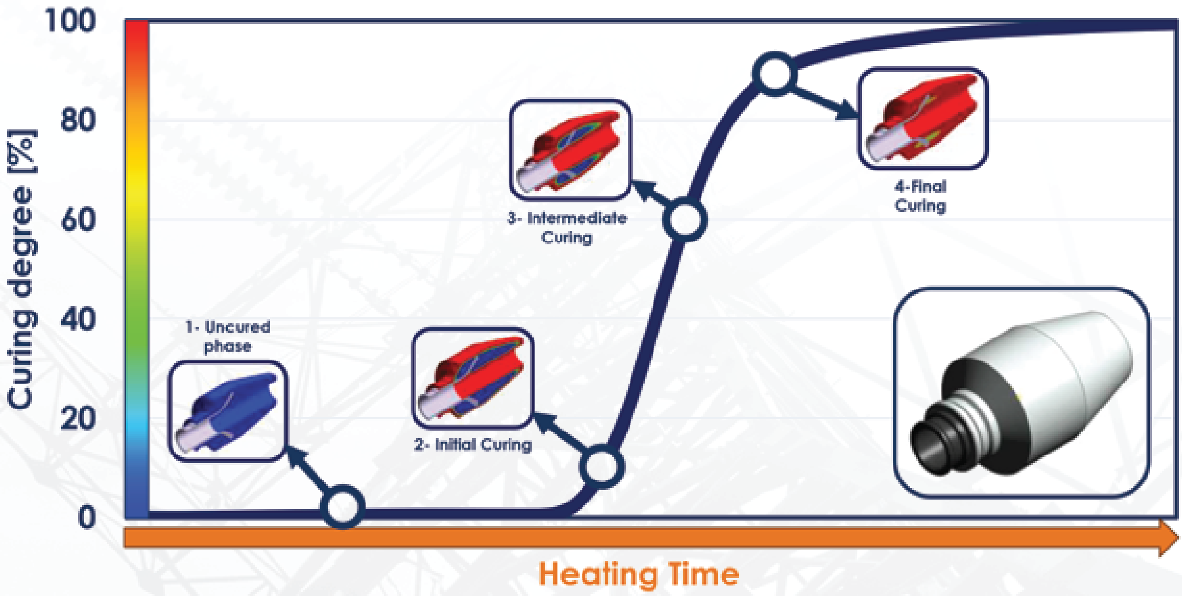
Catalyst Function and Control

- The platinum catalyst initiates and drives the addition reaction but is not consumed in the process.
- Cure can be inhibited by certain impurities (e.g., sulfur, amines, tin compounds), so clean mixing and processing environments are essential.
- Inhibitors or retarders may be added to delay cure onset, allowing longer working time (pot life).

In liquid silicone rubber, cure kinetics govern the transition from a liquid to a flexible, durable elastomer through platinum-catalyzed crosslinking. Mastery of cure kinetics is key to producing high-quality LSR parts efficiently and consistently.

Stages of Cure

For cable accessories and composite insulators, the volume of silicone required for curing can range from just a few hundred grams for smaller medium-voltage components to several kilograms for high-voltage parts. The graph below illustrates the four curing stages of a high-voltage stress cone, a critical component in high-voltage cable terminations.



There are four stages of Curing:

1. Uncured phase: Liquid LSR can be injected into the mold.
2. Initial Curing: The first layer in contact with the hot mold surface is cured.
3. Intermediate Curing: The cured layer thickens, but a significant portion of uncured LSR remains.
4. Final Curing: Most of the material is over 90% cured, achieving mechanical stability. The part can be demolded.

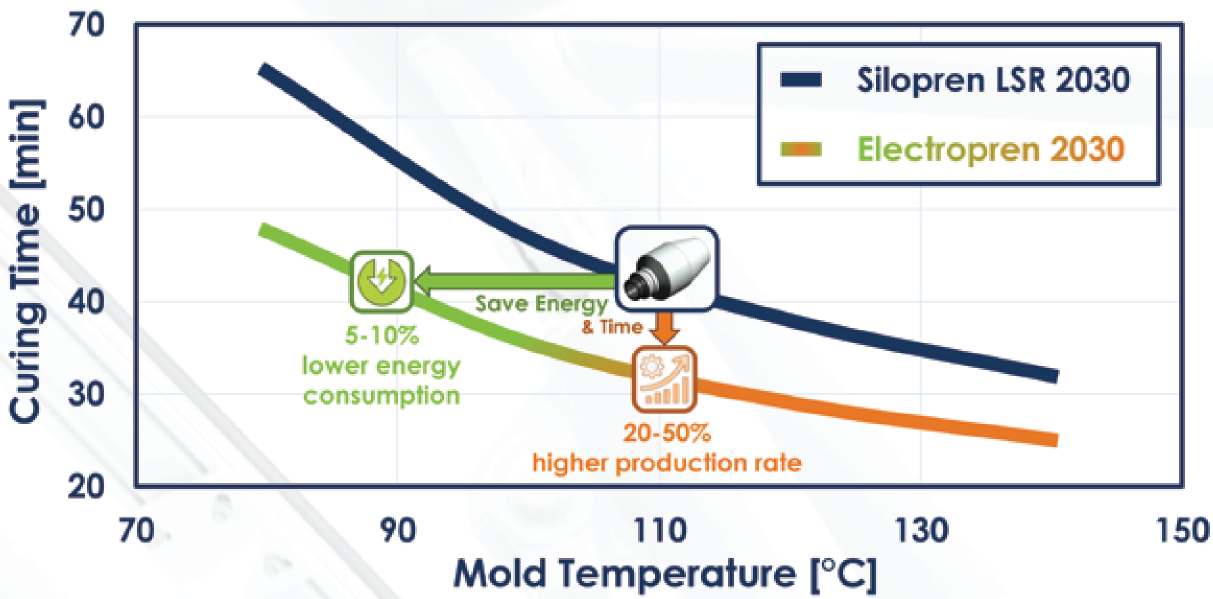
Important: The time and temperature at which the curing kicks in is influenced by the nature of the catalyst.

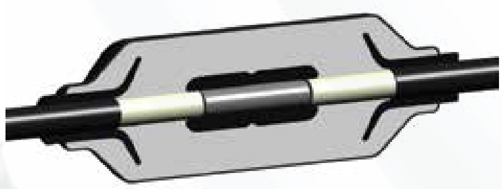
Electropren™: Innovative Low Temperature Catalyst Technology

Momentive's Electropren technology line featuring the innovative low temperature technology takes a new approach to industry standard LSR cure kinetics. Through patented, proprietary catalyst technology Momentive has discovered a revolutionary way to alter the platinum cure complex, allowing the silicone material to cure much faster at significantly lower temperatures. As a resultant multiple benefits are achieved:

- Lower energy consumption
- Higher productivity

The following figure shows the dependence of the crosslinking time on the crosslinking temperature of Silopren LSR 2030 (traditional catalyst system) and the new Electropren 2030 with the new low temperature curing technology.





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- Typical curing temperatures for large articles are in the range of 110 to 140°C
- Reducing the curing temperature by 20°C for Electropren 2030 results in the same curing speed as with the traditional Silopren LSR = 5 to 10% less energy is needed for curing
- When keeping the curing temperature, reduction of curing time of 20 to 50% (depending on the article) is possible
- Often a combination of both effects leads to higher productivity and reduced energy consumption, contributing to more sustainable manufacturing, especially for thick-walled products like high-voltage insulators and cable accessories.

Further advantages of Electropren low temperature catalyst technology

- Compatibility with temperature sensitive components
- Lower shrinkage potential
- Same mechanical and electrical properties as standard LSR grades

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