MATERIALS WEEK EUROPE

The next speaker is...

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新元化学（山东）股份有限公司
NEW ERA CHEMICAL SHANDONG CO.,LTD.

Fluorosilicone Material Application Technology Report

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Application Technology Report On Fluorosilicone Materials

Presenter: Hou Zhiwei

Booth No.: 840

新元化学(山東)股份有限公司
NEW ERA CHEMICAL SHANDONG CO., LTD.

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01

Company Profile

COMPANY INTRODUCTION

New Era Chemical (Shandong) Co., Ltd., located in Weihai City, Shandong Province, China, is a professional manufacturer of organic fluorosilicone fine chemicals and fluorosilicone materials. The company has established a complete industrial chain spanning from "Tetrachloroethylene → Trifluoropropene → D_3F → Fluorosilicone Rubber and Fluorosilicone Oil." It is recognized as the National-Level "Specialized, Refined, Distinctive, and Innovative" Enterprise.

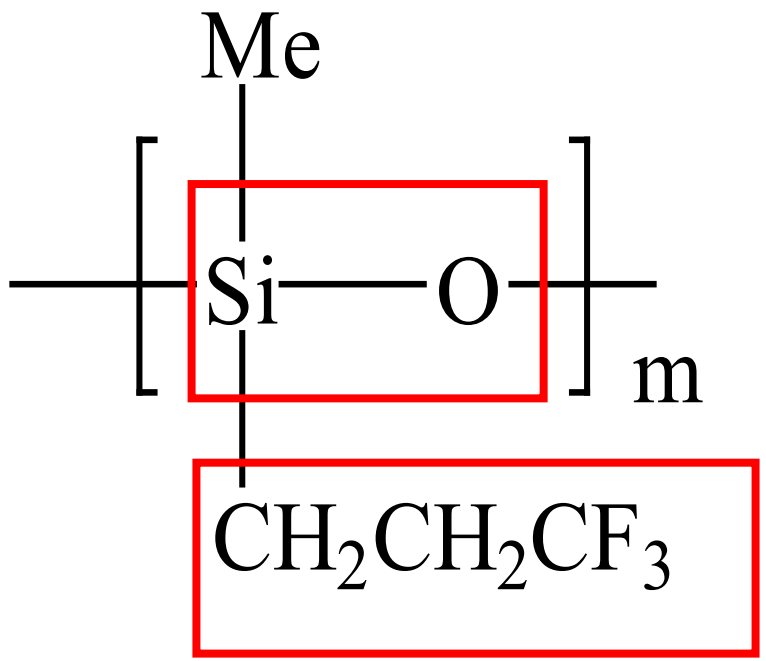
02

Overview of Fluorosilicone Materials

The genetic code of fluorosilicone materials

Fluorosilicone materials are fluoropolysiloxanes characterized by a siloxane (Si–O) backbone and side chains containing both trifluoropropyl and methyl groups.

They integrate the key strengths of their parent materials: the exceptional heat resistance, low-temperature flexibility, weathering stability, and electrical insulation of silicones, together with the superior resistance to hydrocarbons, oils, and chemicals, combined with low surface energy, inherent to fluorinated compounds.



Fluorosilicone Materials: Multi-dimensional Performance

High-temperature resistance

225

(250 °C peak)

Multifunctional chemical resistance

Including fuels, lubricating oils, hydraulic fluids, solvents, and chemicals.

low temperature resistance

(Brittleness Temperature

-62)

Outstanding durability

Excellent resistance to weather, ozone, and aging

Safe, Eco-friendly

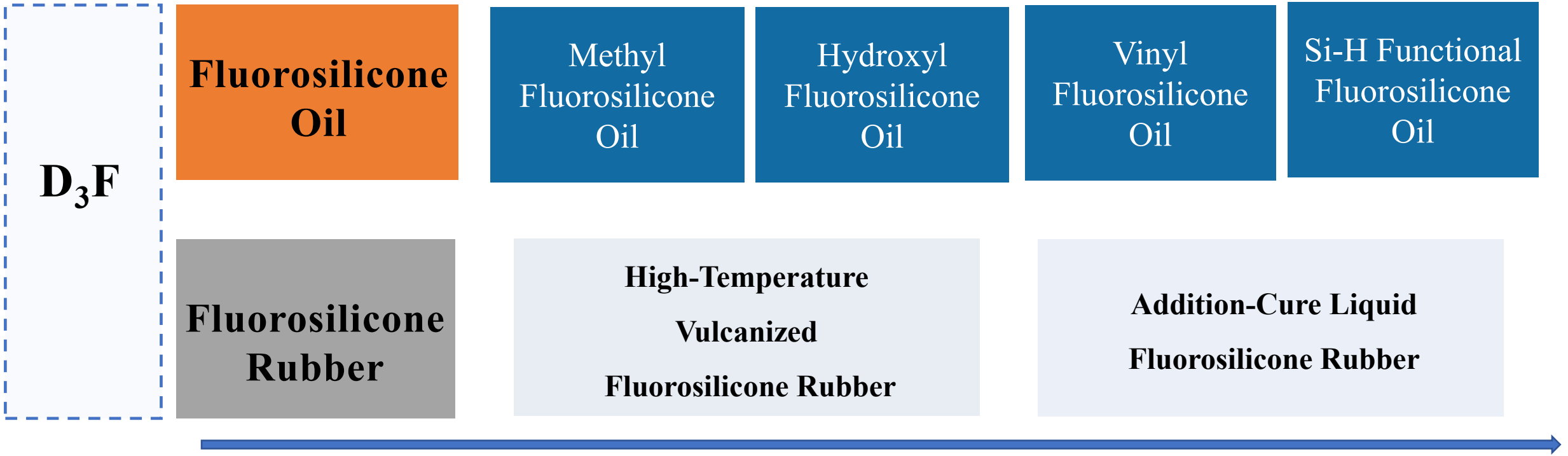
Non-toxic, and Odorless.

THREE

03

Fluorosilicone Materials Family

Fluorosilicone oil and fluorosilicone rubber are synthesized via polymerization of D_3F cyclic trimer.

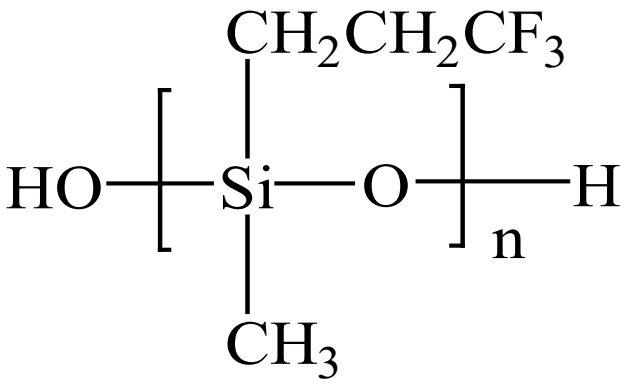


Fluorosilicone Oil

Hydroxy Fluorosilicone Oil

Characteristics: Hydroxyl-terminated fluorosiloxane polymer

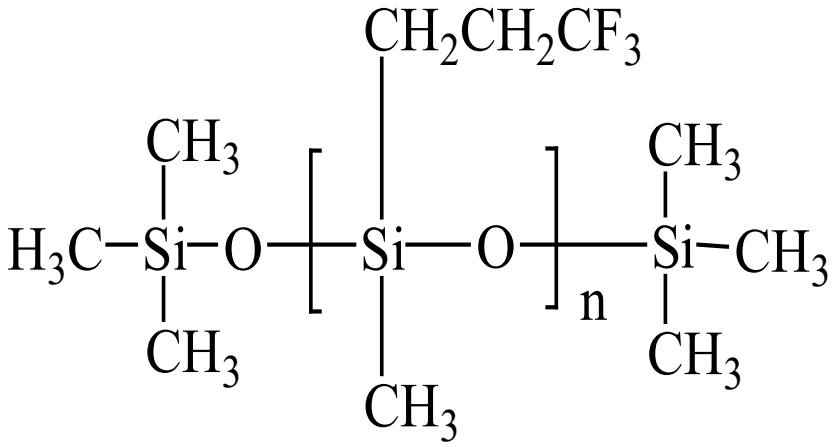
Applications: Used as the structuring control agent for fluorosilicone rubber, and as the base gum or diluent for condensation-cure, room temperature vulcanizing (RTV) fluorosilicone rubber.



Methyl Fluorosilicone Oil

Characteristics: Methyl-terminated fluorosiloxane polymer

Applications: Used as the defoamer, lubricant, and high-voltage cable insulating fluid; also functions as the release agent, barrier coating agent, and gloss enhancer.

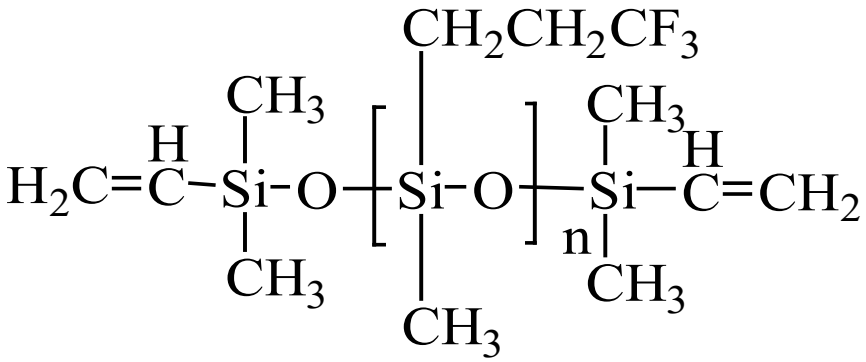


Fluorosilicone Oil

Vinyl Fluorosilicone Oil

Characteristics: Vinyl-terminated fluorosiloxane

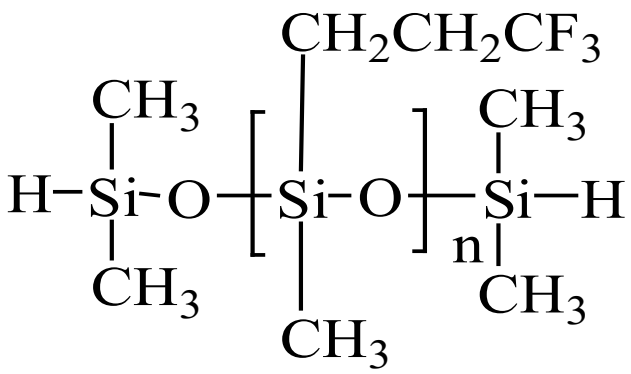
Applications: Base gum for addition-cure fluorosilicone rubber.



Si-H Functional Fluorosilicone Oil

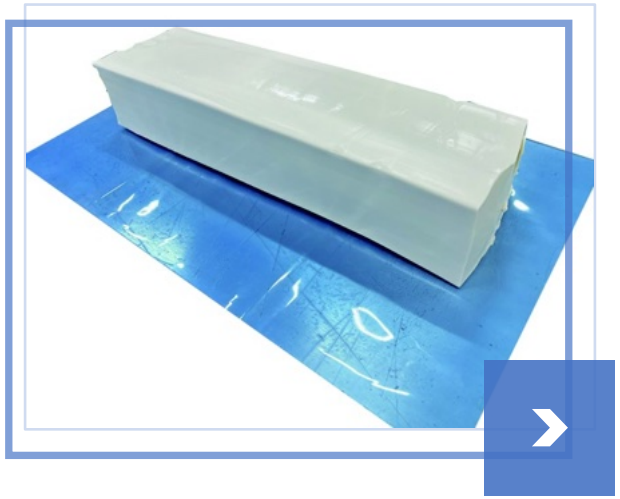
Characteristics: Si-H (silane-hydride) terminated fluorosiloxane polymer.

Applications: Functions as the crosslinker for addition-cure fluorosilicone rubber and as the water-repellent agent for substrates like rubber and metal.



Fluorosilicone Rubber

A hybrid material combining silicone rubber and fluoroelastomer



High-Temperature Vulcanized Fluorosilicone Rubber

A solid compound formulated with a fluorosilicone elastomer gum base, reinforced with silica and modified by structuring control agents and other additives.

01

Addition-Cure Liquid Fluorosilicone Rubber

A liquid, addition-curable polymeric material composed of vinyl-functionalized polyfluorosiloxane as the base polymer and hydrosilyl-terminated oligomeric fluorosiloxane as the crosslinker.

02

High-Temperature Vulcanized Fluorosilicone Rubber	Vs	Addition-Cure Liquid Fluorosilicone Rubber
Solid Compound	Basic Form	Liquid, Two-Part A/B System
Compression Molding, Calendering, Extrusion	Processing Method	Injection Molding
Peroxide Curing	Curing Mechanism	Platinum-Catalyzed Addition Curing
Low	Product Complexity & Precision	Extra-high
Can be produced on a plate vulcanizer; simple mold structure, low cost.	Mold & Equipment Cost	Requires a dedicated LSR injection molding machine; high-precision molds, high cost.

HTV Fluorosilicone Compound Segmentation

01

High-Resilience Fluorosilicone Rubber

Resilience >35%, Suitable for manufacturing umbrella valves, duckbill valves, O-rings, diaphragms, and similar components.

02

High-Tear-Strength Fluorosilicone Rubber

Offers excellent tensile and tear strength, making it ideal for damping elements and dynamic,fatigue-resistant parts.

03

Metal- / Nylon-Bondable Fluorosilicone Rubber

When used with the dedicated primer, it achieves excellent adhesion to metals, nylon, and other substrates.

04

Turbocharger-Hose-Grade Fluorosilicone Rubber

Features excellent bondability to silicone rubber, enabling the production of turbocharger hoses and other composite hose assemblies.

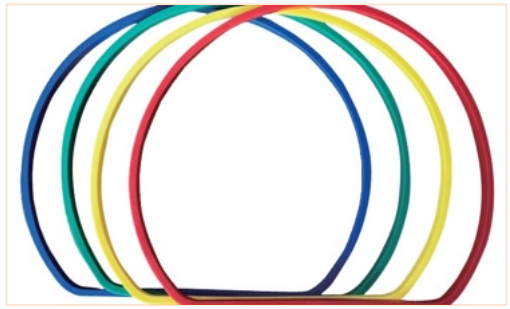
HTV Fluorosilicone Compound Segmentation

05
Flame-Retardant Series Fluorosilicone Rubber

Excellent flame-retardant properties, achieving a **UL94 V-0** rating.

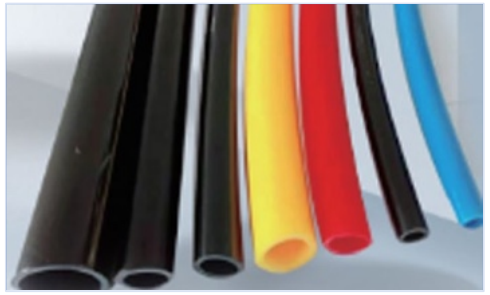
06
Transformer-specific Fluorosilicone Rubber

Features exceptional resistance to transformer oil with a **dielectric loss < 0.5%**.



07
Extruded Series Fluorosilicone Rubber

Excellent extrusion processability for manufacturing a wide range of hoses.

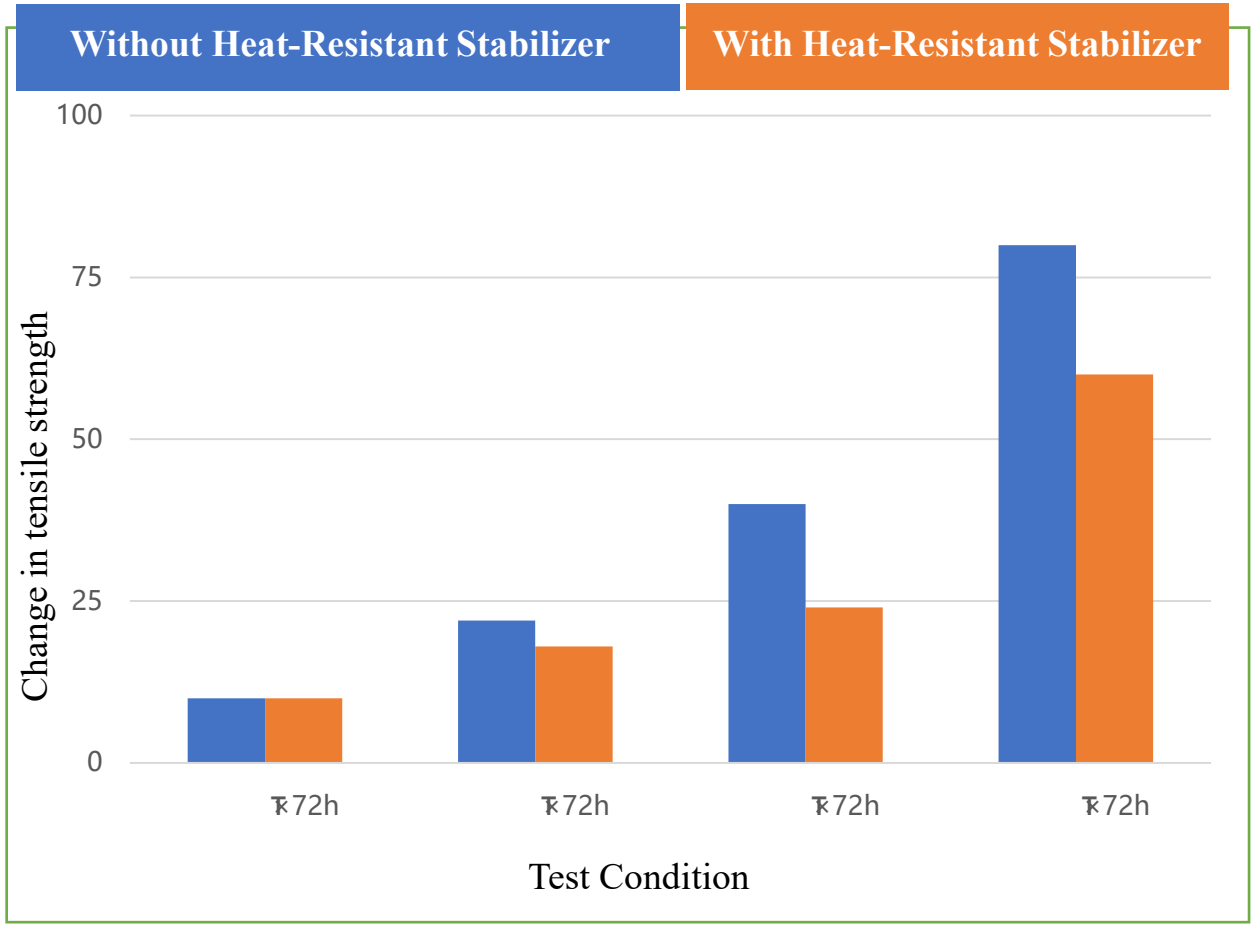


08
Addition-type Fluorosilicone Rubber

Possesses a high safety profile and is suitable for **food-contact applications**.

Fluorosilicone Rubber: Heat Resistance

Fluorosilicone rubber is rated for continuous service at 200 °C. Above this temperature, thermal cleavage of the siloxane backbone occurs, degrading mechanical properties. Formulation with heat-resistant stabilizers is necessary to improve its thermal-oxidative stability.



Effect of Heat-Resistant Stabilizers on Fluorosilicone Rubber

Fluorosilicone Rubber Curing Systems

The curing systems for fluorosilicone rubber include peroxides (DBPH, DCBP) and platinum-catalyzed addition cure. Each offers distinct properties for different application needs.

DBPH

Used for compression/injection molding at 160—170 °C. A cost-effective solution for general industrial parts, automotive seals, and O-rings in price-sensitive applications.

01

02

DCBP

Curing temperature range: 100—120 °C. Applied in processes such as hand-lay-up coating and extruded rubber hose manufacturing.

03

Platinum-Catalyzed

It offers a wide curing temperature range (both high and low). Suitable for applications demanding extreme purity, such as medical, food-contact, high-end electronics, and high-clarity products.

Comparison of Fluorosilicone Rubber Processes

Process Type	Compression Molding	Injection Molding	Extrusion Molding	Coating / Cladding
Product Shape	Medium Complexity	High complexity	2D Constant cross-section	Complex Substrate Surface
Dimensional Accuracy	Good	Excellent	Fair	Process-Dependent
Production Efficiency	Low-Medium	Very High	Very High (Continuous)	Low
Mould/Equi-pment Cost	Low-Medium	High	Medium	Medium-High
Key Applications	Seals, Gaskets	Precision Parts, Oil Seals	Sealing Strips, Hoses	Rubber-covered roll, Hoses

04

Application Fields of Fluorosilicone Materials

Multiscenario Applications of Fluorosilicone Rubber

—Critical Sealing & Flexible Components in Demanding Environments

Automotive

Critical seals for engines, Transmission, and fuel systems.

Aerospace

Seals & Protective Coatings for Fuel Lines, Hydraulic Systems, Engine Bays

Petrochemical

O-rings, Valve Gaskets, Reactor Lid Seals, Storage Tank Roof Seals, Pipeline Seals

Cosmetics Packaging

Bottle Cap Liners, Pump Seals, Tube Connector Seals

Wearables

Watch Straps, Wristbands, Device Seals, Waterproof Components

New Energy

Bionic Robots

Fluorosilicone Rubber's Core Advantages in Automotive Applications

01

Excellent High-Temperature Resistance

It can operate stably for extended periods at temperatures above 200 °C, ensuring that pipelines do not age or deform under extreme operating conditions.

02

Excellent Oil and Chemical Resistance

It exhibits strong corrosion resistance to fuels, engine oils, lubricants, and exhaust environments.

03

Excellent Adhesion to Silicone Rubber and Metals

Through formulation design, fluorosilicone rubber can achieve strong adhesion to substrates such as silicone rubber, metals, and nylon.

Core seals for Engine, Transmission, and Fuel System

Fuel System Applications

Fuel line O-rings, injector seals, fuel tank float seals

Engine System Applications

Turbocharger hoses, bellows, valve stem seals

Transmission Applications

Transmission seals, gaskets, and oil seals

Performance of Fluorosilicone Rubber in Automotive Oil-Contact Environments

Oil Type	Test Condition	Rate of volume change
Diesel	□ ×336 h	7~10%
Biodiesel(B20)	□ ×336 h	7~10%
RME (DIN14214)	□ ×72 h	8~10%
Engine oil 5W30	×168 h	2~3%
Brake Fluid DOT3	×72 h	2~4%
Lubricating oil 206304	×94 h	2~3%
ASTM C	□ ×72 h	19~27%
FAM B	□ ×72 h	24~30%
IRM 903	□ ×72 h	2~3%

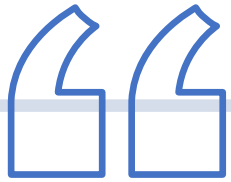
Automotive Applications

Exhaust Gas Valve

Bellows

Turbocharger Hose

Seals

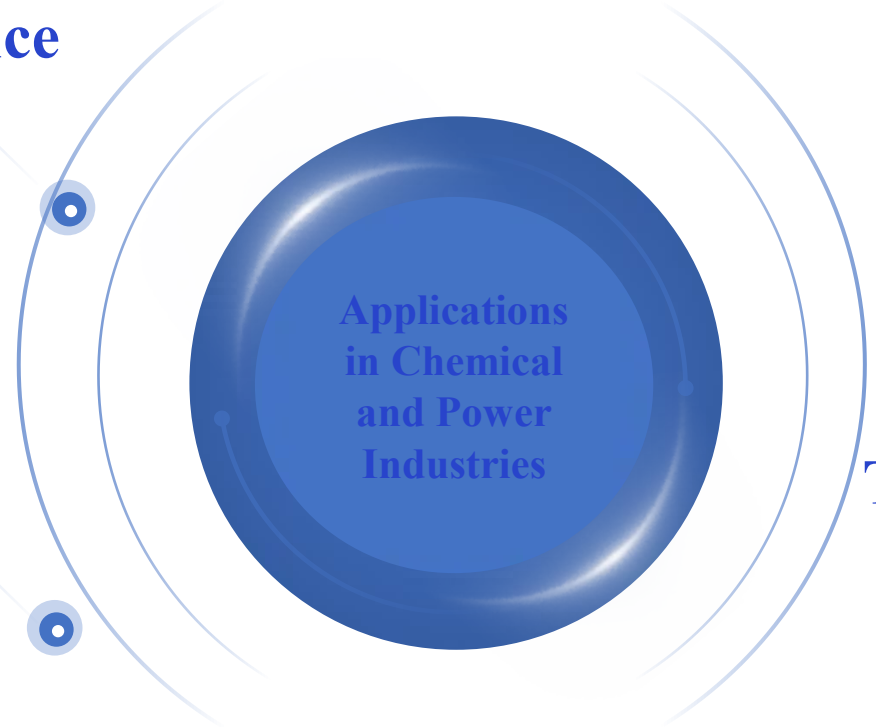


Acid and Alkali Resistance

Suitable for acid/alkali-resistant piping, unaffected by corrosive chemicals.

Weather Resistance

Ideal for outdoor cable sheathing, providing long-term oxidation resistance to ensure reliable power transmission.



Solvent Resistance

Used in valve seals, coating seals, and tank roof seals, offering excellent resistance to solvents.

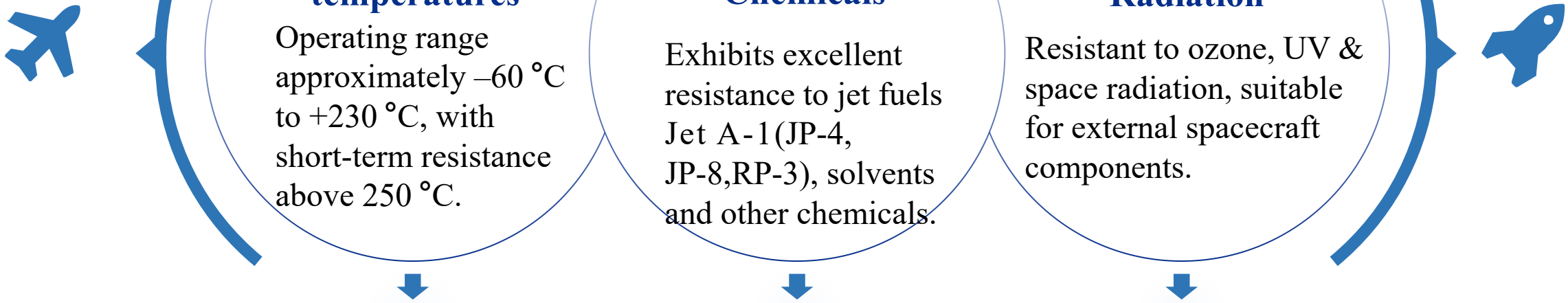
Transformer Oil Resistance

Applied in transformer seals, with a dielectric loss of <0.5% in transformer oil.

Resistance to Solvents, Acids, and Alkalis of Fluorosilicone Rubber

	Medium	Test Condition	Volume Change Rate/%
1	10 wt% HCl solution	□ ×168 h	+2
2	Concentrated HCl	□ ×168 h	+8
3	10 %6u1OR/L76b/)□	□ ×168 h	+1
4	10 wt% NaOH solution	□ ×168 h	+1
5	50 wt% NaOH solution	□ ×168 h	+2
6	Ethanol	□ ×168 h	+5
7	Xylene	□ ×168 h	+20
8	Carbon tetrachloride	□ ×168 h	+20

Sealing for Extreme Operating Conditions in Aerospace



Applications include fuel tank seals, O-rings, refueling valve gaskets, and fuel lines.

Liquid Fluorosilicone Rubber (LSR) is also used as a surface coating, lubricant, sealant mastic, and adhesive.

Performance of Fluorosilicone Rubber in Aerospace Applications

	Oil Type	Test Condition	Volume Change Rate/%
1	Jet A-1 (RP-3)	×24 h	+5
2	Jet A-1 (RP-3)	□ ×72 h	+12
3	AMS 2629	□ × 22 h	+21
4	AMS 3021	□ × 70 h	+12

	Performance	Test Condition	Test Result
5	Ozone resistance (aging)	200×10^{-8} T×72 h 20%Tensile	No cracking

Smart Wearables

Fluorosilicone materials are key to enhancing the durability, safety, and premium feel of high-end smartwatches and fitness trackers.

Watch Bands: All-Day Comfort

Hypoallergenic and resistant to sweat, oils, alcohol, and cosmetics; easy to clean and disinfect.

Housing/Seals: Superior Water & Dust Resistance

Effectively protects internal electronics from moisture and dust, significantly extending product lifespan.

Medium	Test Condition	Volume Change Rate/%
Oleic acid	□ ×24 h	1%
Artificial sebum	□ ×24 h	1%
Artificial Sweat	□ ×24 h	1%

Applications in Cosmetics

Lipstick Molding Tube

Addition-type liquid fluorosilicone rubber

● Bottle Cap Seals and Gaskets

Prevent leakage of essential oils and active ingredients; resistant to alcohols, glycerine, and other solvents.

● Lipstick molding tubes

Resistant to components in lipstick such as tree wax, mineral oil, and vegetable oil.

Essential oil	Test Condition	Volume Change Rate/%
Gardenia Essential Oil	▒▒ ×24 h	7%
Eucalyptus essential oil	▒▒ ×24 h	12%

Broadening Application Areas

New-Generation Bionic Robots

Bionic skin

Offers superior tactile sensing and biocompatibility while protecting internal precision components.

Special sealing

High oil and heat resistance, suitable for demanding and complex working conditions.

Conductive fluorosilicone rubber

Integrates EMI shielding and tactile sensing in a single, smart design.

Broadening Application Areas

——New Energy

Outstanding Performance in New Energy Applications

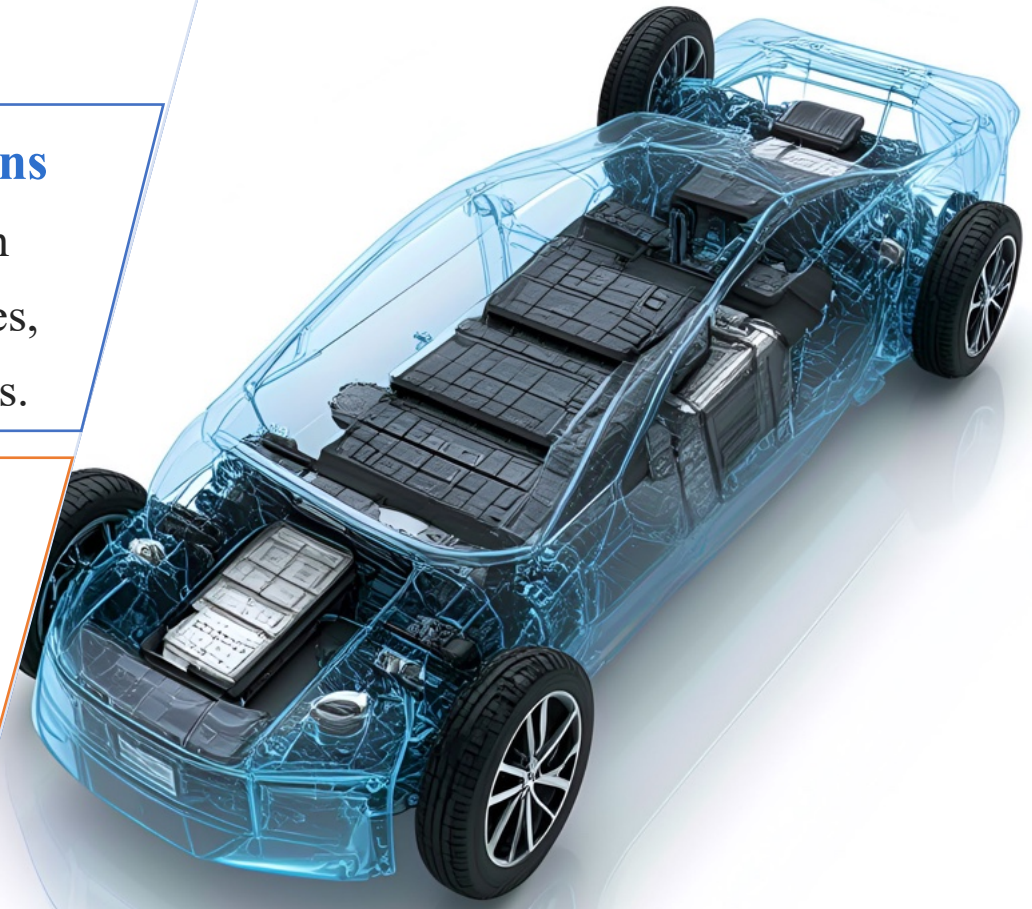
With high temperature and corrosion resistance, it serves as an ideal material for sealing and insulation in new energy batteries, significantly enhancing the safety and lifespan of battery packs.

Reliable Protection for Photovoltaic Modules:

Provides encapsulation and frame sealing, effectively resisting UV exposure and extreme weather conditions to ensure long-term stable operation of the modules.

Safety Assurance for Energy Storage Systems:

Offers excellent electrical insulation and chemical resistance, delivering efficient and reliable protection for energy storage systems.



Performance Comparison Between Fluorosilicone Rubber and Other Rubbers

Material	Advantage	Limitation
Fluorosilicone Rubber (FVMQ)	Excellent oil resistance across a wide temperature range; well-balanced over all properties	Higher cost; lower tensile strength compared to fluororubber
Fluorocarbon Rubber (FKM)	Excellent oil resistance and high strength	Poor low-temperature performance (prone to embrittlement above –30 °C)
Silicone Rubber (VMQ)	High-temperature resistance (up to 300), good flexibility	Poor oil resistance, susceptible to swelling in oils
Acrylate Rubber ACM	Excellent oil resistance	Inferior low-temperature performance

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