Advanced protection for extreme environments.
Specialty Coating Systems is the global leader in delivering Parylene conformal coating solutions for advanced technologies. For more than four decades, customers have turned to SCS for the planning, development, engineering and applying of thin-film Parylene polymer coatings to their critical components.

A team of the world’s foremost Parylene specialists, strict quality control systems, and state-of-the-art coating facilities across the Americas, Asia and Europe ensure SCS customers receive the most innovative, precise and consistent coating processes . . . for components and applications where compromise is not an option.

SCS provides innovative solutions for advanced technologies, including Parylene coatings that protect critical components in harsh automotive environments. Parylene coatings provide benefits that enable smaller, more reliable, longer-lasting electronic packages and components, as demanded by the competitive automotive market.

**SCS Parylene Coatings**

Ultra-thin and pinhole-free, SCS Parylene coatings offer exceptional properties for automotive component protection. SCS combines the properties of Parylene with its years of experience, vast technology and worldwide resources to provide the automotive industry with Parylene coatings and services it can rely on, including Parylene HT®, specifically engineered to withstand the most extreme conditions.

The benefits of SCS Parylene HT include:

- Thermal stability up to 450°C
- Superior fluid, chemical, moisture and electrical barrier
- Excellent crevice and multi-layer penetration
- Unparalleled ultraviolet stability

**Environment-Friendly Coatings and Processes**

SCS Complies

As worldwide industry requirements and directives continue to evolve, SCS is at the forefront ensuring our products and services comply with relevant regulatory, environmental and biological standards.

SCS Parylenes comply with the European Union’s Restriction on the use of Hazardous Substances (RoHS). Additionally, SCS has lead-free, halogen-free and low VOC initiatives to support our customers. For more information about SCS certifications and standards, visit SCScertifies.com.

**Metal Whisker Mitigation**

As a result of industry directives, pure metal plating is replacing lead in the solders used throughout the worldwide electronics industry. While safer for the environment, metal plating is known to form whiskers, which cause reliability problems for electronic systems. Parylene coatings suppress the formation of metallic whiskers, OSEs (odd shape eruptions) and dendrites.

**Parylene Coating Properties that Protect Barrier Properties**

SCS Parylene coatings are excellent moisture and chemical barriers for automotive components. Applied in the micron range — much thinner than industry standard coatings — Parylene provides a superior pinhole-free, uniform barrier to protect against corrosive liquids, fluids, gases and chemicals, even at elevated temperatures. Table 1 shows that Parylene HT films did not swell significantly with exposure to automotive chemicals and fluids. Additionally, there were no perceivable changes in the film’s visual or mechanical properties.

Circuit boards coated with SCS Parylene HT were salt-fog tested by an independent testing facility. The coated boards suffered no corrosion, salt or heavy iron oxide deposits after 144 hours of exposure in accordance with ASTM B117-(03) (See Figure 1).

**Figure 1: Circuit boards after 144 hours of salt-fog exposure**

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**Thermal Stability**

Harsh automotive operating environments range from –40°C to more than 300°C, making coating stability critical to the trouble-free life of vehicle electronics. SCS Parylene HT is specifically engineered to provide long-term thermal stability up to 350°C, with intermittent exposures up to 450°C.
UV Stability
SCS Parylene HT offers measurable UV stability after more than 2,000 hours of UV exposure (ASTM G154). Its chemical structure provides protection from degradation and discoloration as a result of such exposure.

Dielectric Properties
SCS Parylenes also have excellent dielectric properties. Their high dielectric strength is attributable to the fact that they can be formed as thin, continuous films, free from defects and the fillers commonly found in conventional coatings, both of which tend to reduce dielectric strength.

SCS Parylene HT has the lowest dielectric constant and dissipation factor among industry standard coatings, enabling it to transfer electric signals without absorption or loss.

Useful in Many Automotive Applications
SCS can apply Parylene coatings to virtually any surface material, including metals, resins, elastomers, plastics, ceramics and glass, in thicknesses ranging from a few hundred angstroms to several mils. Parylene polymerizes as a uniform, thin-film coating that conforms to all surfaces, edges and crevices of a substrate, including the interior of multi-layer electronic packages. As a result of its ultra-thin application, Parylene adds little dimension or mass to critical, weight-sensitive components.

Sensors
Today’s engines and automotive systems rely on complex sensors to monitor the accuracy and operation of moving parts, fluid levels and pressures. Parylene’s excellent barrier properties protect critical sensors from harsh chemicals, fluids and gases, even in high temperature environments.

Hybrid and Fuel Cell Electronic Systems
Many major automotive companies have developed hybrid vehicles that utilize and generate electricity to reduce the world’s reliance on oil for fuel. Parylene HT offers some of the best dielectric properties of protective coatings on the market – ensuring that the high level of power required for operating these hybrid electronic systems will not be weakened or distorted.

Fuel cells operate in the midst of corrosive compounds at elevated temperatures, a very harsh environment for electronics. Parylene HT is chemically structured to provide superior protection for these components.

MEMS
MicroElectroMechanicalSystems (MEMS) represent the cutting edge of automotive innovation and can hold anywhere from 1,000 to 10,000 devices on a 6-inch wafer. Parylene is an ideal protective coating since it is applied as a vapor and has excellent penetrating ability, regardless of shape, size or complexity of the component.

Table 1: Automotive Chemical and Fluid Resistance of SCS Parylene HT

<table>
<thead>
<tr>
<th>Chemical / Condition</th>
<th>Parylene HT Film Swelling</th>
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</thead>
<tbody>
<tr>
<td><strong>Automotive Fluids Heated to 90°C</strong></td>
<td>&lt; 2.5%</td>
</tr>
<tr>
<td>Antifreeze — 50% solution</td>
<td>Engine Oil — 10W30</td>
</tr>
<tr>
<td>Transmission Fluid — Dexron III Mercon</td>
<td></td>
</tr>
<tr>
<td><strong>Automotive Chemicals Heated to 75°C</strong></td>
<td>&lt; 1%</td>
</tr>
<tr>
<td>Nitric Acid — 10% and 70% solutions</td>
<td>Sulfuric Acid — 10% solution</td>
</tr>
<tr>
<td>Sulfuric Acid — 95% – 98% solution</td>
<td></td>
</tr>
<tr>
<td><strong>Automotive Fluids at room temperature</strong></td>
<td>&lt; 1.5%</td>
</tr>
<tr>
<td>Brake Fluid — DOT 3</td>
<td>Power Steering Fluid</td>
</tr>
<tr>
<td>Windshield Washer Fluid</td>
<td>Unleaded Gasoline — 87 Octane</td>
</tr>
<tr>
<td>Diesel Fuel</td>
<td></td>
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</tbody>
</table>

Testing Parameters:
- Film thickness: 16-20 micron
- Exposure time: 120 minutes

SCS Parylene Services
SCS Parylene coatings are applied in a vacuum chamber via a vapor deposition polymerization (VDP) process. Components to be coated are only required to have a reasonable vacuum tolerance. There are no solvents, catalysts or plasticizers involved in the coating process and, since Parylene deposition occurs at ambient temperatures, there are no associated cure stresses. Unlike Parylene coatings, other industry coatings may require catalysts, elevated temperatures or cure cycles to improve coating properties.

With advances in SCS’ worldwide resources and technologies, Parylene coatings are cost-competitive and, in many cases, less expensive than traditional coatings. In addition to a proven track record of timely processing and delivery of customer parts, SCS has years of experience with automotive quality standards, including ISO 9001:2008 certifications and Production Part Approval Processes (PPAP).
Innovative solutions for advanced technologies.

Specialty Coating Systems leads the industry in providing Parylene solutions for its global customers’ advanced technologies. SCS is a direct descendant of the companies that originally developed Parylene, and we have more than 40 years of experience and expertise that we leverage on every project for our customers—from the initial planning phases, to advanced engineering, to the development of application processes.

Our worldwide resources include highly experienced sales engineers, some of the world’s foremost Parylene specialists, and expert manufacturing personnel, working in eleven state-of-the-art coating facilities around the globe. In addition to Parylene coating services, we design and manufacture industry-leading Parylene deposition systems; liquid spray, dip and spin coating systems; ionic contamination test systems; and UV and thermal cure units. Our equipment is used in environments that range from university and research labs to high-volume production applications.

Our extensive and proactive approach to production and quality requirements—testing, validating, documenting and processing—provides our customers peace of mind and minimizes their resources needed to meet the most challenging industry specifications and quality requirements.