**Product Information**

**Clean Surface Coatings**

**Dow Corning® 2634 Coating**

**FEATURES**
- Clear, low-viscosity solution
- No impact on substrate appearance
- Covalently bonds to glass, plastic and metal oxide surfaces
- Dries to a thin, transparent film

**BENEFITS**
- Provides excellent oil and water repellency to surfaces
- Provides excellent and durable reduced stain properties
- Develops a surface with a low coefficient of friction
- Creates an easy-to-clean surface
- Displays excellent abrasion resistance

**COMPOSITION**
- 20% active polymer in solvent

**APPLICATIONS**
Reduced-fingerprint, easy-to-clean, abrasion-resistant Dow Corning® brand Clean Surface Coatings are suitable for many substrates, including glass, plastic, metals and films. Typical applications include:
- Flat-panel displays
- Touch-screen displays on electronic devices
- Office equipment
- Cellular phone components
- As reduced-fouling coatings for optical fibers

**TYPICAL PROPERTIES**
Specification Writers: Please contact your local Dow Corning sales office or your Global Dow Corning contact before writing specifications on this product.

<table>
<thead>
<tr>
<th>Property</th>
<th>Unit</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td></td>
<td>Colorless to pale yellow</td>
</tr>
<tr>
<td>Specific Gravity at 20°C (68°F)</td>
<td></td>
<td>1.5</td>
</tr>
<tr>
<td>Viscosity at 25°C (77°F)</td>
<td>mm²/s</td>
<td>1.0</td>
</tr>
<tr>
<td>Nonvolatile Content</td>
<td>%</td>
<td>20</td>
</tr>
</tbody>
</table>

**DESCRIPTION**
Surfaces routinely subjected to touch are commonly stained with fingerprints, skin oil, sweat and cosmetics. Once a surface is contaminated, stains are not easily removed, or cleaning materials are required. Surfaces with anti-reflective coatings are very sensitive to surface contamination such as dirt and fingerprints, which not only can cause negative impacts on aesthetic appearance but also can result in safety issues.

In demanding applications, such as handheld electronic devices and displays, the challenge is to obtain a fouling-resistant surface with long-term surface performance durability.

**Dow Corning® Clean Surface Coatings** are new alkoxysilane functional perfluoropolyether (PFPE) hybrid polymers that exhibit the synergistic effects of the oleophobicity and low coefficient of friction of fluoro-polymers and the hydrophobicity and durability of silicone. Improved abrasion and UV durability over current chemical treatments are obtained with the use of a monofunctional terminal alkoxyl silane to the PFPE polymer. The alkoxyl silane reactive end will covalently bond to the surface via hydrolysis and condensation reactions, resulting in a structurally ordered chemical modification of the surface. This covalent bond gives the needed durability in applications such as touch-screen displays.

A major advancement of this new technology is resistance to wear by rubbing, allowing the surface to stay cleaner for a longer period of time. The easy-to-clean surface comes from the low surface energy of the alkoxyl silane functional PFPE polymer.

This chemical surface modifier is particularly useful in forming a low-surface-tension layer or a dirt-
preventive layer on the surface of various substrates.

A wide range of uses will benefit from these surface improvements, including applications such as electronic (touch) display screens (e.g., liquid-crystal displays, CRT displays, plasma displays, projection TVs).

HOW TO USE
Application
*Dow Corning*® 2634 Coating can be applied by dip coating or PVD (Physical Vapor Deposition) coating.

Dip Coating
2. Dilute *Dow Corning* 2634 Coating to 0.1% solids with an appropriate fluorinated solvent (see list below).
3. Dip the substrate into *Dow Corning* 2634 Coating solution for approximately 3 minutes.
4. Dry coated substrate for 8 hours at room temperature, or 1 hour at 50°C (122°F) and 50% relative humidity. (Drying in an acidic environment will increase the bonding rate to the substrate.)
5. Rinse coated substrate in a sonication bath with a suitable solvent (see list below).
6. Dry at room temperature for several minutes.

PVD Coating
2. Load *Dow Corning* 2634 Coating and substrate into vapor deposition chamber.
3. Deposit coating at appropriate temperature, time and pressure for desired substrate.

*Dow Corning* possesses adequate PVD processing experience to assist customer processing.

Solvents
Examples of solvents suitable for use with *Dow Corning* 2634 Coating include:
- Perfluorohexane (C₆F₁₄)
- Hydrofluoroether (C₄F₉CH₃)
- *Novec®* HFE-7100 or HFE-7200
- *Solvay Solexis®* HT-110
- *Fluorinert®* FC-77

HANDLING PRECAUTIONS
PRODUCT SAFETY INFORMATION REQUIRED FOR SAFE USE IS NOT INCLUDED IN THIS DOCUMENT. BEFORE HANDLING, READ PRODUCT AND SAFETY DATA SHEETS AND CONTAINER LABELS FOR SAFE USE, PHYSICAL AND HEALTH HAZARD INFORMATION. THE SAFETY DATA SHEET IS AVAILABLE ON THE DOW CORNING WEBSITE AT DOWCORNING.COM, OR FROM YOUR DOW CORNING REPRESENTATIVE OR DISTRIBUTOR, OR BY CALLING YOUR GLOBAL DOW CORNING CONNECTION.

PERFORMANCE DATA
The following performance tests were completed with *Dow Corning* 2634 Coating using coated-on-glass substrate with a dip coating method.

Water and Oil Repellency Properties
The static and sliding contact angles are presented for *Dow Corning* 2634 Coating and compared with commercially available fluorinated treatments respectively (Table I-III).

*Dow Corning* 2634 Coating exhibits excellent static contact (θs) and sliding (α) angles for water, ethylene glycol and n-hexadecane.
The reduced-fouling property can be estimated from the static contact angle ($\theta_s$), which indicates the repellency against the liquid. The higher contact angle ($\theta_s$) suggests a reduced fouling property.

The easy-clean property can be estimated from the sliding angle and the hysteresis of dynamic contact angle, which is the difference of advancing angle ($\theta_a$) and receding angle ($\theta_r$), i.e., “$\theta_a-\theta_r$.” The lower sliding angle and hysteresis suggest a higher easy-clean property.

**Molecular Structure and Performance**

The excellent performance of Dow Corning 2634 Coating results from its unique $\alpha$-perfluoropolyether alkoxy silane molecular structure.

The long perfluoropolyether chain provides:
- High fluorine concentrate (60 perfluoro alkyl units per mol)
- Flexible molecular chain

The $\alpha$-functional alkoxy silane terminal provides:
- Mono-molecular flexible layer

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**Table I. Water Contact and Sliding Angle**

<table>
<thead>
<tr>
<th>Product</th>
<th>Contact Angle, degrees</th>
<th>Sliding Angle, degrees</th>
<th>Advancing Angle, degrees</th>
<th>Receding Angle, degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dow Corning 2634 Coating</td>
<td>112</td>
<td>11</td>
<td>120</td>
<td>110</td>
</tr>
<tr>
<td>C8Rf Silane</td>
<td>110</td>
<td>23</td>
<td>118</td>
<td>99</td>
</tr>
<tr>
<td>C6Rf Silane</td>
<td>111</td>
<td>16</td>
<td>119</td>
<td>105</td>
</tr>
<tr>
<td>Comparative PFPE Sample</td>
<td>106</td>
<td>29</td>
<td>114</td>
<td>93</td>
</tr>
</tbody>
</table>

**Table II. Hexadecane Contact and Sliding Angle**

<table>
<thead>
<tr>
<th>Product</th>
<th>Contact Angle, degrees</th>
<th>Sliding Angle, degrees</th>
<th>Advancing Angle, degrees</th>
<th>Receding Angle, degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dow Corning 2634 Coating</td>
<td>67</td>
<td>7</td>
<td>71</td>
<td>61</td>
</tr>
<tr>
<td>C8Rf Silane</td>
<td>65</td>
<td>6</td>
<td>69</td>
<td>61</td>
</tr>
<tr>
<td>C6Rf Silane</td>
<td>66</td>
<td>5</td>
<td>70</td>
<td>63</td>
</tr>
<tr>
<td>Comparative PFPE Sample</td>
<td>66</td>
<td>9</td>
<td>68</td>
<td>58</td>
</tr>
</tbody>
</table>

**Table III. Ethylene Glycol Contact and Sliding Angle**

<table>
<thead>
<tr>
<th>Product</th>
<th>Contact Angle, degrees</th>
<th>Sliding Angle, degrees</th>
<th>Advancing Angle, degrees</th>
<th>Receding Angle, degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dow Corning 2634 Coating</td>
<td>96</td>
<td>17</td>
<td>100</td>
<td>80</td>
</tr>
<tr>
<td>C8Rf Silane</td>
<td>91</td>
<td>12</td>
<td>96</td>
<td>82</td>
</tr>
<tr>
<td>C6Rf Silane</td>
<td>93</td>
<td>10</td>
<td>98</td>
<td>88</td>
</tr>
<tr>
<td>Comparative PFPE Sample</td>
<td>88</td>
<td>21</td>
<td>95</td>
<td>73</td>
</tr>
</tbody>
</table>

Figure 2. Abrasion Property of Reduced-Fouling-Treated Substrate (cotton cloth, 3,000 gf, 60 strokes/minute)
**Dow Corning 2634 Coating** protects the substrate against water, oil, stains or dirt.

**Abrasion Resistance**
A glass substrate coated with Dow Corning 2634 Coating was abraded with a dry cotton cloth fixed to the surface of a stainless block (3000 g) at 60 strokes per minute. Abrasion resistance was evaluated using the static contact angles against water (2 μL) to measure performance.

**Dow Corning 2634 Coating** exhibits excellent abrasion resistance (light gray line, Figure 2).

The perfluoropolyether chain has a flexible and low coefficient of friction and it shows better abrasion resistance than the perfluoro alkyl coating material (black line, Figure 2).

Within perfluoropolyether-type materials, Dow Corning 2634 Coating, (monofunctional α-perfluoropolyether silane), showed higher initial contact angle and higher abrasion resistance than the comparing sample (ω-perfluoro alkyl coating silane) (dark gray line, Figure 2).

**PROCESSING GUIDE**

**Substrate Preparation**
**Dow Corning 2634 Coating** can treat any substrate, such as glass, ceramics, silicon or metals with activated surfaces, that has reactive hydroxyl functionality on the surface. Dow Corning 2634 Coating is difficult to apply on inert substrate surfaces such as bare plastics, metal oxide surfaces, plating surfaces, etc.

Because the performance of *Dow Corning* 2634 Coating depends upon the cleanliness of the substrate surface, the following pretreatments are recommended.

**Glass, Ceramics, Silicon**
- Clean substrate to provide a dry and oil-free surface.

**Metals**
- Pretreat surface to remove metal oxide.

**Plastics**
- Apply a SiO₂-type hard coat layer as a primer.

**Post-Cure Guide**
The reactive unit of *Dow Corning* 2634 Coating is alkoxy silane. The mechanism of the curing process is generally described in Figure 3.

**Process Flow Chart for Hydrolysis Curing Mechanism of Dow Corning 2634 Coating**

Because the hydrolysis process is slow, especially in neutral environments, it may take more than one week to cure completely in a neutral environment at low temperature and humidity, such as during the winter season (Figure 4).

**USABLE LIFE AND STORAGE**
*Dow Corning* 2634 Coating has a usable life of 15 months from date of manufacture.

**PACKAGING**
*Dow Corning* 2634 Coating is available in 20- and 100-g (0.7- and 3.5-oz) bottles.

*Dow Corning* 2634 Coating is also available as *Dow Corning* 2634P Coating, which features a 100% active polymer on a carrier system suitable for use in PVD applications.

**LIMITATIONS**
This product is neither tested nor represented as suitable for medical or pharmaceutical uses.

**HEALTH AND ENVIRONMENTAL INFORMATION**
To support customers in their product safety needs, Dow Corning has an extensive Product Stewardship organization and a team of Product Safety and Regulatory Compliance (PS&RC) specialists available in each area.
For further information, please see our website, dowcorning.com, or consult your local Dow Corning representative.

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Figure 5. Contact, Sliding Angle Property of Reduced-Fouling-Treated Surface Against Various Liquids

<table>
<thead>
<tr>
<th>Liquid</th>
<th>Contact Angle (°)</th>
<th>Sliding Angle (°)</th>
<th>Receding Angle (°)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water (72 dyn/cm)</td>
<td>112</td>
<td>23</td>
<td>110</td>
</tr>
<tr>
<td>Ethylene Glycol  (48 dyn/cm)</td>
<td>96</td>
<td>12</td>
<td>100</td>
</tr>
<tr>
<td>n-Hexadecane (27 dyn/cm)</td>
<td>60</td>
<td>10</td>
<td>82</td>
</tr>
</tbody>
</table>

Note: 1° Contact Angle (2μL), 2° Sliding Angle (20μL), 3° Advancing Angle, 4° Receding Angle

1 CF₃(CF₂)₇(CH₂)₇OS(OEt)₂
2 CF₃(CF₂)₇(CH₂)₇OS(OEt)
3 CF₃(CF₂)₇(CH₂)₇OS(OEt)
4 α,ω-functional type perfluoropolyether silane treating material

Picture shows the photo of the droplet at the sliding angle (α). The tangent line of the left shows the advancing angle (θa) and the tangent line of the right shows the receding angle (θr).