**FluoroSyl™ 3750 and Physical Vapor Deposition**

FluoroSyl™ 3750 is an antifouling coating that repels water, oil, foods and fingerprints. The general characteristics of FluoroSyl include:

- Fluorosolvent-borne functional PFPE
- Forms a durable bond to glass and SiO₂ coated surfaces
- Transparent to visible light with excellent optical properties in the visible spectrum
- Applied by physical vapor deposition (PVD) or spray, dip, spin, or flow coating.
- Significantly reduces static and kinetic coefficients of friction of glass.
- A nano coating of 10 – 15 nm that will not distort optical properties of glass.

**Application guide:**

The substrate must be cleaned to provide a dry and oil free surface. The cleaning options include the following:

- Ultrasonic clean system with base, glass cleaning detergent and deionized water; rinse and dry
- Plasma / corona treatment
- Wet chemical acid/base (i.e., concentrated H₂SO₄ + H₂O₂ to increase Si-OH on glass surface)

The following is a basic guide for FluoroSyl application by PVD. FluoroSyl may be applied by PVD (electron beam or thermal evaporation) after depositing onto heated boats or porous pellets. Boats or pellets are heated in the PVD system to vaporize the FluoroSyl. For best results, a SiO₂ adhesion layer should be deposited on the substrates immediately before depositing FluoroSyl.

- Place substrate in holders and load into PVD chamber
- Load SiO₂ crystals into e-beam heater
- Place the FluoroSyl on the molybdenum or tungsten boat of resistance heater
- Pump down vacuum chamber till pressure is less than 2.0 x 10⁻⁵ Torr
- Ion clean the substrate for 3 minutes using Argon (start at 120V at 6A)

- E-beam evaporate SiO₂
  - Deposit a ~10 nm layer of SiO₂
  - Monitor thickness using Quartz Crystal Microbalance (QCM) (tooling factor = 1, density = 2.6, acoustic impedance (z-ratio) set to SiO₂)
  - Deposition rate ~ 0.5 nm per second

- Pump down vacuum chamber till the pressure is less than 2.0 x 10⁻⁵ Torr

- Resistive heat evaporate and deposit FluoroSyl
  - Use a Quartz Crystal Microbalance to monitor the deposition with tooling factor = 1, acoustic impedance (z-ratio) = 1.0, density = 1.0.
  - Typical current input is 80-100A for resistance boat heaters. Less power maybe needed for resistive coil heaters (temperatures less than 300°C preferred, deposition rates of ~0.5 nm per second and Quartz Crystal Microbalance thickness of 15 nm.

- Vent the chamber and remove coated parts

**Cure Process:**

There are two options for curing FluoroSyl. The Low Temperature and 50% Relative Humidity method at 50-60°C for 1 hour. Or High Temperature and 50% Relative Humidity method at 150°C for 30 minutes.

If the coated surface appears oily or hazy, wipe it with a clean non-abrasive cloth.

**Properties:**

<table>
<thead>
<tr>
<th></th>
<th>FluoroSyl</th>
<th>Uncoated Glass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water contact angle</td>
<td>&gt;110°</td>
<td>&lt;10°</td>
</tr>
<tr>
<td>n-Hexadecane contact angle</td>
<td>&gt;65°</td>
<td>&lt;10°</td>
</tr>
<tr>
<td>Fingerprint reduction</td>
<td>Excellent</td>
<td>Poor</td>
</tr>
<tr>
<td>Easy to clean properties</td>
<td>Excellent</td>
<td>Poor</td>
</tr>
<tr>
<td>Permanent maker repellency</td>
<td>Excellent</td>
<td>Poor</td>
</tr>
<tr>
<td>Kinetic coefficient of friction</td>
<td>0.08</td>
<td>0.15</td>
</tr>
<tr>
<td>Steel wool abrasion</td>
<td>&gt;5000 cycles</td>
<td>N/A</td>
</tr>
</tbody>
</table>