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 SiO_2 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 H_2SO_4 + H_2O_2 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 SiO_2 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 SiO_2
- Deposit a ~10 nm layer of SiO_2
- Monitor thickness using Quartz Crystal Microbalance (QCM) (tooling factor = 1, density = 2.6, acoustic impedance (z-ratio) set to SiO_2)
- 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:

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

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