



Surface Modification Coatings

Integrated Surface Technologies (IST) RPX-540™ offers the most advanced vapor processing technology available by integrating the latest hardware designs found in the semiconductor industry. The RPX-540 has the lowest COC (cost of consumables) of any vapor-based surface modification tool in the industry. IST has engineered a large, user-configurable chamber with multiple precursor vaporizers, all powered by National Instruments' flexible Labview software and controller. This unique combination allows users to easily custom tailor surface coatings for multiple applications in the same platform, saving the user space and time, while increasing productivity. The RPX-540 is designed for 24/7 production with guaranteed uptimes and is equipped with Vaporrix™* chemical cartridges. Vaporrix cartridges are pre-filled, pre-conditioned, and pre-qualified for quick chemical changes or refilling, and are easy to install by IST personnel.



RPX-540 Advanced Vapor Deposition System



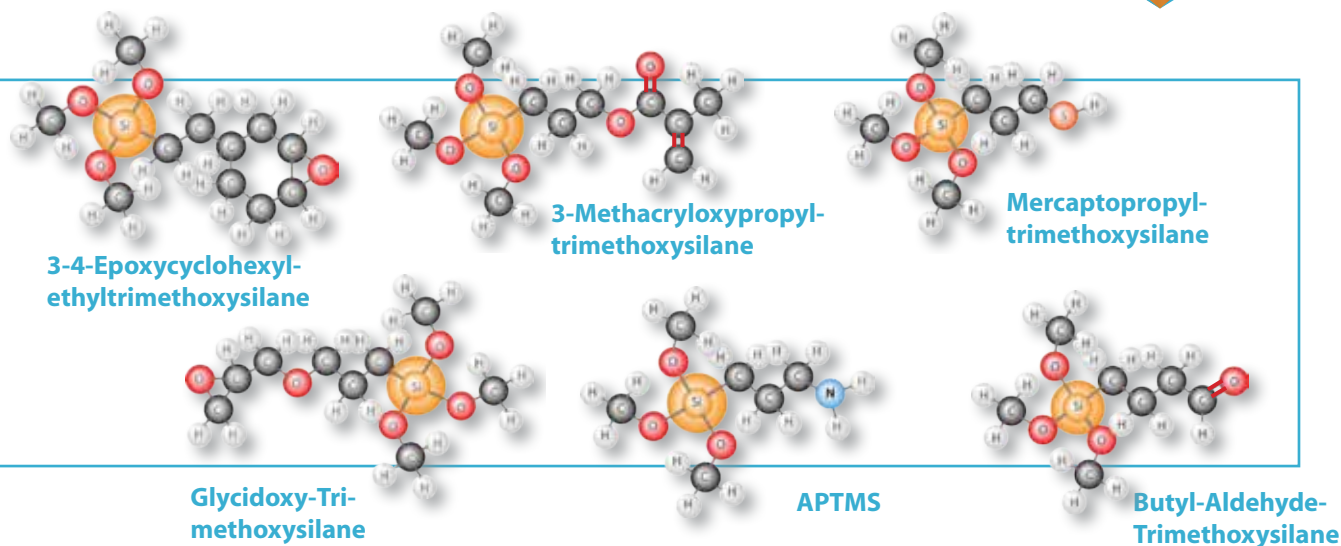
**5 Vapor Source Capability for
Maximum Flexibility**

The RPX-540 is ideal for biological, industrial and tribological applications. For biological applications, functional silanes as well as inert barriers can be applied. For industrial applications, a wide variety of adhesion promoters (epoxy, amine, thiol) are available. For tribological requirements, long-chain self assembling monolayers (SAM's) can create low-surface energy anti-stiction films or imprint release layers. The RPX-540 has a configurable chamber which can accommodate trays, wafer cassettes or large size objects.

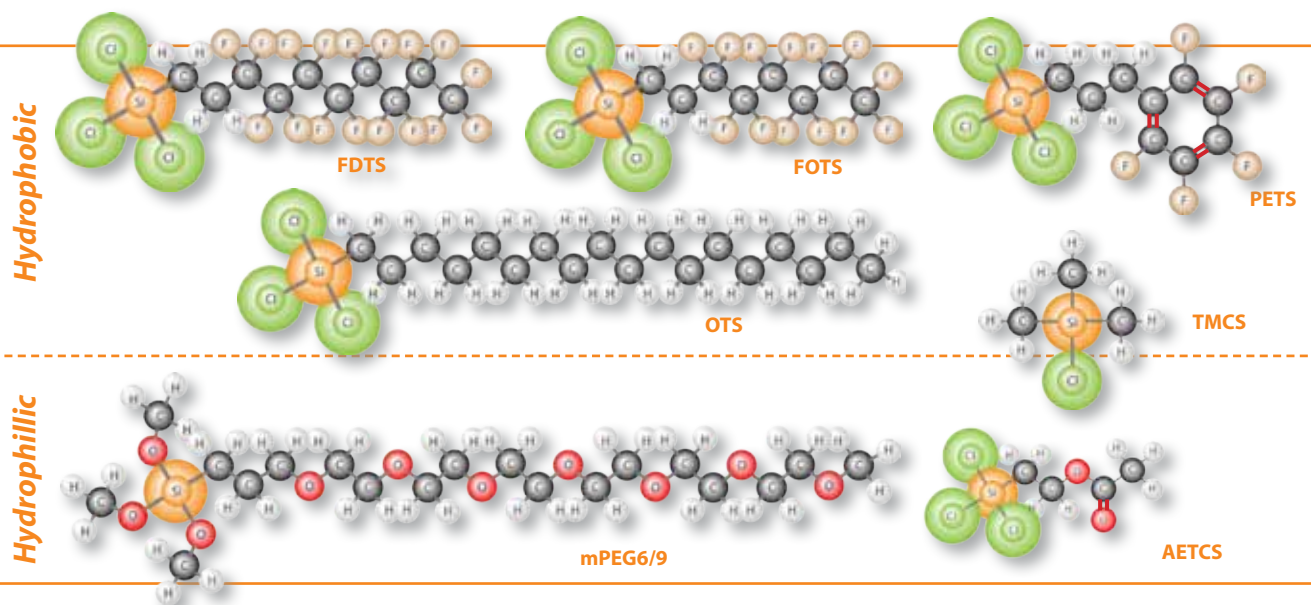
IST's unique high efficiency vaporization hardware mixes carrier gases with the precursors and delivers them to the surfaces for a controlled reaction. Up to five precursors can be applied, either individually, sequentially, or in parallel, depending on the application. By using advanced semiconductor technology with surface mount technology for valves and metering, we reduce the cost of the system and standardize the maintenance. This also facilitates the RPX's ability to uniformly control the temperature along the precursor's path from the source to the chamber. IST's flexible software delivers the precise dose of chemicals for each application. We do not require super-saturated deposition conditions or mechanical metering of the precursors.

*Patent pending

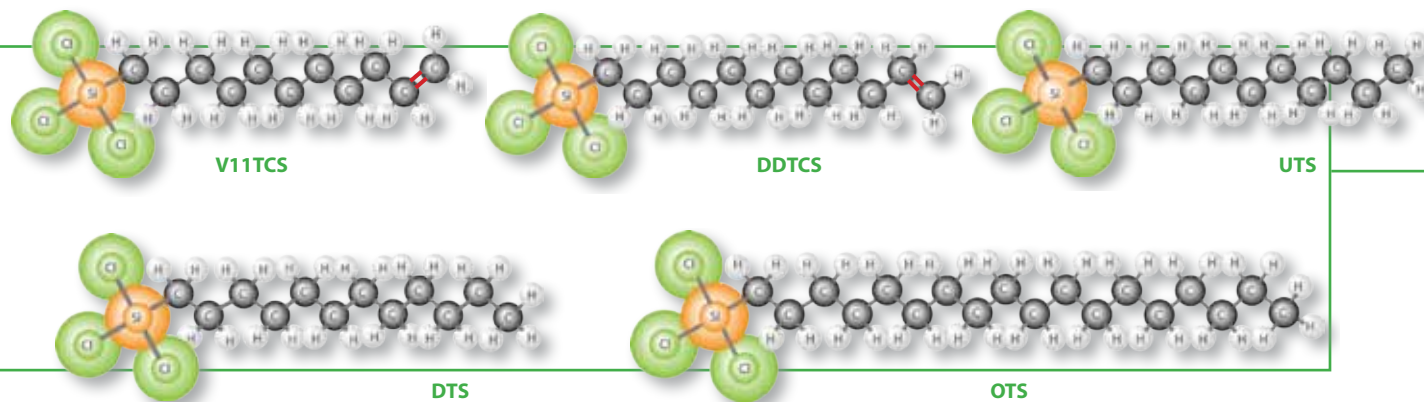
Adhesion Promotion Precursors



Surface Energy Modification Precursors



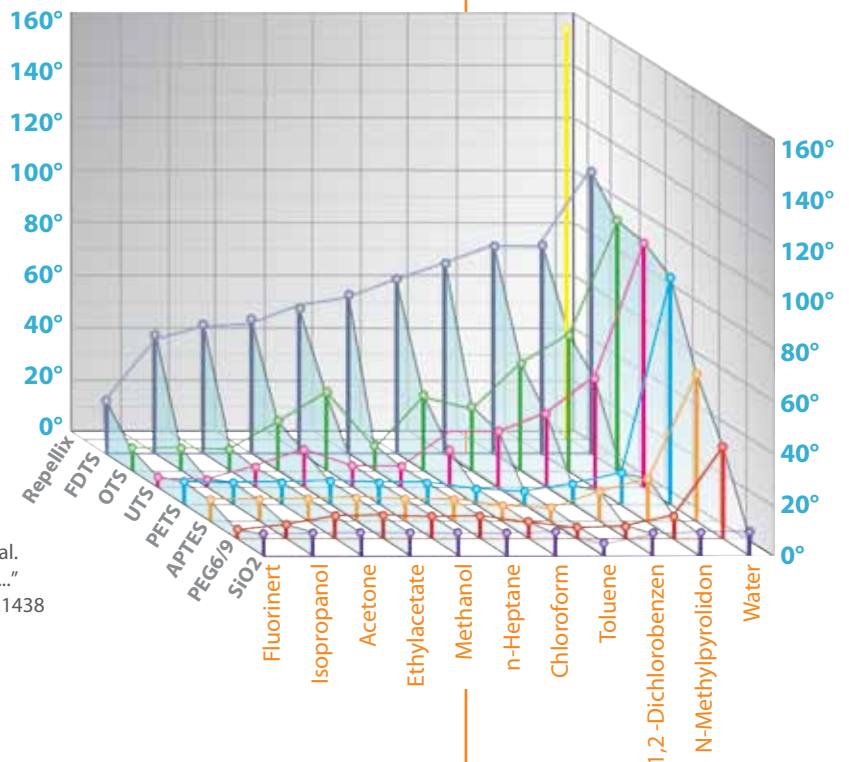
Biological Sciences Precursors



Contact Angle Versus Surface Coating

	FDTs	OTS	UTS	PETS	APTES	PEG 6/9	SiO ₂
Water	109.6	98.2	95.0	88.0	58.0	36.0	10.0
N-Methylpyrrolidone	80.5	55.0	44.6	14.7	17.8	10.0	10.0
1,2-Dichlorobenzene	80.5	42.7	30.4	9.4	13.2	5.6	10.0
Methanol	74.5	24.8	23.3	6.2	6.4	4.8	5.3
Chloroform	68.8	30.0	22.9	7.3	7.3	7.6	10.0
Toluene	62.7	10.0	10.0	10.0	10.0	10.0	10.0
Ethylacetate	58.2	31.5	10.0	10.0	10.0	10.0	10.0
n-Heptane	52.9	20.5	16.6	10.4	10.0	10.0	10.5
Isopropanol	50.5	9.5	10.0	10.0	10.0	10.0	10.0
Acetone	45.2	10.0	4.9	10.0	10.0	6.4	10.0
Fluorinert	21.6	10.0	4.4	10.0	10.0	4.4	10.0

Data from Ditniri Jansson, et al.
 "Static Solvent Contact Angle..."
Thin Silicon Films 515 (2006)1433.1438



Process Flexibility:

The five-gas Vaporrix system provides process engineers with a wide range of options. This wide-range is the unique combination of multiple precursors (up to 5), the temperature range of the delivery system (up to 150°C) and the strength of the carrier gas flow for low vapor pressure precursors.

Adhesion Promotion:

IST offers a variety of adhesion promoters in the RPX-540. Methoxy-silanes are generally used which combine surface reactivity and a variety of functional terminations.

Surface Energy Modification:

For hydrophobic surface properties, both perfluorinated and hydro-carbon alkyl-chains are available. Chloro-silanes are generally used for coupling to the surface. To tune the surface energy, a variety of alcohol or glycol precursors are available.

Biological Sciences:

All biological science applications use a silane coupling to attach to the surface. A variety of long chain precursors with functional (vinyl) and non-functional end-groups are available.

RPX-540 for Surface Modification

Features

Precision Monolayer Control
Wide Range of Chemicals
5 Process Vapor Sources
High Reliability
Vacuum Environment

Control Benefits

Tribological (Surface Energy, Adhesion)
Mechanical (Stiction Control)
Chemical (Reactivity, Repellency)
High Aspect Ratio Geometries

Applications

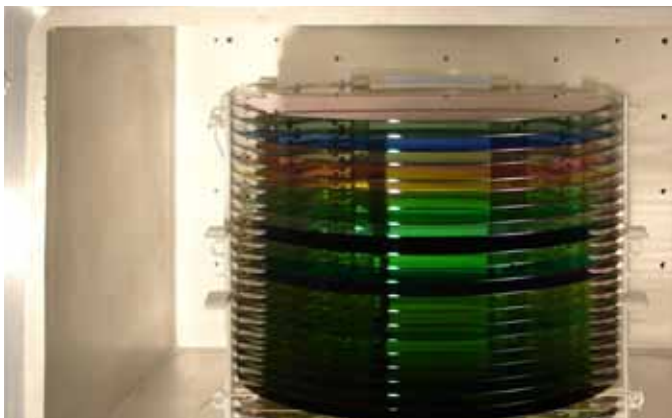
Earphones
Bio Devices
Microphones
MEMS Mirrors
MEMS Anti-Stiction

The Vacuum Advantage

As vacuum vapor delivery systems continue to replace wet chemical alternatives, several key advantages are becoming apparent. First, the vacuum environment ***eliminates day to day moisture variation***, which is critical for surface modification coatings. These coatings normally utilize water-based oxidizing agents. Second, the ability to coat ***high aspect ratio features*** is greatly enhanced at lower pressures. The mass transport paths are more open, allowing precision dosing within the gaps as well as the walls. Third, the tuned vapor process ***uses only a fraction of the chemicals*** required by wet techniques. This results in great cost savings by not having to dispose of chemical waste, and also protects the environment. Fourth, as the AFM images indicate, the vapor based coatings are ***smoother***, less 'clumpy', which is desirable for anti-stiction and surface energy control.

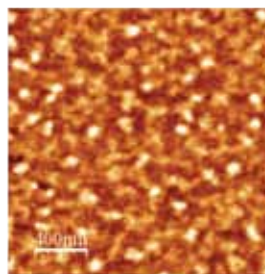
However, if not designed correctly, vacuum vapor systems can become expensive and complex. The IST technical team has over 25 years of experience with vacuum systems, and 7 years with sub-atmospheric vapor delivery technology. The result is the RPX-540 design, with its novel Vaporrix gas delivery system. It offers the most gases, the widest process range, the largest capacity, with an easy-to-use operating system. This combination provides vapor delivery of precision coatings at affordable prices with sustainable support operations.

The system is built for high volume production due to its large capacity chamber, but is equally suited for laboratory or university research because of its breadth of chemical precursors as well as the flexibility of its process architecture.

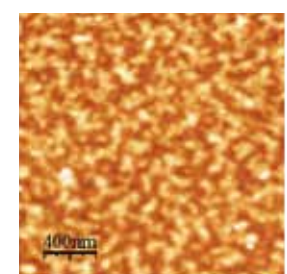


Excellent Uniformity at 300mm Wafer Size

Liquid Phase Coating
RMS 1.33nm



Vapor Phase Coating
RMS 1.13nm



Vapor Phase Coatings are Smoother
AFM images courtesy of Agilent Technologies