YES-ÉcoCoat

Vapor Phase Deposition System with Plasma

Yield Engineering Systems, Inc.

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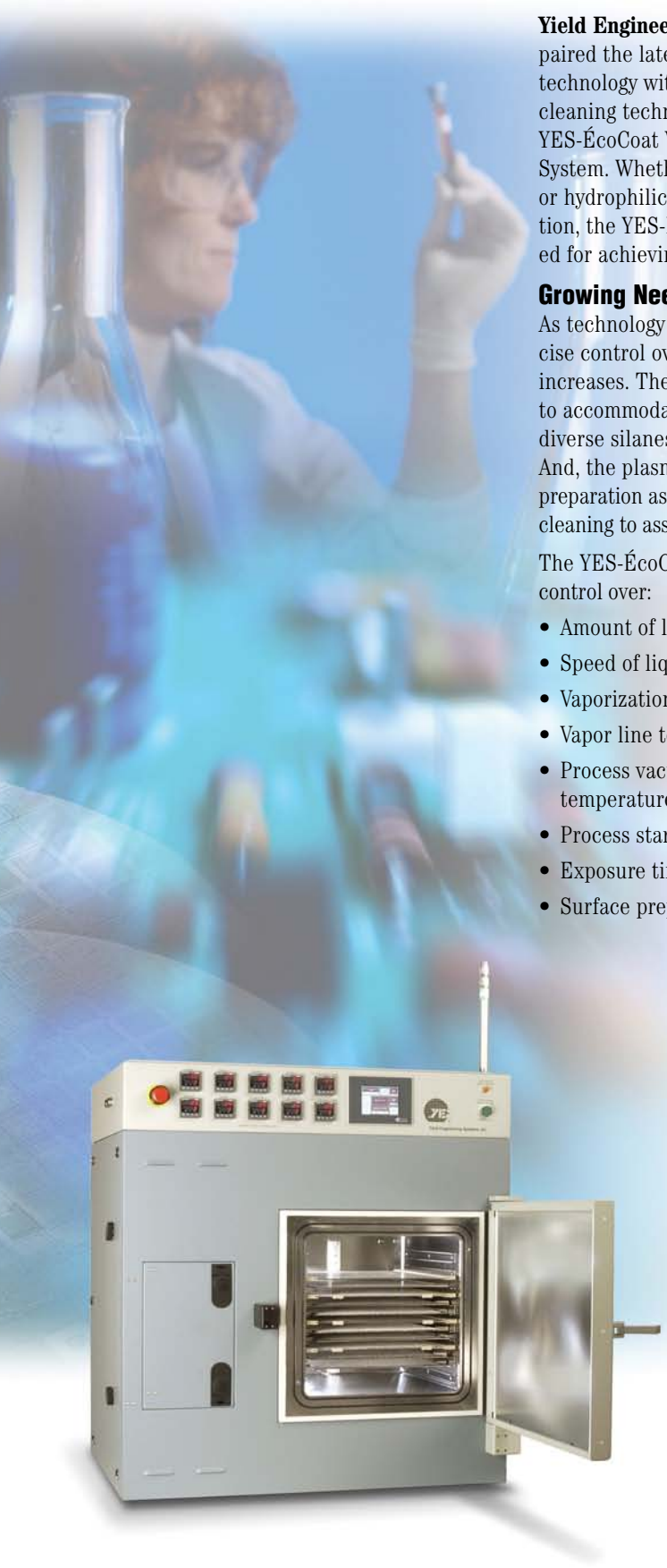
Precise Surface Modification & Coating



Yield Engineering Systems (YES) paired the latest advances in deposition technology with established plasma cleaning technology to create the YES-ÉcoCoat Vapor Phase Deposition System. Whether you need a hydrophobic or hydrophilic surface for your application, the YES-ÉcoCoat is especially suited for achieving uniform results.

Growing Need for Process Control

As technology shrinks, the need for precise control over nanoscale surface areas increases. The YES-ÉcoCoat is designed to accommodate a variety of functionally diverse silanes, for a variety of surfaces. And, the plasma function allows surface preparation as well as in-situ chamber cleaning to assure run-to-run repeatability.

The YES-ÉcoCoat gives process engineers control over:

- Amount of liquid
- Speed of liquid injection
- Vaporization chamber temperature
- Vapor line temperature
- Process vacuum chamber temperature
- Process starting pressure
- Exposure time
- Surface preparation

Benefits

- Total control over process environment
- Flexible system accommodates a variety of silanes, processes, and surfaces
- Contact angle repeatability within +/- 3 degrees
- Moisture resistant surface modification
- Angstrom-level thickness control
- Typically 90% less chemical usage over wet chemical modification
- Plasma cleaning ensures all runs start from the same point

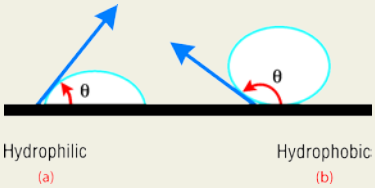
Common Applications

- Surface modification to prevent or promote adhesion
- Photoresist adhesion for semiconductor wafers
- Low-k dielectric repair
- Silane/substrate adhesion for microarrays
- MEMS coating to reduce damaging stiction
- BioMEMS and biosensor coating to reduce "drift" in device performance

Vapor Phase Deposition Process

Dehydration followed by vapor phase deposition provides a superior silane/substrate bond that is stable after exposure to atmospheric moisture, extending the time available between process steps. Vapor deposition also significantly reduces waste and chemical costs, while improving run-to-run reproducibility.

Contact Angle Test for Surface Tension



Depending on your process chemistry, surfaces can be either hydrophilic or hydrophobic.

A water drop will spread out on a hydrophilic surface (a) or bead up on a hydrophobic surface (b).

The vapor phase deposition process begins with vacuum chamber cycle purges to prepare the substrates. The chamber is evacuated to low pressure and refilled with pure nitrogen several times to completely remove water vapor and oxygen. Nitrogen is preheated, which helps heat your product.

Once cycle purges are finished, the YES-ÉcoCoat pumps the chemical directly from the source bottle to the heated vaporization chamber – without exposing the chemical to moisture. Introducing the vapor into a vacuum environment ensures uniform substrates exposure.

The YES-ÉcoCoat accommodates two chemical source bottles as well as wide variations of vapor pressures among different silanes. Processes are easily programmed using a touch screen operator interface.

Adding Plasma
Incorporating a plasma cleaning function into the YES-ÉcoCoat provides three main process advantages:

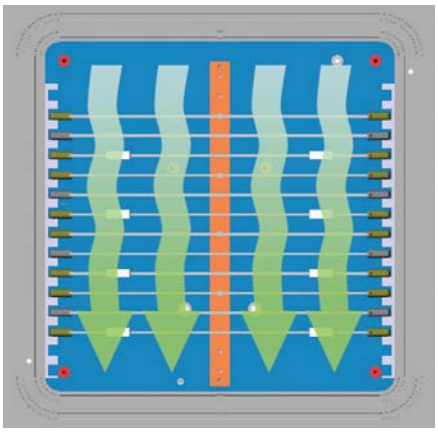
1. Plasma cleaning prior to silane deposition improves repeatability.
2. Plasma cleaning the process chamber before each run ensures all runs start from the same point.
3. Plasma prepares the substrate for deposition.

Typical Applications

MEMS Packaging
For MEMS devices, a hydrophobic coating reduces stiction, the undesired static friction that wears down devices. Minimizing this stiction goes a long way towards increasing device reliability and longevity as well as preventing damaging lock-up, which occurs when the device flexes and sticks to itself.

Semiconductor Fabrication
The YES-ÉcoCoat promotes photoresist adhesion to wafers, typically using 90% less chemical than wet processes. Properly treated wafers will last for weeks with no change to surface adhesion.

Silane chemistry can also treat damage done to low-k dielectrics during typical processing (such as CMP or plasma etch), restoring the k factor to pre-damage levels.



Plasma flow through chamber.

Copper Capping
When copper is annealed, some of the copper molecules tend to diffuse into the dielectric, reducing the insulation. However, if a cap is placed in between the copper and the surrounding dielectric, diffusion can be minimized. Additionally, the cap prevents oxidation, extending device longevity and performance.

Microarrays
The YES-ÉcoCoat facilitates higher temperature boiling for the silanes and has the flexibility to deal with "irritable" silanes that react unfavorably to air or decay with prolonged exposure to moisture or higher temperatures. A few of the functional groups include amino, mercapto, epoxy, and aldehyde.

DNA Microarrays
For DNA microarrays, precise surface modification in the YES-ÉcoCoat ensures your slide/chip is properly prepared. After your slide/chip is treated with the silane, an oligonucleotide is introduced. Oligonucleotides bond to the silane on the slide and "stick out" ready for further reaction.

Protein Microarrays
In the case of protein microarrays, the biggest challenge is to immobilize protein in its native state while mitigating adsorption (the accumulation of background molecules on microstructures). The YES-ÉcoCoat allows treatment of slides/chips in the pure vapor ensuring a clean signal and tightly bound proteins.

BioMEMS
For bioMEMS devices, the YES-ÉcoCoat achieves a precise surface coating in order to reduce problematic accumulation (adsorption) of background molecules on microstructures that causes "drift" in device performance.

Achieving Biocompatibility
When most synthetic materials come in contact with biological materials, they quickly become coated with sticky biomolecules. This fouling (adsorption) can severely reduce device reliability, as well as cause unintentional effects on biological matter. Using the YES-ÉcoCoat to apply an appropriate barrier film will significantly reduce fouling.

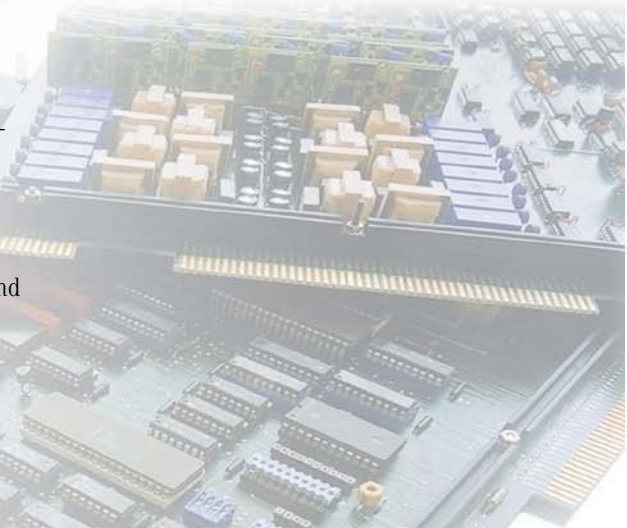
Chamber Design

The YES-ÉcoCoat uses capacitive RF plasma generation; using low frequency plasma (40 kHz) reduces parasitic capacitive reactance losses for more efficient plasma generation.

System design ensures temperature uniformity throughout the chamber. There are no cold spots, preventing condensation reaction.

System Options

- Mass Flow Controllers (MFCs)
- Automatic LN_2 refill system for operator free cold trap liquid nitrogen level control
- Data Collection and Analysis
- Stainless Steel Process Cassettes
- Pumps (Dry & Oil)
- Water Vapor Injection
- Stainless Steel Cassettes



Summary

Successful surface modification requires stringent control of the interaction between the silane and substrates they contact. Using the YES-ÉcoCoat to apply your silane will achieve your specific results – with less chemical usage. The system offers process flexibility, and the chamber design provides easy scalability from R&D to manufacturing.

Contact Us

For more than 30 years, YES has specialized in building equipment for innovative process engineers. When you're ready to run process tests, just let us know – a demo can be arranged using your chemicals and samples. Call +1 925-373-8353 (worldwide) or 1-888-YES-3637 (US toll free).

Specifications

Hardware	
Clean Room Compatibility	Class 10
Chamber Material	316L stainless steel
Chamber Size	40.6 cm (W) x 46 cm (D) x 40.6 cm (H) (16"x 18" x 16")
Overall System Dimensions	103.5 cm (W) x 111.1 cm (D) x 114.46 cm (H) (40.75" x 42.75" x 45.06") Light tower increases height by 30 cm (11.81")
Loading	4 removable internal stainless steel shelves; 16 available configurations
6-in. Cold Trap Capacities	LN_2: 1.6 liters; condensate: 1.6 liters
Filter	0.5 micron filter
Mass Flow Controllers	Optional, up to 4 for gas mixing
Software	
Number of Recipes	6 CVD, 4 plasma
Range of Exposure Time	0-999999
Resolution of Timer Setting	1 second
Performance	
RF Plasma Frequency	40 kHz
RF Plasma Power	100-1000 watts
Operation Temperature	Ambient to 205 °C
Uniformity	± 5 °C during dwell after stabilization period
Chemical Usage	Typical process 3-5 ml
Chemical Volume Control	Control down to 0.1 ml
Process Gas Inputs	1
Plasma Gas Inputs	3
Vent Gas Consumption	10 SCF/run average
Reactant Gas Consumption	4.2 x 10-3 SCF (based on standard process: 170°C @ 1000W w/20 SCFM pump)
Wafer Capacity	8 cassettes 100mm - 150mm wafers 2 cassettes 200mm - 300mm wafers
Wafer Throughput	Typically 1-2 loads/hr; varies by process
Slide Throughput	600 slides/hr for CVD
Additional	
Safety	Audible and visual alarms; redundant over-temp monitoring
Power Requirements	230V, 30 amps, 50 Hz, 1 phase, 5400 watts (European) 208V, 30 amps, 60 Hz, 1 phase, 4835 watts (domestic)
Auto LN_2 Refill (option)	200-240 VAC ± 10%, 50-60 Hz, 4.2 amps max., 1 phase, 850 watts max.
Power Consumption	420 watts (idle), 2100 (peak), 1210 watts (average) –check QA tool
Shipping Weight, Crated (approx.)	499 kg (1100 lbs)
Crate Dimensions	106.7 cm (W) x 137.2 c, (D) x 114.3 cm (H) (42" x 54" x 45")

Yield Engineering Systems, Inc.

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