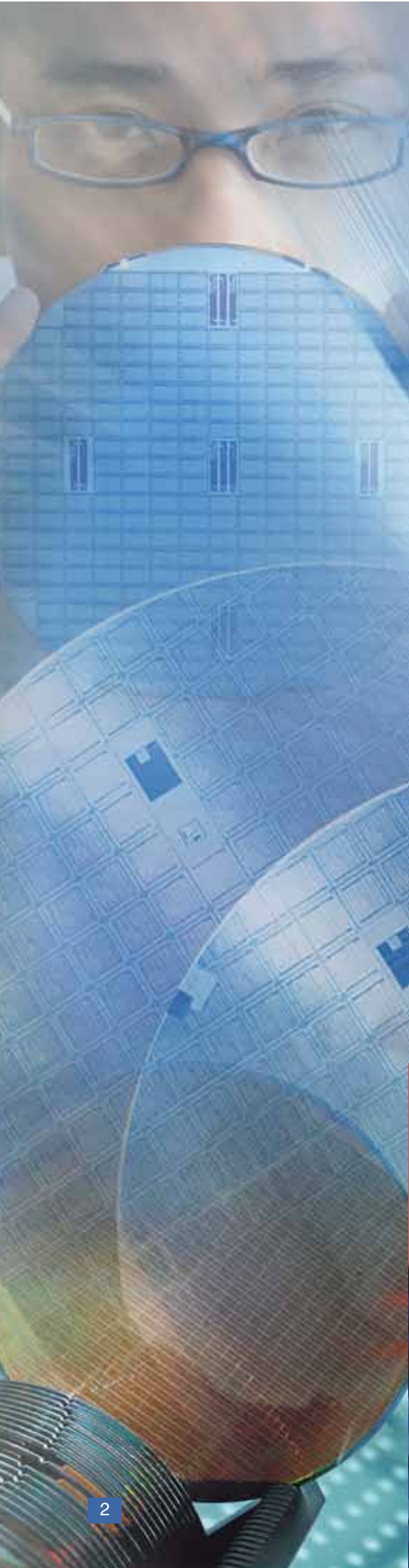


Yield Engineering Systems Product Guide



Yield Engineering Systems, Inc.



Emerging Innovation – Customer Dedication... Building Value and Trust for 30 Years!

Yield Engineering Systems (YES) works closely with customers to develop process equipment and the processes that live up to today's demanding schedules and tight budgets. We know engineers need answers. The answer is Y.E.S. Thirty years of listening has brought us to today, where we offer a full range of products to meet your R&D and production needs. We design and manufacture sensibly priced, high quality, high up-time equipment that is low cost of ownership, low maintenance, and clean room friendly.

YES continues to grow and create new tools based on customer's specifications. We are constantly refining our tools and processes and mostly, listening to our customers.

YES systems achieve precise surface modification and cleaning in order to increase yields and extend the life and performance of devices. YES systems are designed to meet today's most demanding process applications and provide stringent environmental control, so you get the results you want. Additionally, YES systems provide the flexibility needed by research and design engineers, while achieving the simplicity of recipe needed for the manufacturing line. Our equipment can grow with your process, from R&D to pilot line to high volume manufacturing.

Our goal is to provide customers with improved processes, not just great tools. We have a complete staff of process, design, mechanical, electrical, software and service engineers ready to assist with your process needs. All our work is done in house—we do not outsource. This keeps our resources close at hand when you need us.



Dedication to Innovation

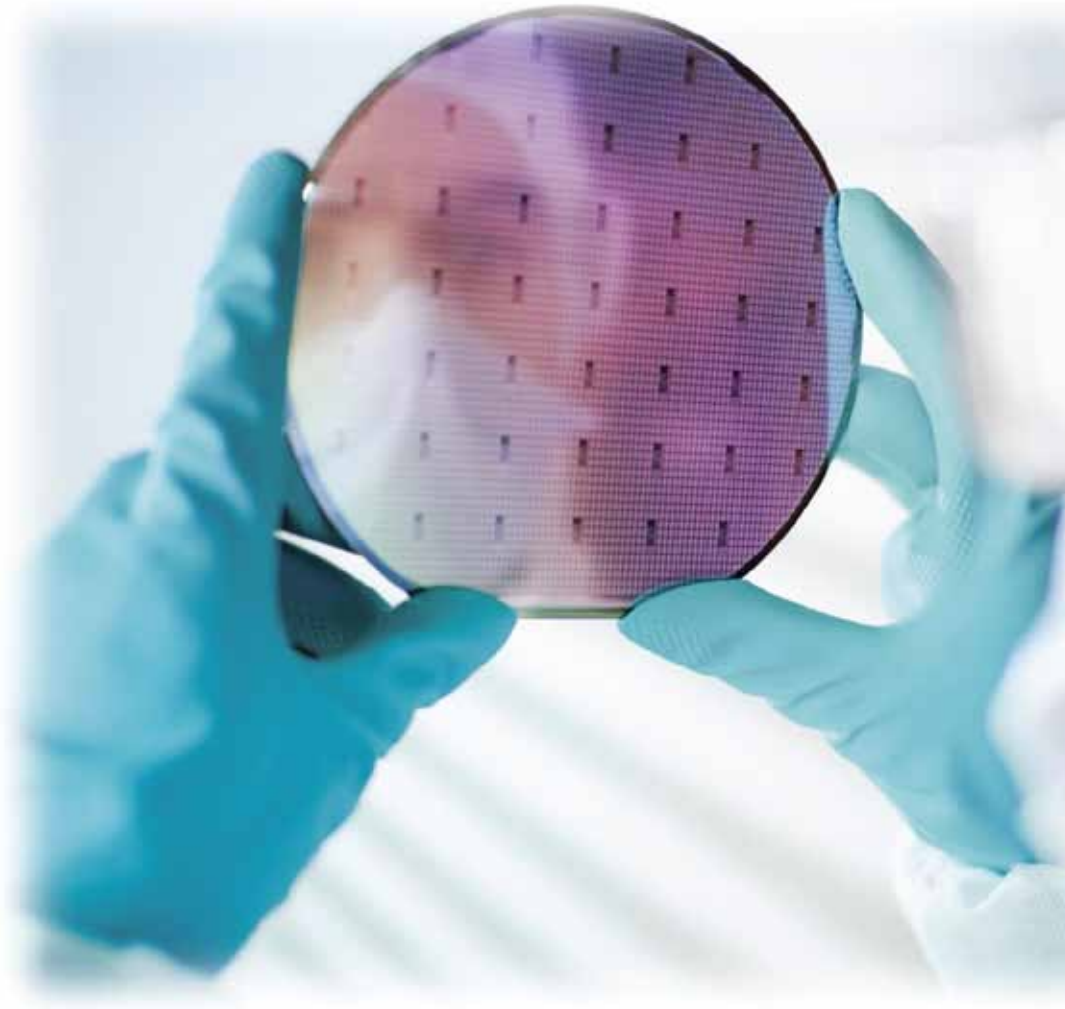
YES Tools & Industries

Industries:

- Semiconductor
- Biotechnology
- Nanotechnology
- Optical
- Disk Drive
- Solar
- MEMS

Materials:

- Ceramic
- GaAs
- Glass
- Indium Phosphide
- Lithium
- Si
- SiC
- Si/Ge
- Alumina
- Stainless Steel
- Plastics (low-temp plasma or vapor deposition)



Products:

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YES-1224P & YES-LabKote

Vapor Deposition Systems

YES paired the latest advances in deposition technology to create the YES-1224P and YES-LabKote Vapor Deposition systems. Whether you need a hydrophobic or hydrophilic surface for your application, this system is especially suited for achieving uniform results.

These systems are designed to accommodate a variety of functionally diverse silanes, for a variety of surfaces. And, the plasma cleaning function in the YES-1224P allows surface preparation, as well as, in-situ chamber cleaning to assure run-to-run repeatability.

The YES-1224P and YES-LabKote give 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

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
- Copper capping
- Anti-corrosive coating
- Nanolithography surface preparation for disk drive and LED manufacturers
- SAM Coating



YES-LabKote



Benefits to your Process

- 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
- Can also be used as a silylation oven

In Detail

The YES-1224P Vapor Deposition system is designed to accommodate the wide variety of processing needs likely to be encountered in an R&D environment. The efficient use of chemical allows coatings using as little as 100 μ L of chemical. At the same time, the 18x18x16 chamber can accommodate large or oddly-shaped substrates or larger numbers of substrates in a pre-production mode.

From a process standpoint, the plasma system can be set-up to run processes from very gentle downstream cleans to more aggressive active or ion trap modes. Gases used range from inert gases, such as argon or helium for surface activation to oxidizers and reducers, such as oxygen, CF₄, ammonia or forming gas for cleaning and etching application.

The vapor deposition portion of the system can use silanes ranging from non-reactive adhesion promoting coatings such as HMDS to alkyl silanes such as OTS to more reactive chemistries such as amines, acrylates or epoxies. For anti-stiction applications, fluorinated silanes can be used.

The linked recipes allow the user to easily go from plasma surface preparation to hydration to deposition without breaking vacuum. The linking also allows for sequential deposition, reacting one silane with another or passivating the chemistry at the end of the deposition with a reducing plasma to ensure a known surface.



YES-1224P

YES-G Series

Plasma Cleaning Systems

YES succeeds in manufacturing safe, reliable plasma cleaning systems with the smarter approach, delivering energy with excellent uniformity and superior controllability.

These tools give engineers flexibility over their cleaning processes. The YES-G1000, and the smaller YES-G500, operating principles and plasma density are the same. With total control and simple user interface, the systems are the answer for operators and engineers alike.

Applications

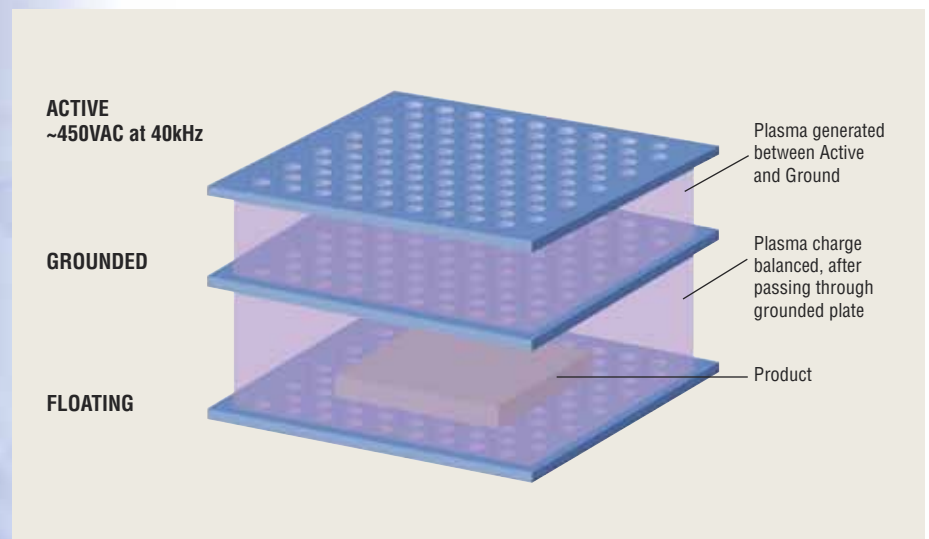
- Wire bond surface preparation
- Removing contaminants (flux) or sterilizing a surface
- Promoting adhesion between two surfaces
- Controlling surface tension to achieve a hydrophilic surface
- Increasing biocompatibility
- Improving polymer performance through cross-linking to decrease friction that wears out devices



YES-G Series

Benefits to your Process

- Environmentally friendly – no wet chemical usage
- Five plasma mode selections (Electron-free/ Downstream mode, Active mode, RIE mode, Active ion trap mode, Downstream ion trap mode)
- Touch screen PLC control
- Safe for sensitive electronic devices (Plasma charging damage is eliminated)
- Repeatable, uniform results



Downstream Configuration

YES-450PB Series

High Temp Vacuum Cure Ovens

The YES-450PB series of manual, high temperature, air-cooled, laminar flow vacuum ovens are the result of many years of experience in the design and manufacture of low particle ovens. Operating at temperatures up to 450°C (550°C with a special order), the systems come with a simple guarantee: Wafers out will be cleaner than wafers in – every time!

The YES-450PB series of tools are designed for many different processes:

- Polyimide bake
- BCB bake
- Copper anneal
- Copper oxide removal
- Aluminum anneal

Benefits to your Process

- Fully-automated process
- Cleaner process
- Uniform solvent evaporation
- Consistency
- Temperature uniformity
- Oxygen-free environment



YES-450PB Series

Pulling a vacuum in a series of nitrogen purge cycles removes all traces of oxygen, moisture and atmospheric contaminants. Running at 250 Torr (1/3 of atmosphere) gently draws out solvents in a gentle vertical laminar flow that removes particles. Processing at reduced pressure prevents a problematic heat reaction, in which a hard skin forms on the top of polyimide film before it is completely baked and traps solvents.

Wafer Cassette Capacity

Number of SEMI standard 25-wafer cassettes that can fit inside the laminar flow zone:

Wafer Size	YES-450PB6-2P-CP	YES-450PB8-2P-CP	YES-450PB12-2P-CP
2 inch	4	9	25
3 inch	2	6	15
100mm	2	3	10
125mm	2	3	10
150mm	2	3	10
200mm	0	2	3
300mm	0	0	2

YES-VertaCure Series

High Temp Vacuum Cure Ovens

The YES-VertaCure automated, high temperature cure series of ovens is designed for today's most demanding MEMS and semiconductor process applications. Whether it's for proper curing of multiple layers of polyimide in an RDL (Bond Pad Re-routing) application or annealing copper in an advanced semiconductor device, the YES-VertaCure helps achieve total environmental control to increase yields and extend device performance.

The system incorporates the laminar flow technology of the YES-450PB series. It accommodates 200 and 300mm wafers with one or two load ports and a wafer handling robot inside an integrated Class 1 minienvironment. Up to 50 wafers are loaded into a stainless steel cassette-type rack on the oven chamber door and, when loading is complete, lifted up into the vacuum chamber.

Applications

(YES-VertaCure)

- Polyimide cure
- Copper anneal
- BCB cure
- Low-k dielectric cure

High Vacuum Option

(YES-VertaVac)

- Wafer dehydration
- Getter activation
- Gas desorption
- Metal annealing
- Thin film resistors thermal treatments

Silane Vapor Deposition Option

(YES-VertaCoat)

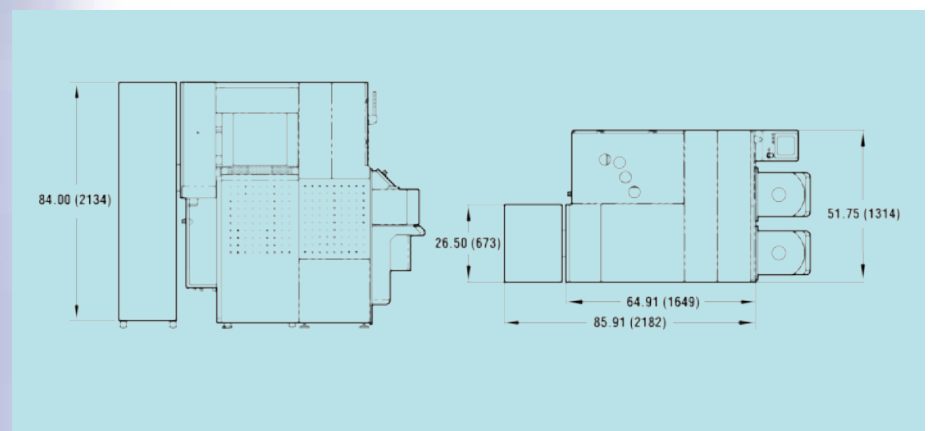
- Porous dielectric repair
- Copper to low-k adhesion repair
- Copper anti-oxidation barrier
- Copper oxide removal

- Copper diffusion barrier
- Moisture removal/film sealing
- Imprint lithography surface adhesion control
- Hydrophobic sealing

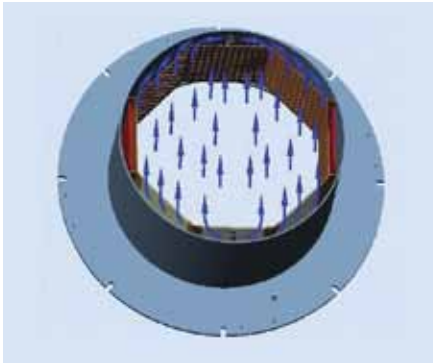
Ideal Process Environment

Achieve tight control over your process atmosphere:

- Maximum process temperature of up to 450°C
- Controlled ramp up and cool down
- Extremely low oxygen process concentrations
- Low, or no, particle addition
- Fully-automated
- Touch screen interface
- Horizontal laminar flow for increase particle isolation and removal (for most cure processes, average particle addition is negative)



YES-VertaCure Footprint

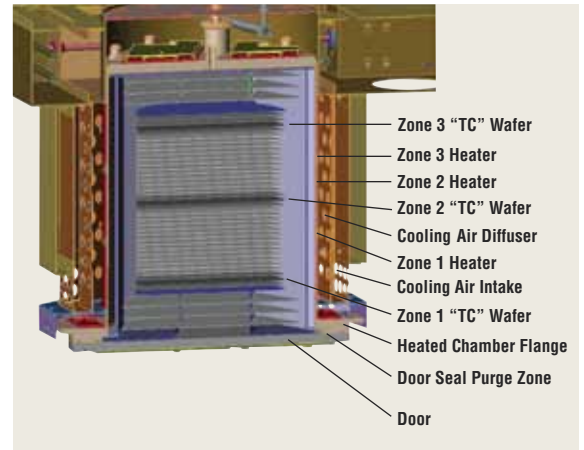


Horizontal Laminar Flow. For improved particle isolation and removal. Average particle addition is typically negative.

Temperature Control

The YES-VertaCure offers three temperature control zones for improved wafer temperature uniformity. The tool has improved low temperature control stability and ramp tracking with adjustable-flow forced-convection cooling.

The tool also features accelerated cooling rates with forced-convection cooling of the exterior of the vacuum chamber and low temperature cooling with PLC controlled chamber cooling air mixing ratio.



Thermocouples are embedded among wafers for accurate temperature control and data acquisition for process verification.

YES-VertaCure Process

The process begins with vacuum cycle purges to remove oxygen and water vapor followed by a continuous horizontal laminar flow of up to four process gases. The laminar flow of gas can be maintained during a recipe-driven temperature profile. Operating temperatures are 150°C to 450°C; pressure range is 50-500 Torr.

YES-VertaVac (High Vacuum Process)

The process begins with vacuum cycle purges to remove oxygen and water vapor followed by a continuous horizontal laminar flow of up to four process gasses. The laminar flow of gas can be maintained during a recipe-driven temperature profile. Operating temperatures are 150°C to 450°C; laminar flow pressure range is 0.50-500 Torr. The tool is also capable of evacuation down to 5E-5 Torr using a vacuum turbo pump.

The YES-VertaVac gives engineers moisture resistant surface modification and increased time available between process steps.

YES-VertaCoat (Silane Vapor Deposition Process)

Silane vapor deposition is a process that assists in the deposition of a thin film of various chemistries in order to achieve precise surface modification. Vapor deposition is the preferred method for coating surfaces with silanes.

As technology shrinks, there is a growing need for precise control over nanoscale surface areas. The YES-VertaCoat gives you total control over your process environment. The tool also is designed as a flexible system to accommodate a variety of silanes and processes.

Specifically, the silane vapor deposition process assists with MEMS coating to reduce damaging stiction and photoresist adhesion for semiconductor wafers.

The entire YES-VertaCure series is designed to give you uniform, repeatable results with an added bonus of cost savings!



YES-VertaCure Series

YES-TA Series

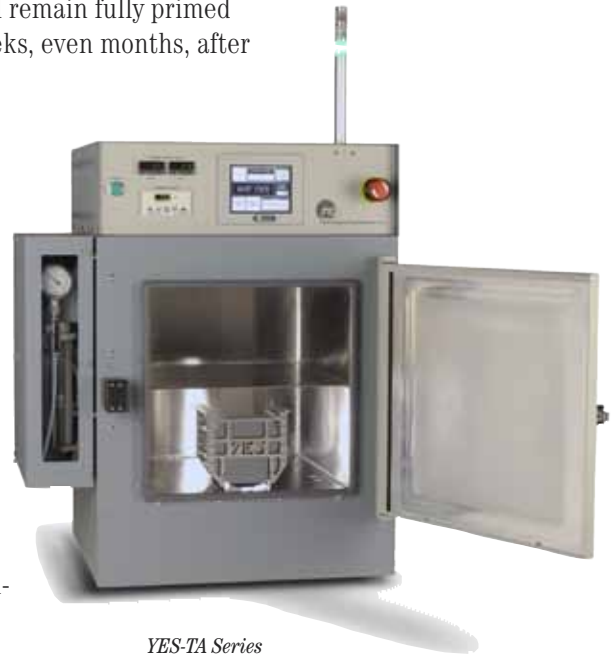
Vacuum Bake/Vapor Prime/Image Reversal Ovens

Vacuum Bake/Vapor Prime was the first product YES produced in 1980. There are currently thousands of these systems in use everyday. YES Vacuum Bake/Vapor Prime Systems provide a “one-stop” environment for pre-programmed dehydration and vapor deposition of a priming agent. No other process can provide a prime layer with the uniformity and stability of the Vacuum Bake/Vapor Prime System.

A typical YES primed wafer will remain fully primed and totally hydrophobic for weeks, even months, after deposition!

Benefits to your Process

- Chemical deposition uniformity
- Contact angle uniformity within ± 3 degrees
- Moisture resistant surface modification
- Increased time available between process steps
- Enhanced photoresist adhesion
- Less chemical usage & chemical costs



YES-TA Series

Vacuum Bake

In order to promote a strong HMDS bond to the substrate, first, wafers must be completely dehydrated. To achieve this, YES developed a process combining heat with low pressure.

Vapor Prime

Once dehydrated, wafers are then reacted with HMDS vapor. The result is a surface that the photoresist can easily adhere to. Once primed, a superior bond is formed on the surface that is stable even after exposure to atmospheric moisture.

Image Reversal

An additional capability of the system is image reversal. The image reversal process reverses the action of positive resist so negative images can be formed with the same resolution and processing ease that a positive resist allows. Image reversal also allows variation of the slope of the photoresist sidewall for higher resolution and/or lift-off profiles. Production processes with 0.1 micron metal lines are common.

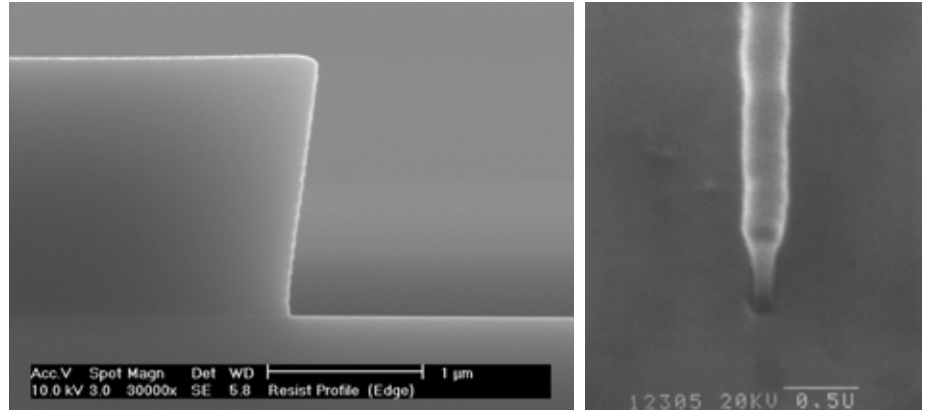


Image reversal SEM photos.

An Ideal Process Environment

YES-TA Series vacuum bake/vapor prime ovens provide a “one stop” environment for substrate dehydration and vapor deposition of hexamethyldisilazane (HMDS). YES ovens give an HMDS prime layer with superior uniformity and stability. Each YES-TA oven offers the following features:

1. Nitrogen is preheated prior to entering chamber to prevent adiabatic cooling.
2. Filtration mechanisms and input locations virtually eliminate introduction of particulates from system sources.
3. Surge suppression systems in the nitrogen input lines significantly limit turbulence and particle introduction typically associated with loading a cassette into the oven.
4. Analog controlled system gives the process engineer the ability to set any temperature and/or time. Any process deviation will sound an alarm.
5. Chamber size and volume is selected for maximum strength, efficiency, and particle control.

In addition to being used for silicon wafer processing, YES-TA ovens can also be used for low temperature HMDS priming of gallium arsenide, lithium niobate, and other exotic materials.

Wafer Cassette Capacity

For SEMI standard 25-wafer cassettes:

	YES-310TA	YES-58TA
100 mm	8	12
125 mm	2	8
150 mm	2	8
200 mm	1	2
300 mm	0	1

YES-CV200RF Series

Plasma Strip/Descum Systems

The YES-CV200RF, YES-CV200RFS and YES-CV200RFL plasma stripping systems remove thick layers of photoresist and polyimide in the shortest amount of production time.

Applications

- Photoresist removal
- Polyimide removal
- Organics removal
- CD master cleaning
- Descumming

Benefits to your Process

- Environmentally friendly – no wet chemical usage or waste
- Higher yields
- Repeatable results
- Strip rates up to 6,000-7,000 Angstroms per minute
- Gentle descum process, as well as, strip process
- Zero CV shift
- No plasma charging damage

Features

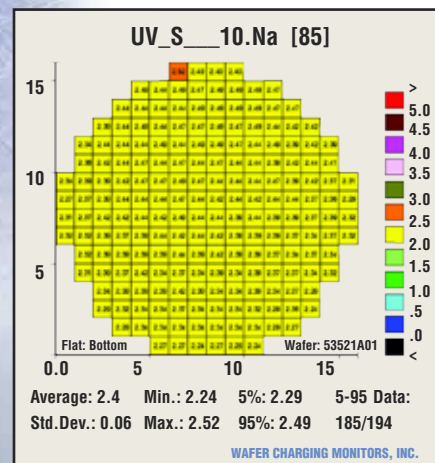
- Low frequency (40 kHz)
- Variable power supply
- Downstream process
- Accurate wafer temperature control
- Multiple process gas inputs
- Available as manual load (CV200RFS) or automatic cassette-to-cassette single wafer (YES-CV200RF and YES-CV200RFL)
- YES-CV200RF is available with 1-3 chambers for increased throughput and/or flexibility of process



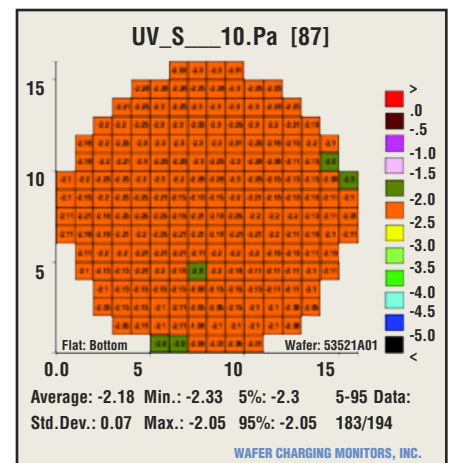
YES-CV200RF



YES-CV200RFS



Charm Wafer 1



Charm Wafer 2

Charm data showing no electron damage to wafers

SECS/GEM & Data Collection

Process Management Software

Yield Engineering Systems (YES) offers multiple software data collection options to increase visibility and control of your process. Trending, analysis and reporting options are available in two basic configurations that can be customized to accommodate unique requirements. We offer the industry standard SECS/GEM and proprietary software called YES-DAQ.

SECS/GEM Host Communications

SEMI E5-0308 and SEMI E30-0307 compatible host communications and remote tool control are available as an option for YES-PB series and YES-VertaCure vacuum ovens. The SECS/GEM host communications option offers the following capabilities:

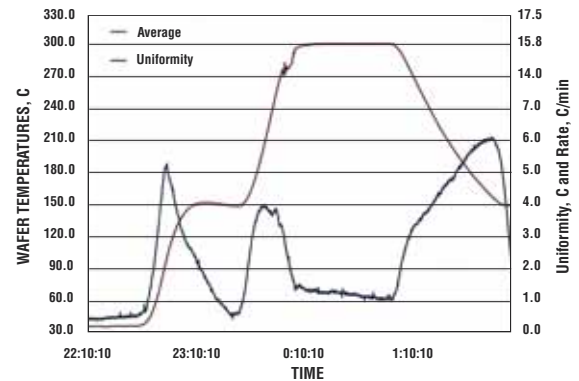
- Establish communications
- Remote or local tool control
- Status variable reporting
- Date & time
- Loop Back Diagnostic
- Message spooling
- Equipment constant reporting and modification
- Status variable limit monitoring
- In-process materials status
- Alarm reporting
- Alarm report enable/disable
- Unlimited simultaneous trace reports
- Unlimited event report definition and linking
- Event report enable/disable
- Process program selection
- Process program upload/download
- Process program verification

The SECS/GEM option includes a user interface (UI) implemented as a web page. The UI can be accessed from any computer connected to the host network using a standard Web browser. The UI offers the following capabilities:

- Process program editing and verification
- Process program download to the tool and upload from the tool
- Alarm history log showing both enabled and disabled tool alarms
- Collection Event history log showing enabled and disabled collection events
- Material history log showing material MID

YES-DAQ Standard Local Data Collection offers:

- Quick response to process upsets
- Access to historical data to study and improve process strategy
- Detailed reporting
- Improved efficiency
- View process data in real-time
- Store process data
- Extract process data for analysis in Excel or other software
- May be used remotely or locally
- Connects to equipment via network or serial connection
- Pre-installed on a PC and runs on Windows



YES-DAQ Analyzing Process Data

Stainless Steel Cassettes

YES cassettes can be used throughout your clean room in semiconductor fabrication processes where plastic or quartz cassettes are inappropriate or do not perform well. Cassettes are designed to SEMI specifications and mate to most plastic cassettes, so they can be used on all automated vertical or horizontal transfer systems.

YES cassettes are ideal for:

- Polyimide bake
- BCB cure
- Copper anneal
- Other cure processes

YES cassettes are designed to achieve maximum strength with minimal mass. Temperatures remain uniform throughout heat up and cool down applications minimizing hot/cold spots due to heat sinking.

Available Sizes

25 Wafer Cassettes	
2 inch	6 inch (150 mm) short
3 inch	8 inch (200 mm)
4 inch (100 mm)	8 inch (200 mm) short
5 inch (125 mm)	12 inch (300 mm) FOUP
6 inch (150 mm)	12 inch (300 mm)
13 Wafer Cassettes	
12 inch (300 mm) FOUP	12 inch (300 mm)
Cassettes Handlers	
2 inch	6 inch (150 mm)
3 inch	8 inch (200 mm)
4 inch (100 mm)	12 inch (300 mm)
5 inch (125 mm)	





Yield Engineering Systems, Inc.

If you are interested in finding out further information about any of our innovative process tools or processes, please contact us. We can provide you with a quote and when you are ready to run process tests, a demonstration can be arranged using your chemicals and samples.

Call +1 925-373-8353 (worldwide), 1-888-YES-3637 (US toll-free), or visit us online at: www.yieldengineering.com.

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We look forward to meeting your specific process requirements!

YES is the Answer!

