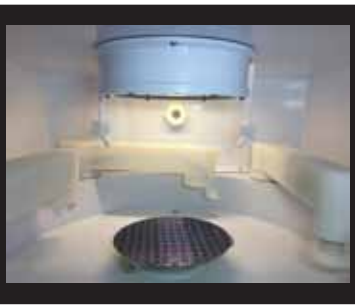
Single Wafer Thin Film Processing Systems

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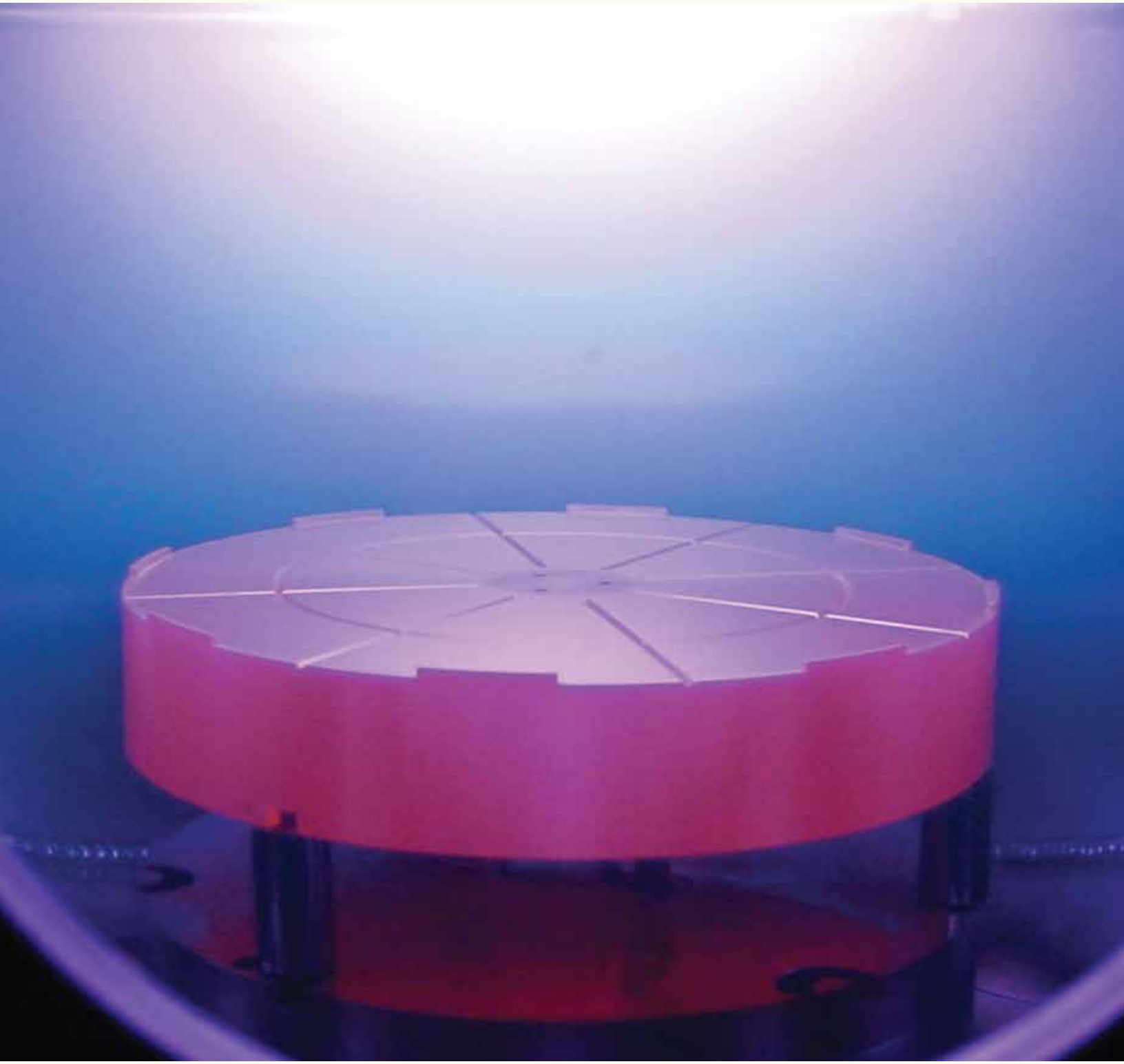
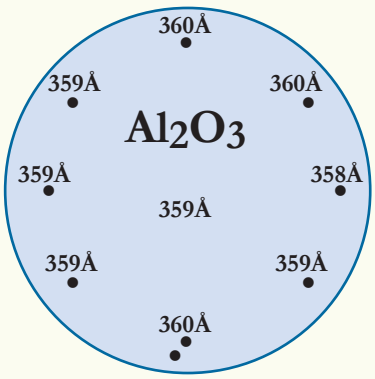
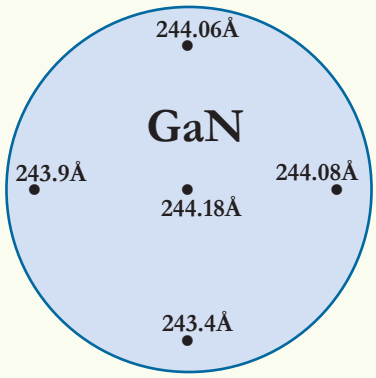


Plasma Enhanced Atomic Layer Deposition Systems

NLD-4000 with Auto Load/Unload
US Patent # 9,972,501



Cycles: 300
(TMA + H_2O)
Uniformity: 0.27%



Cycles: 150
($GaCl_3$ + N_2 Plasma)
Uniformity: 0.3%

NLD-4000 Uniformity Data on 6" Wafer

The NLD-4000 is a stand alone PC controlled ALD system which is fully automated and safety-interlocked having capabilities to deposit oxides and nitrides (e.g. AlN, GaN, TaN, TiN, Al_2O_3, AlN, TiN, ZrO_2, LaO_2, HfO_2) for Semiconductor, Photovoltaic and MEMS applications. It has a 13" aluminum chamber with heated walls and a pneumatically lifted top for easy access. The system features an onboard glovebox which can accommodate an array of up to seven heated or cooled 50cc cylinders for precursors and reactants incorporating fast-pulse delivery valves for pulsed gas input. Unreacted precursors can be captured with a heated filter on the chamber exhaust port. Recipes, temperature setpoints, gas flows, pump-down and vent cycles, and the flushing of delivery lines are all controlled automatically via LabVIEW software. Options include automatic load/unload (without changing system footprint), Planar ICP source with remote plasma for Plasma Enhanced ALD (Planar ICP geometry maintains a small reaction chamber volume for faster cycle times), and turbomolecular pump for lower base pressures.

FEATURES

- Less than 1Å uniformity
- 13" anodized aluminum chamber
- Minimal volume for fast cycle time and throughput
- Up to 8" substrate
- Heated chamber walls
- 400°C substrate heater
- Onboard precursor glovebox
- Up to seven 50cc precursor cylinders
- 300 l/sec maglev turbomolecular pumping package
- $5x10^{-7}$ torr base pressure
- Fast pulse gas delivery valves
- Large area filter to capture unreacted precursors
- High aspect ratio structure coating
- Fully automated PC based, recipe driven
- LabVIEW user interface
- Computer controlled safety interlocks
- 26"x44" footprint compatible with Class 100 cleanrooms

OPTIONS

- Downstream planar inductively coupled remote plasma source for PE-ALD process
- Auto load/unload
- Additional precursors

APPLICATIONS

- High-k dielectrics
- Hydrophobic coating
- Passivation layer
- High aspect ratio diffusion barriers for Cu interconnects
- Conformal coatings for micro fluidics applications
- Fuel cells, e.g. single metal coating for catalyst layers

Plasma Assisted MOCVD Systems

NANO-MASTER has developed the world's first table top Plasma Assisted Metal Organic Chemical Vapor Deposition (PA-MOCVD) system for GaN, InGaN and AlGaN deposition processes. In this unique system, having a plasma source N_2 is used instead of NH_3 for growing nitrides thus eliminating abatment of NH_3 and lowering H_2 content in the films. Plasma enhancement via RF showerhead plasma source also allows lower deposition temperatures (600°C versus 1100°C) making it possible to offer this process in a table top system.

Higher throughput for manufacturing can be achieved through clustering.

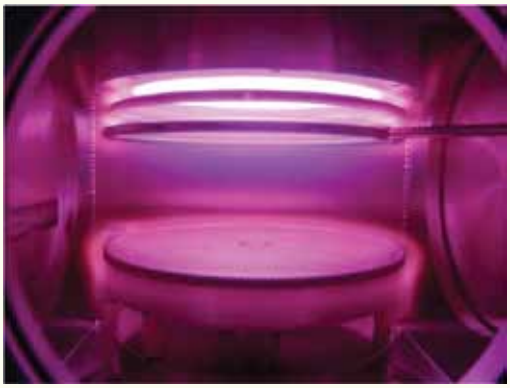
FEATURES

- Table top system
- 10" SS chamber
- RF plasma source with showerhead gas distribution
- Auto tuner
- 4" Substrate holder, heated up to 900°C
- Five bubblers with individual cooling/heating baths
- Heated gas lines
- Additional MFCs
- 250 l/s turbomolecular pumping package
- 5x10^{-7} torr base pressure
- Fully automated PC based, recipe driven
- LabVIEW user interface
- EMO protection and safety interlocks

Planar ICP Source

OPTIONS

- Stand alone system
- ICP or microwave plasma source
- 14" SS electropolished cubical chamber
- 8" or 12" substrate holder
- Additional bubblers and MFCs
- Auto load/unload
- Cluster configuration compatibility



RF Plasma Source with Shower Head Gas Distribution

APPLICATIONS

- III-V Semiconductor layers
- Blue LEDs
- Laser Diodes
- InN Nanorods in UV-Vis-IR optoelectronics
- MoS_2, BN and Graphene in 3D and 2D materials

Thermal Evaporation Systems

NTE-4000

Chamber

NTE-3500

NANO-MASTER Thermal Evaporation systems are built for a wide range of applications in organic and metal evaporation. They have a 2kVA system utilizing SCR circuitry for accurate temperature control which is crucial when evaporating organic materials. The thermal evaporators are designed with extreme care to achieve clean, uniform, and reproducible processes on a small footprint. They provides low cost, high quality capabilities for demanding applications in R&D and low scale manufacturing.

The NTE-4000 is a stand alone version of the NTE-3000 thermal evaporator system allowing more room for additional options such as various chamber sizes, substrate cleaning and cooling, co-evaporation, and sputtering capabilities.

FEATURES

- 12” Bell Jar / Cylindrical 10” SS / Cubical 14” SS chamber
- Up to 7”x7” plates and 200mm wafers
- Two evaporation boats or crucibles
- Water cooled feedthroughs
- Solid state switching for sequential evaporation
- SCR circuitry for accurate current control
- Individual source and substrate shutters
- Cross contamination shields
- Quartz crystal thickness sensor
- Twist lock mechanism for easy substrate load/unload
- Substrate rotation
- Closed loop evaporation control
- Fully automated PC based, recipe driven, LabVIEW user interface
- EMO protection and safety interlocks

OPTIONS

- Substrate heating up to 800°C or chilled wafer cooling
- Glancing Angle Deposition (GLAD) with rotation
- Planetary substrate holder
- Additional power module for co-evaporation
- Additional evaporation sources up to six
- RF/DC substrate bias
- Ion source for substrate cleaning
- Magnetron source for sputtering
- MFCs for reactive sputtering/evaporation
- Automatic load/unload
- Various pumping options including cryo pumping stations

APPLICATIONS

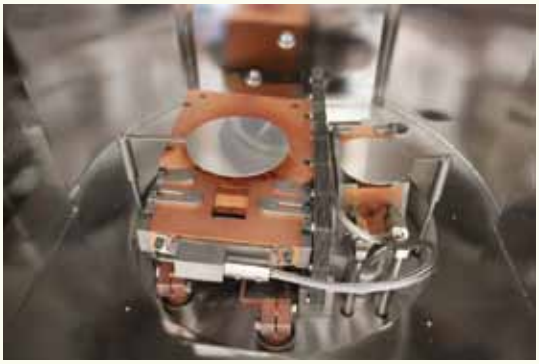
- Metallization in IC interconnects
- Metal contact layer in CIGS applications
- Organics field effect transistors
- Perovskite solar cells applications
- OLED

E-Beam Evaporation Systems

NEE-4000

The Electron Beam Evaporation system is available in two different configurations: A compact vertical dual chamber configuration features a 14” cube main chamber where the platen is located, and underneath the main chamber a secondary chamber is provided for housing the e-beam source. This configuration can be provided with a gate valve between the two chambers to be used as a load lock to keep the e-beam source and the evaporation pockets in vacuum while substrates are loaded and unloaded from the main chamber. For applications where automatic loading and unloading of wafers are needed a third chamber is attached to the left face of the cube for another load lock. In this case, the main chamber can be kept at low 10^{-7} torr range at all times and evaporation can start just a few minutes after loading the wafer. The second configuration features a single large chamber design that allows e-beam evaporation guns, magnetrons, and thermal evaporation mounted onto the baseplate. In this configuration coating of multiple wafers are possible using planetary substrate holder.

NANO-MASTER offers combinatorial evaporation system using substrate masking and computer controlled evaporation rates for individual e-beam evaporators.



Dual E-Beam Source

FEATURES

- Electropolished 14” cubical or 21”x21”x22” 304L SS chamber
- $5x10^{-7}$ torr base pressure attained with turbomolecular pumping package
- 4x 15cc pocket E-gun
- Source and substrate shutters
- 6 and 10 kW switching power supply
- Automatic pocket indexing
- Programmable sweep controller
- 26”x44” footprint with SS panels for Class 100 cleanrooms
- Quartz crystal thickness sensor
- Substrate rotation
- LabVIEW user interface
- EMO protection and safety interlocks

Large Chamber Evaporator

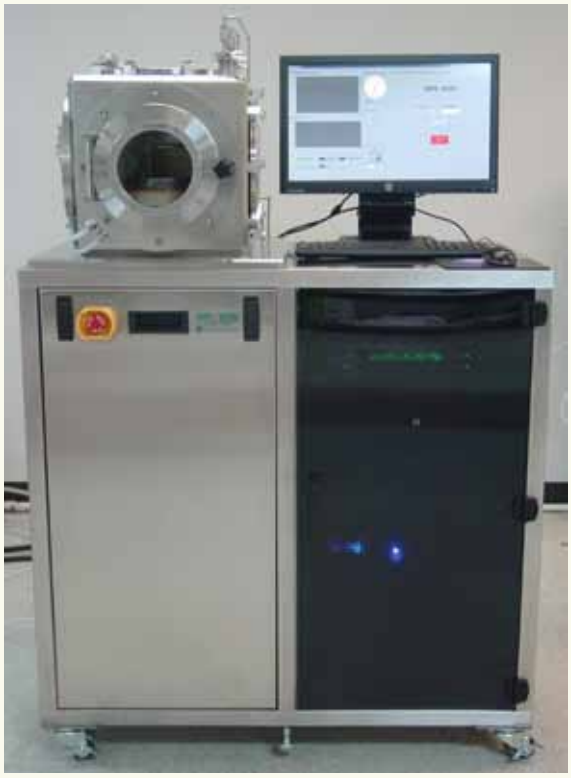
OPTIONS

- Substrate heating up to 800°C or cooling
- Glancing Angle Deposition (GLAD) with rotation
- Planetary substrate holder
- Substrate RF/DC bias
- Dual e-beam source for co-evaporation
- Ion source for substrate cleaning and ion assisted evaporation
- Additional PVD sources (thermal, sputtering)
- MFCs for reactive evaporation
- Automatic load/unload

APPLICATIONS

- Lift off
- Optical coatings
- Thin film transistors
- Active CIGS layer
- Josephson junctions

PECVD Systems

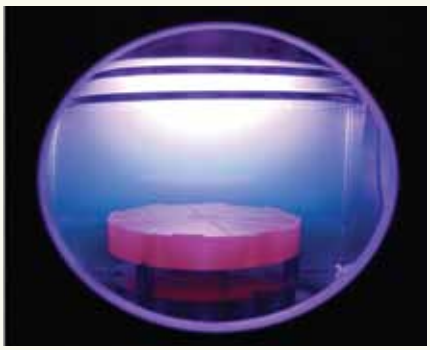


NPE-4000 System

NANO-MASTER's PECVD systems are capable of depositing high quality SiO_2, Si_3N_4, CNT, DLC and SiC films. Depending on application RF showerhead, Hollow Cathode, ICP or Microwave plasma sources can be used. The platen can accommodate up to 8" wafers and can be biased with RF, Pulsed DC or DC while being heated up to 800°C resistively or with IR lamps. The chamber is evacuated to $5x10^{-7}$ torr pressure range using 250 l/sec turbomolecular pump backed with 5 cfm mechanical pump. The system utilizes LabVIEW PC control for full automation.

FEATURES

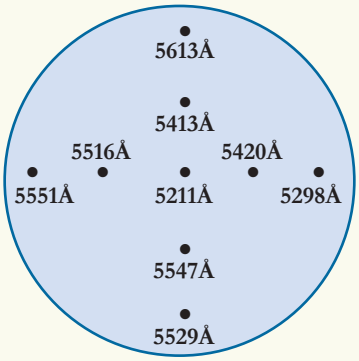
- 13" Al chamber or 14" SS cube chamber
- $5x10^{-7}$ torr base pressure attained with turbo pumping package
- Plasma sources: RF showerhead, ICP, hollow cathode and microwave
- Gas ring for precursors and dopants
- Platen: 200°C - 800°C, rotating, biasable with RF, low frequency RF, DC, and pulsed DC
- MFCs with electropolished gas lines and pneumatic shut-off valves
- Fully automated PC based, recipe driven
- LabVIEW user interface
- EMO protection and safety interlocks



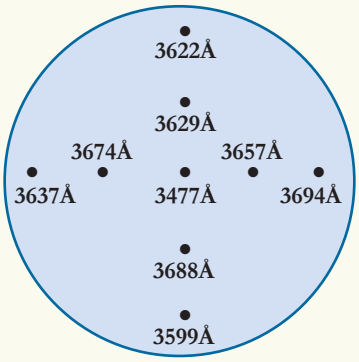
700 °C, ICP Source

OPTIONS

- ICP source for high density plasma
- Substrate Pulsed DC bias
- Substrate LF bias for film stress control
- Rotating platen for coating 3D parts
- Auto load/unload
- Dry pump
- Bubblers for organo-metallics with heated gas lines
- Gas box for toxics gases with toxic gas monitors
- End point detection
- Various dopants (PH_3, B_2H_6)



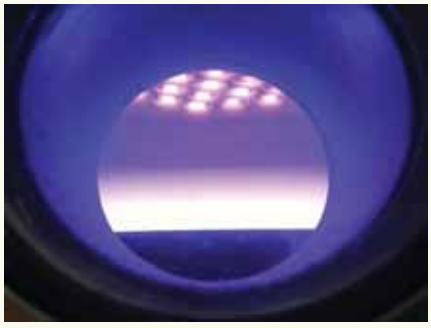
Silicon Dioxide
Wafer Size = 6"
Tc (°C) = 200 °C
Uniformity % = 3.6%
Refractive Index = 1.48



Silicon Nitride
Wafer Size = 6"
Plate Temp (°C) = 230 °C
Uniformity % = 2.9%
Refractive Index = 2.03

APPLICATIONS

- Encapsulation, isolation
- Photonics structures
- DLC's coating
- CNT's - memory devices
- Surface passivation layer - Solar cells
- Graphene - Nano scale electronics



Hollow Cathode Plasma Source

Sputtering Systems

NSC-4000

NSC-3500

NSC-1000

NANO-MASTER's state of the art Sputtering Systems can be constructed with various chambers and source configurations for deposit of metals and dielectric thin films on to substrates up to 200 mm. The systems can be equipped with DC, RF and Pulsed DC power supplies to enable sequential or co-sputtering. The systems come with a turbomolecular pumping package to achieve a base pressure of $5x10^{-7}$ torr. Magnetron to substrate distance is adjustable in order to achieve desired uniformity and deposition rate. Rotating platen with off axis magnetrons provide means of achieving the best film uniformity. Crystal thickness monitor is provided for terminating process automatically. Platen can be heated up to 800°C and RF biased.

FEATURES

- Electropolished 14" cubical chamber optimized for sputtering
- $5x10^{-7}$ torr base pressure attained with turbomolecular pumping package
- Single or multi magnetron configuration with varying target sizes
- Sequential sputtering/co-sputtering
- Adjustable magnetron to substrate distance
- 1" to 6" diameter planar magnetron
- Source and substrate shutters
- Mass flow controller with electropolished gas lines
- 4" viewport with manual shutter
- Quartz crystal thickness sensor
- Substrate rotation
- Fully automated PC based, recipe driven
- LabVIEW user interface
- EMO protection and safety interlocks

OPTIONS

- Substrate heating up to 800°C or cooling
- Glancing Angle Deposition (GLAD) with rotation
- Custom chamber sizes
- 1.5-5kW Pulsed DC power supply for ITO/ZnO like materials
- Tilted magnetrons
- RF biased substrate
- Ion source for substrate cleaning
- Ion assisted sputtering
- Additional RF and DC power supplies for co-sputtering
- Thermal and E-beam sources
- Additional MFCs for reactive sputtering
- Automatic load/unload
- Various pumping options including cryo pumping stations

APPLICATIONS

- Optical coatings, and ITO coatings
- Hard coatings
- Protective coatings
- Microelectronics patterning
- TCO in OLED applications

Optical Coating Systems

FEATURES

- RF biasable platen
- Thickness monitor
- $5x10^{-7}$ torr base pressure
- High accuracy and repeatability
- High quality films
- Atomic level clean surfaces
- Atomic cleaning and polishing
- LabVIEW user interface
- Automatic load/unload
- Automatic transfer in vacuum between chambers
- Recipe driven, password protected
- Safety interlocks
- 46”x44” footprint

OPTIONS

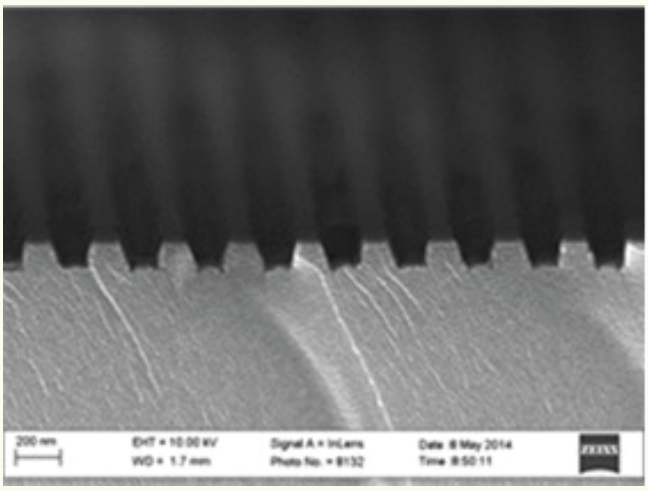
- Sputter down/up
- Co-sputtering
- DC, RF and pulsed power supplies
- Ion beam assisted deposition
- E-beam and plasma sources

APPLICATIONS

- Optical Coatings
  - Sputtering
  - IBAD
- Reactive Ion Beam Etching Cleaning
- Ion Beam Milling
- Infrared Coatings
- Surface Treatment

NANO-MASTER NOC-4000 Optical Coating System provides state of the art atomic level cleaning and etching of optical samples in one chamber and automated sample transfer to a second chamber for optical coating without breaking vacuum. The system can also use the chambers independently, each with its own automatic sample loading and unloading.

Ion Beam Cleaning Chamber with Tilted Platen



Grating with a Pitch of about 323 nm on a Glass Substrate after Etching Process

Reactive Ion Etching Systems

NANO-MASTER's NRE-4000 is a stand alone Reactive Ion Etching (RIE) system with showerhead gas distribution and water cooled RF platen. It has a stainless steel cabinet and a 13" cylindrical aluminum chamber that opens from top for wafer loading or chamber cleaning. It can accept up to 8" (200 mm) wafers. The chamber has two ports, one with a 2" window the other with a blank off for diagnostic equipment such end point detection. The chamber is extremely clean in design and reaches a base pressure in the $5x10^{-7}$ torr range or lower depending on the pumping package. It can be operated in the pressure range of 20 mTorr to 8 torr. The standard pumping package has a 250 l/sec corrosive turbomolecular pump, sieve filter, and a 10cfm PFPE prepared backing pump. The RF power is provided by a 600W 13.5 MHz power supply, and an auto tuner. The substrate DC bias is continuously monitored and reaches as high as -500 V, which is important for anisotropic etching. The system is PC controlled recipe driven giving maximum flexibility to user while maintaining high reproducibility. Single wafer and cassette to cassette auto load/unload are available.

NRE-3500

NRE-3000

FEATURES

- 13" aluminum chamber
- Showerhead gas distribution
- Up to 200mm substrates
- MFCs with SS gas lines
- DC bias: up to -500V self bias up to -1000V external bias
- Automatic pressure control
- 600W RF power supply with auto tuner
- Water cooled or heated (400°C) platen
- 250 l/sec corrosive turbomolecular pump with suitable backing pump
- Fully automated PC based, recipe driven
- LabVIEW user interface
- Fully safety interlocked

OPTIONS

- ICP high density plasma source for high rate etching
- Plasma source for isotropic etching
- He backside cooling with mechanical clamp for DRIE
- Additional MFCs
- Auto load/unload
- Substrate cooling down to -20°C and heating up to 200°C
- Spectroscopic end point detector
- Electrostatic chuck
- 12" wafer chamber

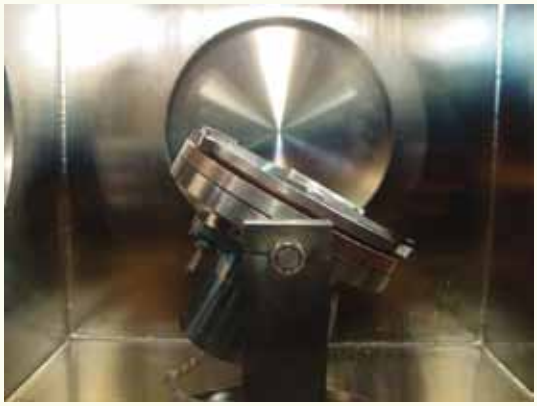
APPLICATIONS

- Compound semiconductors
- GaAs sensor
- Photonics
- MEMS device fabrication
- Deep trenches in silicon etching
- Plasma dicing for advanced packaging
- Etching Vias for TSV fabrication
- High precision motion sensors
- Nano Scale etching and microfludics

Ion Beam Milling, Etching and Cleaning Systems

Ion Beam Milling System
6” DC Ion Source and Auto L/UL

NANO-MASTER’s Ion Beam Milling systems are very adaptable and can be built in various configurations depending on the application. A variety of sample holder and ion source configurations allow for a diverse range of applications. Sample holders used in the Ion Beam Milling systems have ±90° tilt, rotation, water cooling, and helium backside cooling. NANO-MASTER technology has demonstrated capability of keeping substrate temperatures below 50°C. By tilting and rotating trenches are beveled, and control over sidewall profile as well as radial uniformity is improved. Various options are available for different grid configurations and neutralizers. A sputtering option can be provided for coating freshly etched metal surfaces. Single wafer auto load and unload is also available.



Rotating, Tiltable, Cooled Platen

Reactive Ion Beam Etch System
8” RF Ion Source and Auto L/UL

FEATURES

- Electropolished 14" SS cubical chamber
- Water cooled ±90° automatically tiltable rotating substrate holder
- Mass flow controllers
- DC ion sources 1cm-16cm
- ±1.2% etch uniformity across 6" Au substrate
- Capable of cooling substrates to <50°C
- 26"x24" footprint with SS panels for Class 100 cleanrooms
- Fully automated PC based, recipe driven
- LabVIEW user interface
- EMO protection and safety interlocks

OPTIONS

- Spectroscopic end point detection
- Helium backside cooling
- Electropolished 21" SS cubical chamber
- Auto load/unload
- 1200 l/sec turbomolecular pump
- Cryogenic pumping package
- Additional MFCs for reactive gases
- Gridded RFICP sources
- Hollow cathode or filament neutralization
- Sputtering source for passivation layer deposition

APPLICATIONS

- Argon milling for planarization
- III-V photonics components
- Laser gratings
- High aspect ratio etching of photonics crystals
- Deep trenches on SiO_2, Si and metals

Plasma Cleaning and Ashing Systems

NPC-3000

NANO-MASTER Plasma Cleaning and Ashing systems are designed to meet a wide range of needs from wafer resist stripping to surface modification of batch as single wafer loads. They are PC controlled systems with various plasma sources, heated and unheated substrate holders and unique ability to switch from plasma etch to RIE etch modes.

FEATURES

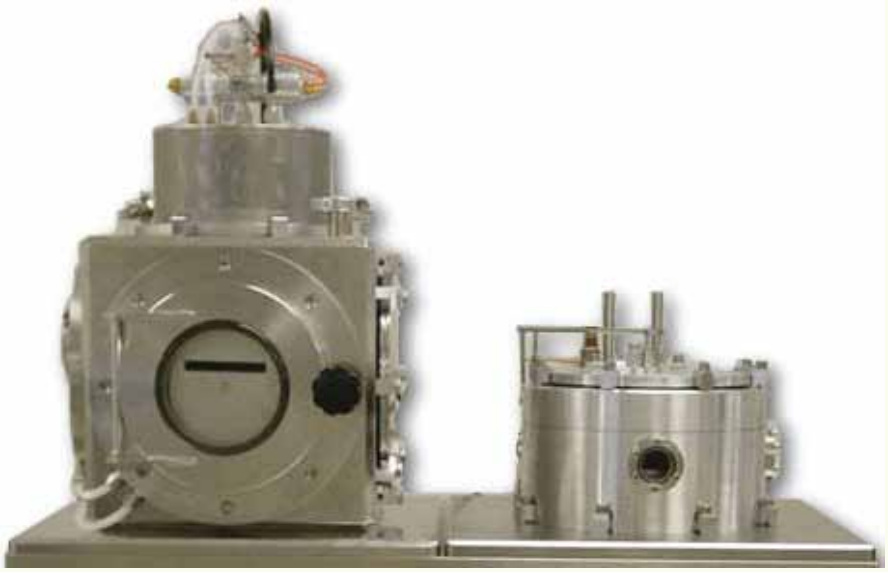
- Stainless Steel, Aluminum or Bell Jar chambers
- Class 100 cleanroom compatible
- Showerhead, ICP or microwave plasma sources
- Rotating platen
- 250 l/sec turbomolecular pump
- $5x10^{-7}$ torr base pressure
- RF biasable heated up to 300°C PID controlled or cooled platen
- Fully automated or manual RF tuning
- Up to four mass flow controllers with electro-polished gas lines
- PC controlled pneumatic valves
- Fully automated PC based, recipe driven
- LabVIEW user interface
- EMO protection and safety interlocks

Chamber

APPLICATIONS

- Delayering for failure analysis
- Removal of organic and inorganic materials without residues
- Photoresist stripping and ashing
- Desmearing and etch back
- Cleaning microelectronics, drilled holes on circuit boards or Cu lead frames
- Descum prior to lift off metallization process
- Adhesion promotion, elimination of bonding issues
- Surface modification of plastics: O_2 treatment for paintability
- Producing hydrophilic or hydrophobic surfaces

Dual Systems



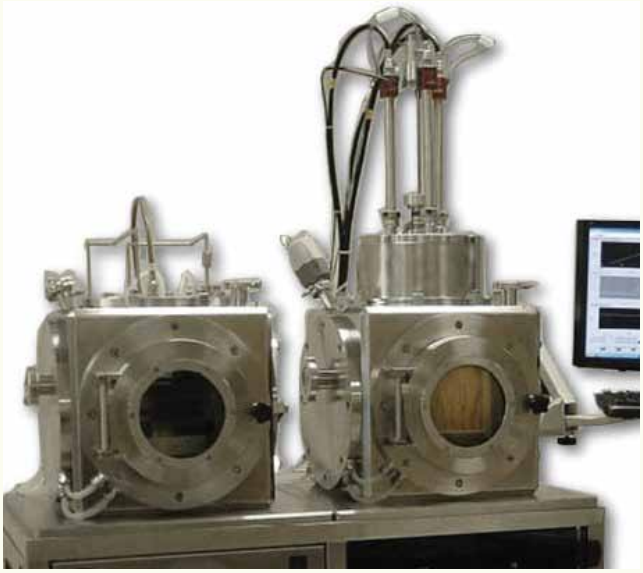
NSP-4000 PECVD / RIE System

Any combination of two systems; ALD, Sputtering, Evaporation, Ion Beam Milling or Etching, RIE, PECVD found in the NM catalog can be configurated as dual system. Cost is cut by sharing pumping systems and power supplies when applicable. The chambers are isolated from each other via gate valves and can be pumped and vented individually. Load lock or in vacuum chamber-to-chamber transfer is available.

FEATURES

- 26"x44" footprint with enclosed panels
- Fully automated PC based, recipe driven
- LabVIEW user interface
- EMO protection and safety interlocks

NIR-4000 Ion Beam and RIE Etching System



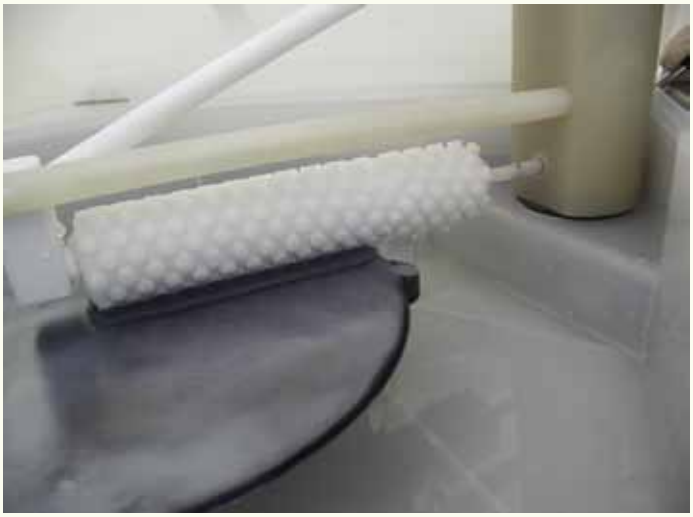
NSP-4000 PECVD / Sputtering System

NRP-4000 ICP PECVD and RIE System with Load Locks and Auto L/UL

Single Wafer Cleaning Systems

NANO-MASTERS's Single Wafer Cleaners (SWC) focus on providing the best possible cleaning capability while maintaining affordability. A standard system is configured with megasonic clean, chemical clean, brush clean, high RPM spin dry with IR heating and N_2 flow. Patented megasonic nozzle movement assures uniform delivery of megasonic energy; therefore, at any point on the surface, energy delivered can be kept below damage threshold.

SWC-4000



CMP Wafer Cleaning with Brush

APPLICATIONS

- Patterned and un-patterned masks and wafers
- Ge, GaAs and InP wafer cleaning
- Post CMP wafer cleaning
- Cleaning of diced chips on wafer frame
- Cleaning after plasma etch or photoresist stripping
- Mask blanks or contact mask cleaning
- Cleaning of x-ray and EUV masks
- Optical lens cleaning
- Cleaning of ITO coated display panels
- Megasonic assisted lift-off process

FEATURES

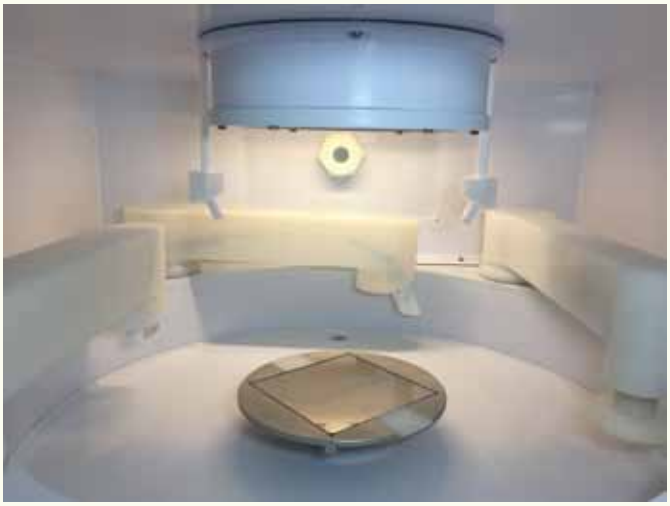
- 12" OD, 7" x 7" substrates
- Stand alone and table top
- Venturi powered vacuum
- Damage free megasonic
- Independent chemical dispenses
- Spin dry and heated N_2
- Microprocessor controlled
- Chemical dispense unit
- Dual drain for acids and solvents
- Suck back valves to prevent drips
- Safery interlocks

OPTIONS

- PVA brush cleaning (100 RPM)
- Post CMP brush (up to 400 RPM)
- Nitogen ionizer
- Bottom side DIW and dry
- CO_2 inject with DIW resistivity monitor
- In-line heaters for DIW or chemical
- Fill sensors for chemical
- FM 4910 materials

Large Substrate Cleaning System

LSC-4000



Chamber

NANO-MASTER's Large Substrate Cleaner (LSC) is a stand alone cleaner which utilizes PC control for substrates up to 21" OD. A LabVIEW interface through a touch screen provides greater control compared to the SWC systems and allows for controlled access levels such as operators, process engineers, and maintenance. The LSC incorporates the same patented megasonic technology and chemical dispenses as the SWC systems. The combination of LabVIEW control and the larger process chamber support additional options such as ozonated DIW, high pressure DIW, pelliclized reticle, and piranha cleaning. Single wafer and cassette to cassette auto load/unload are available.

FEATURES

- 21” OD, 15”x15” substrates and 450mm wafer
- Damage free megasonic cleaning
- Variable speed PVA brush
- Chemical dispenses with suck back valves
- Spin dry with heated N_2
- Dual drain for acids and solvents
- Fully automated PC based, recipe driven
- Touchscreen user interface
- Manual load and unload
- Safety interlocks and alarm
- 32”x28” footprint

OPTIONS

- Pelliclized reticle cleaning
- Double sided brush and megasonic cleaning
- Chemical delivery module
- Fill sensors for chemical bottles
- Piranha cleaning
- Ozonated DI water (20 ppm of O_3)
- High pressure DI water
- Heated DI water
- Nitrogen ionizer
- CO_2 injector with DIW resistivity monitor
- FM4910 materials
- Robotic loading/unloading from SMIF pod

APPLICATIONS

- Si and Saphire wafers
- Post CMP wafers
- Chips on wafer frame
- Display panels
- ITO coated displays
- Patterned and un-patterned masks
- Mask blanks, contact masks
- Backside cleaning of pelliclized reticles
- Cleaning of pellicle frame adhesive

Pelliclized and Unpelliclized Reticle Cleaning Systems

LSC-5000

Chamber

FEATURES

- Two Dual Dispense Arms:
  - Linear Arm Provides Uniform Cleaning of Front Side Alignment Marks for Pelliclized Reticles
  - Radial Arm Provides Uniform Dispense of DIW with Megasonic Energy for Back Side Cleaning
- Pelliclized Reticle Clean: Reticle is mounted face down on the chuck and the back side is cleaned with the radial arm. Reticle is then dried, picked up and flipped. The pellicle protection cup is then mounted onto the front side and the alignment marks are then cleaned with the megasonic nozzle, brush and chemical dispense from the linear drive arm. Chuck is then rotated 180° and other side is cleaned. The reticle is then dried and the protection cup removed. All of the manipulation is automatically done by the robot

CAPABILITIES

- Megasonic clean
- Chemical dispense
- SC1 clean
- Brush clean with megasonic DI water dispense
- Brush self clean with megasonic DI water
- Dual drain
- N_2/IR lamp dry
- Fully automated with touchscreen interface
- Robotic loading/unloading from SMIF Pod
- Automatic bar code reader
- Data/error logging
- CO_2 injector with DI water resistivity measurement
- Class 1 cleanroom compatible
- 59”x45” footprint

OPTIONS

- Ozonated DI water clean*
- Bulkfill for auto mixing SC1
- SC2 clean
- Piranha clean*
- High pressure DI water*
- Heated DI water
- Heated chemicals*
- Up to 9”x9” reticle clean
- 21”OD, 15”x15” large substrate clean

* For Unpelliclized Reticles Only

Space Simulation Systems for Devices and Mini Satellites

NDT-4000

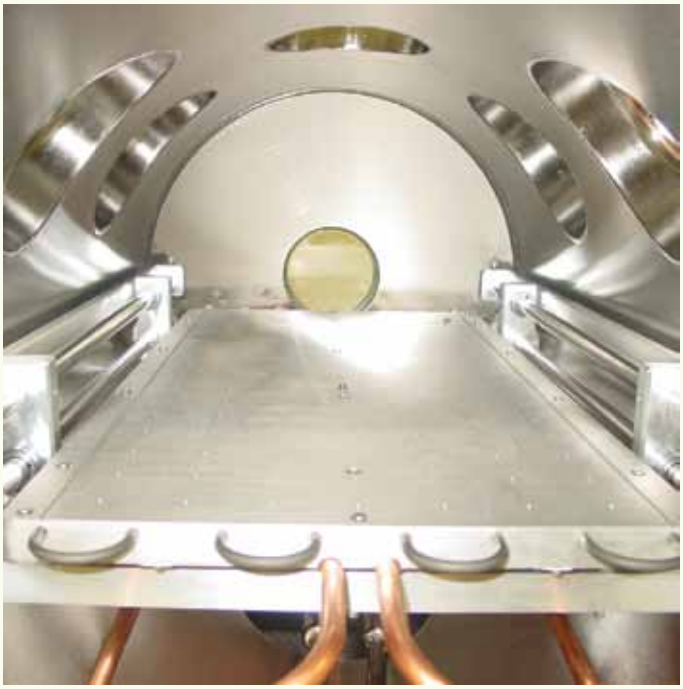
NDT-4000 is a Device Testing System for testing devices or samples in extreme vacuum and controllable uniform heat and cold cycle conditions. It is equipped with computer control, safety interlocks, and multiple levels of access with password restrictions. It can be used to test devices/samples with automated heat and cool cycles for extended periods of time exceeding 36 hours with varying temperature conditions defined by the recipe. One of the common applications of this system would be space simulation. The approximate chamber size is 43" in length and 24" in diameter. A 16"x 32" sliding thermal platform can be controlled within ±1 °C across its surface area for temperatures ranging from -100°C to 150°C. This platform is mounted on rolls so that it can be pulled out to 75% of its length for loading devices/samples. The chamber has provision for 4x 8"CF flanges that can be configured with an assortment of customer-defined feedthroughs for digital and analog communication, temperature measurement, power, RF, and other instrumentation needs. The standard vacuum system consists of a 1250 l/sec turbomolecular pump and a 680 l/min dry scroll backing pump. The base pressure of the system can be as low as $7x10^{-8}$ torr and could reach 10^{-6} torr range in less than 20 minutes.

APPLICATIONS

- Mini satellites
- Device testing in temperatures -100°C to 150°C in extreme vacuum for space simulation

FEATURES

- Rapid heating and cooling times
- 24"x43" horizontal cylindrical chamber
- Chamber has a provision for 4x 8"CF flanges
- 16" x 32" thermal platform controlled within ±1°C for temperatures ranging from -100°C to 150°C
- Thermal platform is mounted on rolls so that it can be pulled out to 75% of its length for loading devices
- Closed refrigeration system to eliminate consumable cost of liquid nitrogen used in most other systems
- Various pumping package configurations
- Base pressure 7 x 10^{-8} Torr, 10^{-6} Torr range in less than 20 minutes
- Automatic pressure control
- Multiple levels of access with password restrictions
- Fully automated PC based, recipe driven
- Custom feedthroughs



Sliding Thermal Platform

About Us

NANO-MASTER, USA was founded in 1992 as a wholly-owned subsidiary of NANO-MASTER, S.A., France, a leading metrology company in defect inspection and high speed overlay measurement. Subsequent to the closing down of Nano-Master S.A. in 1993, Dr. Birol Kuyel took over the ownership of NANO-MASTER, USA. The name was changed later to NANO-MASTER, Inc., which has now become a 100% privately owned US company.

NANO-MASTER started design and development of research tools in 2001 and focused on thin film applications. The first tool was a Sputtering System followed by a PECVD System and later a Wafer Cleaner System was delivered.

NANO-MASTER products are used in LED, MEMS, Optoelectronics, Nanotechnology, Photovoltaic, Semiconductor,and Space Simulation applications. Some of the products are PECVD Systems for deposition of SiO_2, Si_3N_4, DLC and CNT; PA-MOCVD Systems for InGaN and AlGaN; Sputtering Systems (reactive, co-sputtering, combinatorial); Thermal and E-Beam Evaporators, Ion Beam Milling and Reactive Etching Systems; Atomic Layer Deposition and Atomic Layer Etching Tools; Thermal Vacuum Systems; Megasonic Cleaning Systems and Photoresist Stripping Equipment.

NANO-MASTER has established itself as a thin film equipment supplier around the world and sold over 180 units in forty countries primarily to universities, research centers and leading national laboratories.

Birol Kuyel, Ph.D. is the president and CEO of NANO-MASTER, Inc. His background expands to broad range of technologies including High Temperature Plasma Physics, Turbulence, Si_3N_4 Film Deposition and Characterization, X-Ray Source Development, DUV Source Development, DUV Step and Scan Lithography Tool Development (SEMATECH) and the Lithography Cost of Ownership Model (SEMATECH). He has been awarded 12 patents and published numerous papers.

NANO-MASTER employs highly skilled and educated design and manufacturing engineers, application engineers, service engineers and support personnel.

NANO-MASTER's objective is to provide top quality services while maintaining the highest levels of integrity at all times.

NANO-MASTER

Single Wafer Thin Film Processing Systems

Deposition
E-Beam, PECVD, PLD, DLC, DC & RF Sputtering,
Ion Beam Sputtering, Thermal Evaporation

Etching
RIE, DRIE, ICP, Ion Beam Milling & Etching, Plasma, Wet

Growth
PE-ALD, PA-MOCVD, CNT, DLC, Diamond, Graphene

Surface Treatment
Ion Beam, PIII, Plasma

Cleaning
- Dry: Ion Beam, Plasma
- Wet: Megasonic, Brush, Piranha, O_3DIW

Other
Space Simulation Systems, Heated Platens, Plasma Sources,
Ashing, Resist Stripping (Dry & Wet)

Single Wafer Thin Film Processing Systems

◉ NANO-MASTER WORLDWIDE CUSTOMER BASE

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Representative