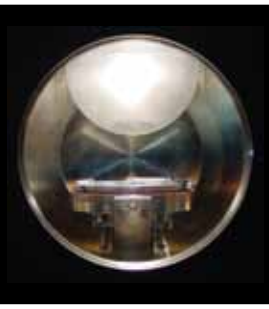
Ion Beam Milling and Etching Systems



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NANO-MASTER Ion Beam Milling and Etching Systems

NANO-MASTER's Ion Beam Milling and Etching systems are field proven, fully automated systems that provide ease of use, high reproducibility, and reliable performance with extremely good uniformity.

A variety of sample holders and Ion Source configurations allow for a diverse range of applications to be carried out. Sample holders used in NANO-MASTER Ion Beam Milling systems have ±90° tilt, rotation, water or LN cooling, and helium backside cooling capabilities. For temperature sensitive applications, NANO-MASTER technology has demonstrated capability of keeping substrate temperatures below 70°C. Heating is also possible via a heating element embedded within the platen assembly. In certain other applications heating samples above 150°C is desired for increased volatility of materials etched and thus increasing the etch rate. By tilting the sample, the sidewall profile can be controlled and radial uniformity can be optimized. Rotation in conjunction with offset of axis of rotation from ion beam axis provides broader radial thus more uniform etch profile.

Various options are available for different grid configurations and neutralizers. Sources such as RF ICP, compatible with reactive gases, provide etch selectivity and etch rate improvement. A sputtering option can be provided for coating freshly etched metal surfaces to protect from oxidation. A load lock chamber with or without turbomolecular pump and automatic load and unload capability is also available.

NANO-MASTER can provide dual chamber systems with RIE and Ion Beam Milling as a platform capable of etching almost all materials or Sputtering and Ion Beam Etching System for etching gratings and coating them on a single footprint. Furthermore two chambers can be connected with auto wafer load and transfer load lock between chambers if two processes need to be carried out without breaking vacuum. Such a dual system reduces the cost and footprint compared to two separate systems by using a common pumping system, power supplies, and control electronics.

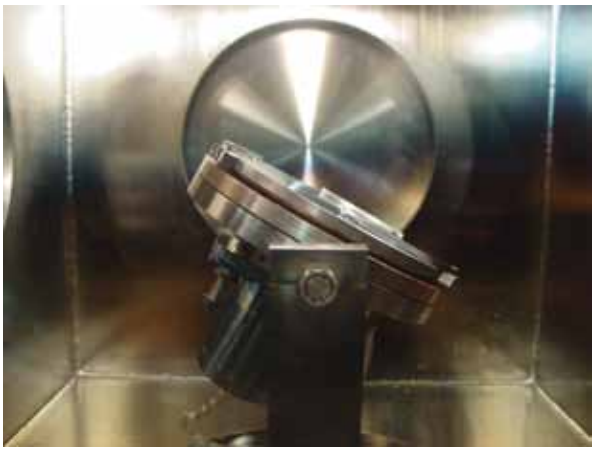
NIE-4000 with 14" Cube

NIE-4000 with 20" chamber and Auto Load/Unload

NANO-MASTER Ion Beam Milling and Etching Systems

FEATURES

- Electro-polished 14" SS cubical chamber
- Up to 8” wafer or substrate holder
- ±90° automatically tiltable and rotating
- Water or LN cooled, optional He backside cooling
- Sample temperature <70°C
- Ion source
- Gridded KDC Kaufman source (1cm-16cm beam sizes available)
  - DC for Ion Milling
  - RF ICP for Reactive Ion Beam Etching
- Pneumatic shutters
- Ion beam neutralization
- ±2% etch uniformity across 6" substrate
- Turbomolecular pump backed up with dry backing pump
- $5x10^{-7}$ torr base pressure
- Ar mass flow controller
- PC controlled with LabVIEW software
- Recipe driven, three levels of password protected access
- EMO protection and safety interlocks
- 26" x 44" footprint with enclosed panels
- Compatible for Class 100 clean rooms



Tiltable, Rotating and Water Cooled Platen

OPTIONS

- Spectroscopic end point detection
- Helium backside cooling
- Electro-polished 20" SS cubical chamber
- Load lock
- Auto load/unload with substrate carrier
- 1200 l/s turbo molecular pump for 10^{-8} Torr range base pressure
- Cryogenic pumping package
- Additional MFCs for reactive gases
- Gridless End-Hall eH sources for high current low energy beam surface cleaning
- Gridded RF ICP sources
- Hollow cathode beam neutralizer
- Sputtering source for passivation layer deposition to protect freshly etched surface from oxidation

Shutter

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

Automatic Load/Unload Chamber

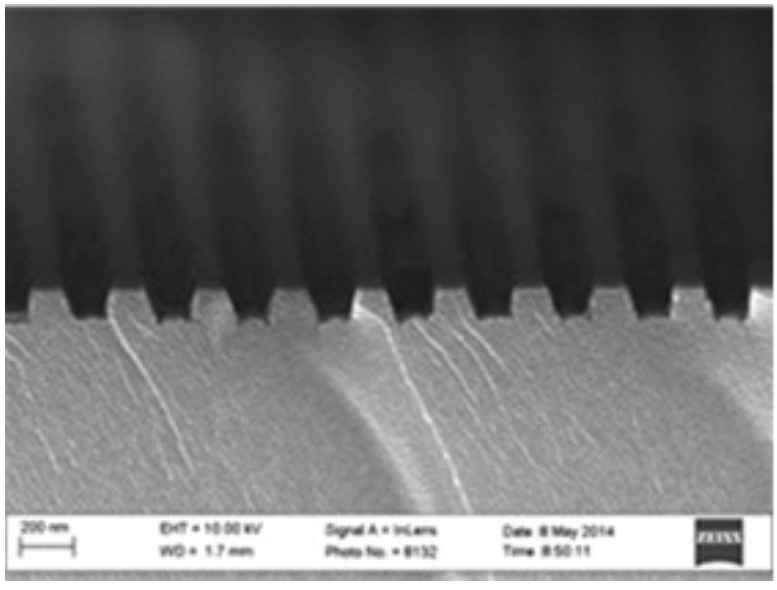
NANO-MASTER Ion Beam Milling and Etching Systems

Dual Chamber Ion Beam Milling/Etching and Sputter Coating in Vacuum Sample Transfer

Ion Beam Cleaning Chamber with Tilted Platen

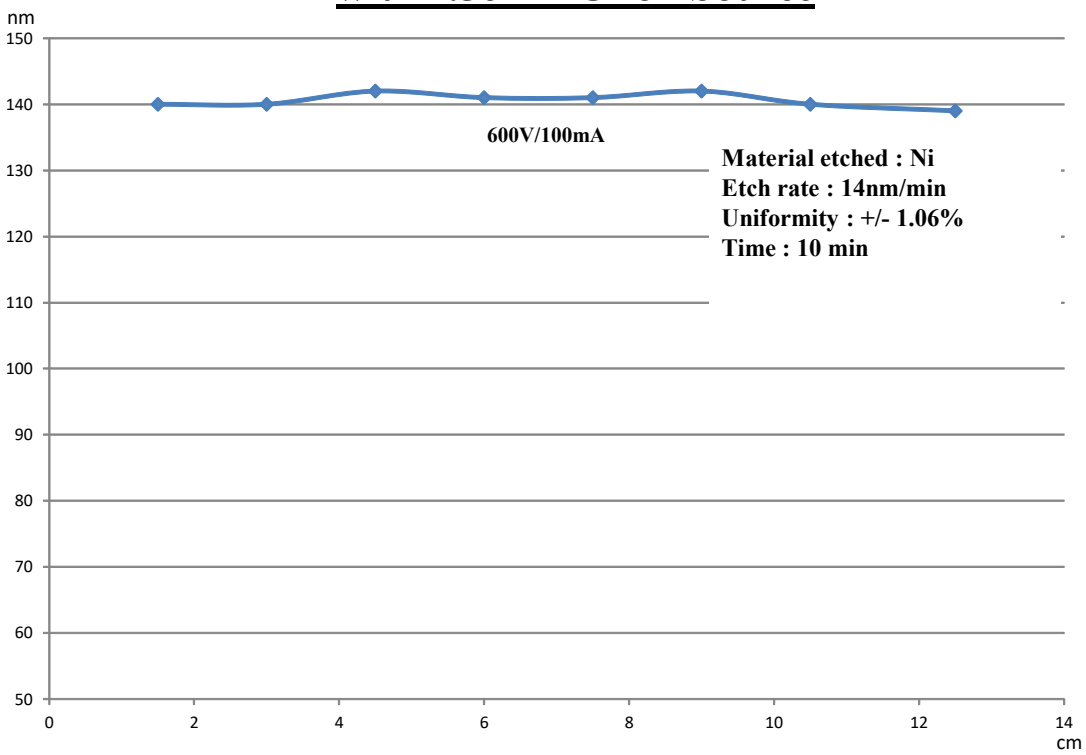
Sputtering Chamber with Rotating, Heated and Biasable Platen

View of Ion Beam

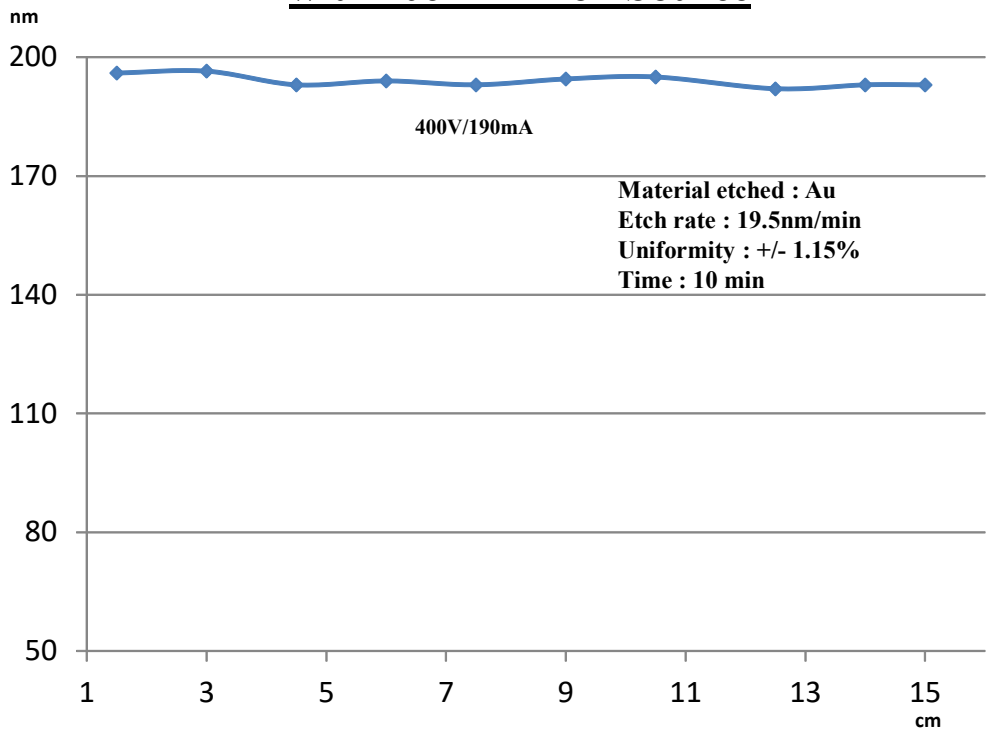


Quartz Grating Etched by Ion Beam (pitch 323nm)

Uniformity Data on 4” Wafer with 7.5cm DC Ion Source



Uniformity Data on 6” Wafer with 20cm RF Ion Source



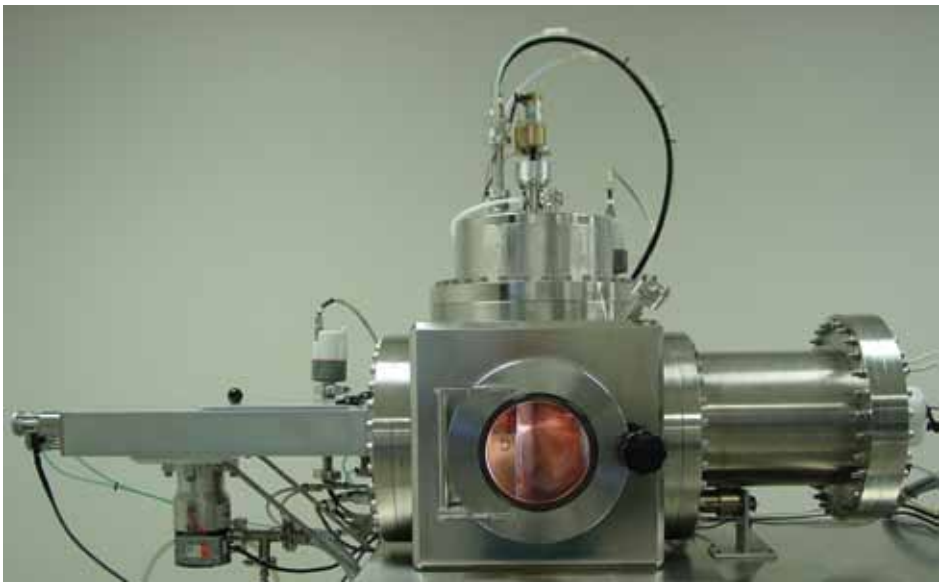
NANO-MASTER Ion Beam Milling and Etching Systems

GENERAL SPECIFICATIONS

Chamber:	14” or 20” SS cube chamber
Maximum Substrate Size:	Up to 6” with DC and up to 8” with RF ion sources
DC Ion Source Beam Diameter:	Maximum 16cm
DC Ion Beam Current:	>650mA
RF Ion Source:	Maximum 20cm
RF Ion Beam Current:	>800mA
Shutter:	Pneumatic
Platen:	Water or LN cooled, rotating up to 20 RPM, tiltable +/-90°
Base Pressure:	$5x10^{-7}$ torr with 260 l/sec turbo, $3x10^{-7}$ Torr with 680 l/sec turbo, $8x10^{-8}$ torr with 1240 l/sec turbo on a 14” chamber
MFCs:	Reactive and non-reactive gases (Ar, O_2, CF_4)
System Control:	PC controlled with LabVIEW, recipe driven
Loading and Unloading:	Manual or automatic wafer load and unload through load lock
Wall Mount:	Available
Class:	100
Footprint:	26”x44”

FACILITY REQUIREMENTS

Power Input:	208VAC/380VAC/415VAC, 20A/Phase, 50/60Hz
Chilled Water:	2gpm @ 50psi, 18°C
Compressed Air:	1/4” Swagelok, 80-90 PSI
Processed Gas:	1/4” Swagelok, 20 PSIG
Nitrogen:	1/4“ Swagelok, 20 PSIG
Exhaust (System):	NW25



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

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