ION BEAM

Ionfab®300

Flexible tools for multiple applications

Gambetti
Vacuum Technology
and Related Solutions

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Ionfab300

Unique abilities in etch and deposition

ION BEAM

Ion beam technology provides an exceptionally versatile approach to etch and deposition by offering a single tool and maximising system utilisation.

Our systems have flexible hardware options including open load, single substrate load lock and cassette to cassette. System specifications are closely tuned to applications, enabling faster and repeatable process results.

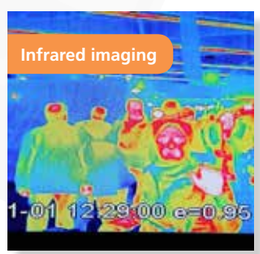
Key Features

- Multiple mode functionality:
  - Ion beam etching (IBE)
  - Reactive ion beam etching (RIBE)
  - Chemically assisted ion beam etching (CAIBE)
  - Reactive ion beam deposition (RIBD)
  - Ion beam sputter deposition (IBSD)
  - Ion assisted sputter deposition (IASD)
- Capable of clustering with other plasma etch and deposition tools
- Single wafer loadlock or cluster wafer handling
- Dual-beam configuration

Extensive and diverse applications

Ion Beam Etch	Ion Beam Deposition
Magnetoresistive random access memory (MRAM)	Laser facet coating • High reflection (HR) • Anti-reflection (AR)
Dielectric films	Ring laser gyroscope mirrors
III-V photonics etching	X-ray optics
Spintronics	Infrared (IR) sensors • II-VI -based
Metal contact and track	Telecom filters
Superconductors	

The **Ionfab**300 platform serves a diverse set of ion beam etch and deposition process requirements across a wide range of applications.



Ionfab300

Versatile system for multiple applications

The **Ionfab**300 is available in standard or large chamber, tailored for both etch and deposition applications.

***Ionfab**300 SC*

Ionfab300 Standard Chamber (SC)

A compact ion beam etch and deposition system designed for flexible research and pilot production, equipped with up to two (15cm) ion sources for etch or deposition. This makes it ideal for deposition on up to 200mm wafer size and with etch process optimised for up to 100mm wafer size.

Ionfab300 Large Chamber (LC)

Having essentially the same footprint but with a larger process chamber, it is designed to process wafers up to 200mm for both etch and deposition. Equipped with a 30cm etch ion source, the system provides excellent etch uniformity and superior process stability, making it a great choice for pilot and full scale production.

***Ionfab**300 LC*

Scalable from R&D to production in one tool

Material Types	Examples
Metals	Au, Ag, Pt, Ni, Cu, Al, etc.
Magnetics / Alloy	MnIr, CoFe, FeMn, NiCr, FeNiCo, etc.
Multi-layers	SiO_2, TiO_2, Ta_2O_3, Al_2O_3, etc.
Refractory oxides	MgO, SiO_2, Al_2O_3, HfO_2, ZrO_2, Nb_2O_5, etc.
III-Vs	GaN, GaAs, InP, InGaAsP, InSb, etc.
II-VIs	CdTe, CdHgTe, ZnO, ZnS.
Composites and others	VOx, DLC, $SrTiO_3$, $LaAlO_3$, $LiNbO_3$, etc.

*The **Ionfab**300 is capable of clustering with other plasma etch and deposition tools*

Ion Beam Etch

IBE, RIBE and CAIBE

Ion beam etch offers maximum flexibility coupled with excellent uniformity and is suitable for a wide range of applications.

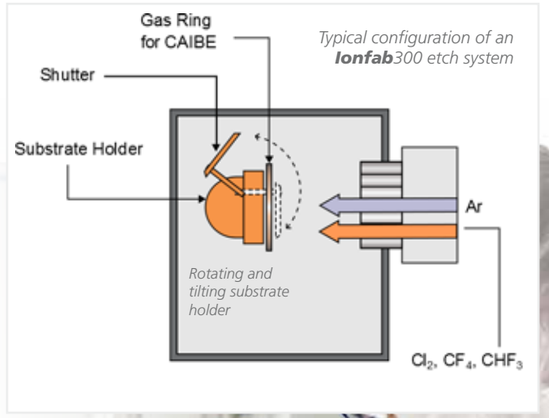
These attributes, along with the superior process repeatability results and low cost of ownership make the Ionfab tool an excellent system that is configurable from R&D to batch production.

Ion Beam Etching Modes

- Ion beam etching (IBE)
- Reactive ion beam etching (RIBE)
- Chemically assisted ion beam etching (CAIBE)

Key Benefits

- Flexible configuration for advanced research applications
- Unmatched uniformity and process reproducibility for production
- Flexible wafer handling capability – open load, single wafer load lock or cassette-to-cassette robotic handler
- Accurate end point detection – SIMS, optical emission
- Two substrate holder options:
  - 0 – 20 RPM, 0 – 300°C water cooled
  - 0 – 1000 RPM, quartz lamp heating with WLOM option



*Typical configuration of an **Ionfab**300 etch system*

Hardware features	Standard Chamber	Large Chamber
Etch RF ion source	15cm	30cm
Etch area	100mm	200mm
Substrate rotation speed	Up to 20 RPM	
Substrate tilt angle	-90° horizontal to +65° facing down	
Platen temperature	5°C to 300°C	
End point detection	• Secondary ion mass spectroscopy (SIMS) • Optical emission spectroscopy (OES)	

Etch Ion Sources

- 15cm or 30cm RF inductively coupled plasma ion source
- Three grid assembly designs
- Grid designs tailored for specific etch requirements
- Filamentless DC plasma bridge neutraliser (PBN) for low maintenance

Ion Beam Deposition

IBSD, IASD & RIBD

Our ion beam deposition products are chosen for their ability to produce deposited films with high quality, dense and smooth surfaces.

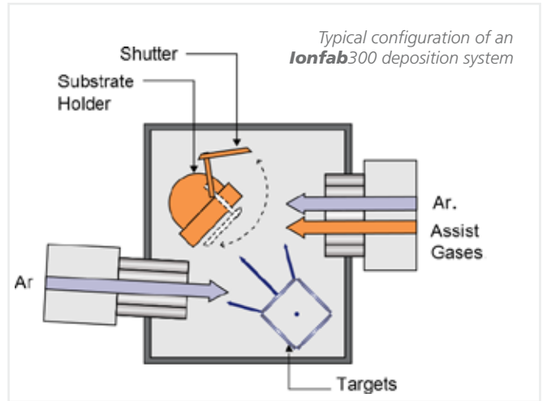
The in-house designed ion sources offer the most reliable and stable deposition processes with excellent run to run repeatability that are ideal for production.

Ion Beam Deposition Modes

- Ion beam sputter deposition (IBSD)
- Ion assisted sputter deposition (IASD)
- Reactive ion beam deposition (RIBD)

Key Benefits

- High quality thin film with ultra low contamination
- High throughput with reduced footprint for lowest cost of operation
- Unmatched batch uniformity and process reproducibility
- Patented high speed substrate holder (up to 1000 RPM) equipped with a white light optical monitor design for very accurate in-situ optical film control
- Very low surface film roughness



*Typical configuration of an **Ionfab**300 deposition system*

Hardware features:	Standard Chamber	Large Chamber	High quality optical coatings
Deposition ion source	15cm		
Assist or pre-clean source	15cm	30cm	15cm
Deposited area	Up to 200mm		
Substrate rotation speed	Up to 20 RPM		Up to 1000 RPM
Number of targets	Up to 4 targets		
End point detection	Crystal monitor		• Crystal monitor • White light optical monitor (WLOM)

Deposition Ion Sources

- Deposition ion source: 15cm, 13.56 MHz driven
- Gas inlet through source, assist source and into the chamber
- Multiple targets with rotating shutter
- Wide range of sputter target sizes with matching deposition ion source grid designs
- Rotating and tiltable high speed substrate holder

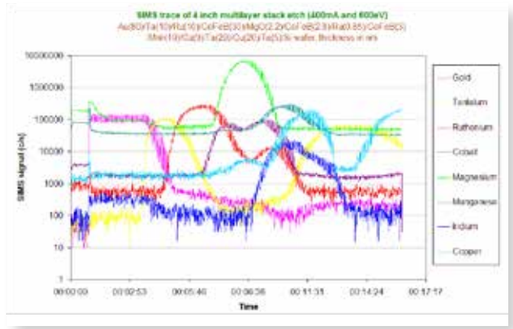
Process Monitoring

Etch Process Monitoring

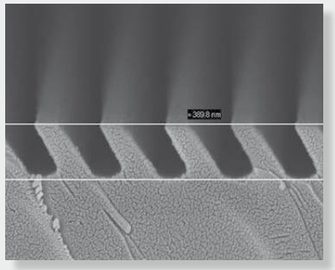
- OES end point detection
- White light optical monitors
- High speed specimen holder
- Etch endpoint monitoring by SIMS for multi-material applications; retractable and isolated from RIBE gases, e.g. Cl_2
- Dual beam functionality for flexible and demanding process requirements
- Closed-loop control of partial pressure of process gas using high pressure RGA for enhanced control of film properties and stoichiometry

Dual beam functionality

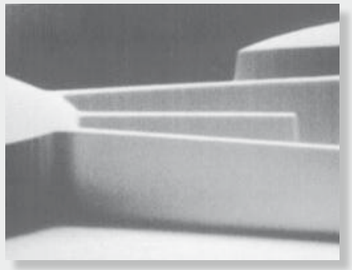
***Ionfab**300 with Hiden SIMS Probe EPD Fitted*



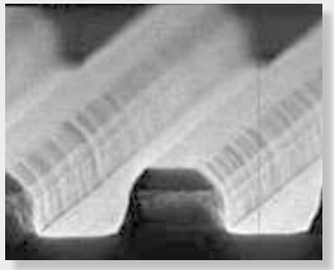
SIMS mass spectrum. Courtesy of Kiel University



InP blazed gratings



2.5 µm deep anisotropic quartz etch Courtesy of University Jena



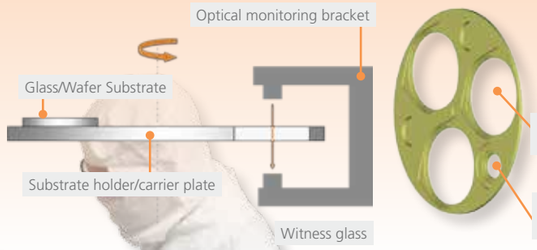
3µm Au etch

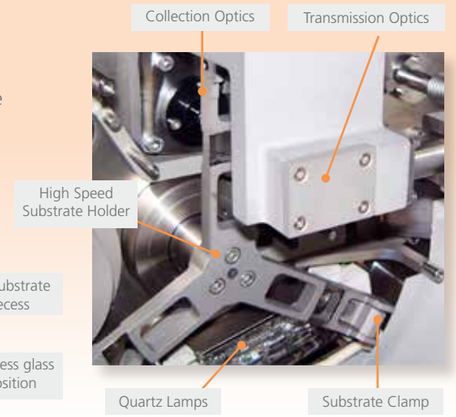
Process Monitoring

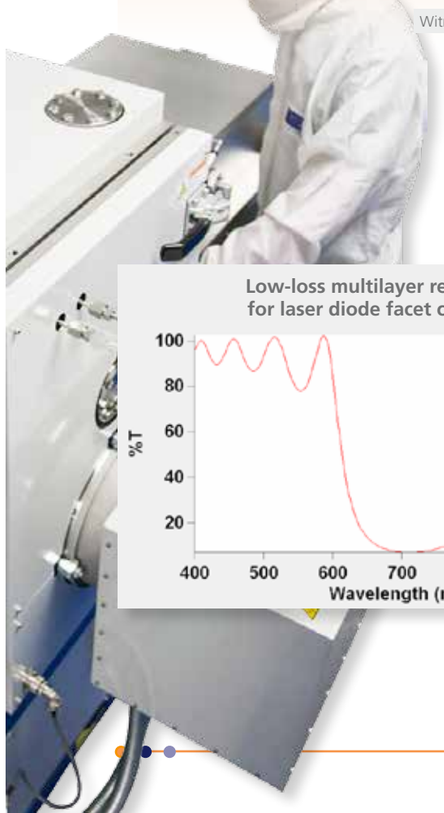
Deposition Process Monitoring

White Light Optical Monitor Hardware

Typical carrier plates are designed with an integral witness glass. The white light optical monitor uses the witness glass to monitor the deposition. The "endpoint" is controlled by the transmission signal.

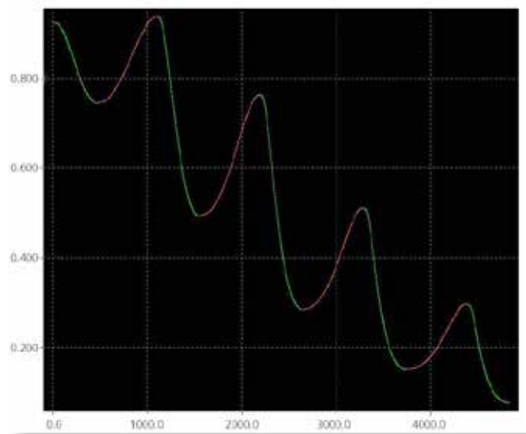






Low-loss multilayer reflector for laser diode facet coating

Transmission spectrum of a 9-layer high-reflecting structure [HL]^4H: H=Ta_2O_5 L=SiO_2



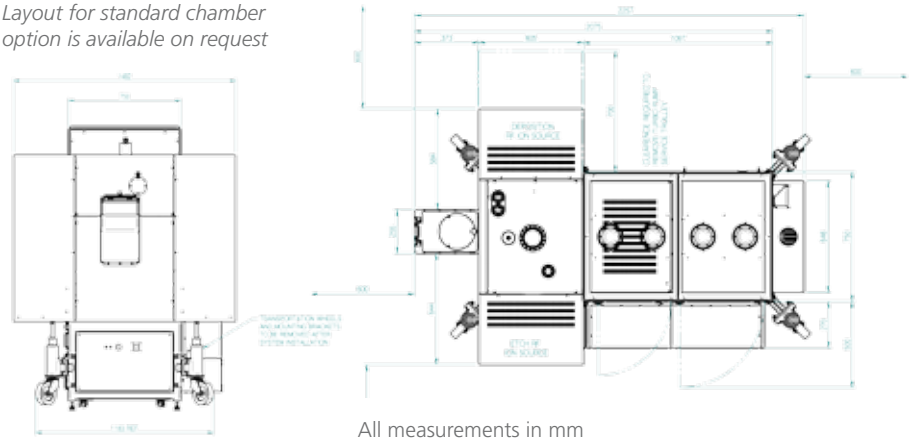
WLOM in situ optical control transmission signal during deposition of above structure

Ionfab300

Technical Specifications

Ionfab300 Large Chamber Layout

Layout for standard chamber option is available on request



All measurements in mm

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