

ION BEAM

Ion beam etch and deposition systems



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The Business of Science®



Ion beam systems

Ion beam technology offers unique abilities in etch and deposition

Oxford Instruments offers a single tool, allowing the flexibility to perform etch and/or deposition, maximising system utilisation.

System specifications can be closely tuned to applications, enabling faster and repeatable process results. The Oxford Instruments Ion Beam range offers functionality in multiple modes:

- Ion Beam Etching / Milling (IBE)
- Reactive Ion Beam Etching (RIBE)
- Chemically Assisted Ion Beam Etching (CAIBE)
- Ion Beam Sputter Deposition (IBSD)
- Ion Assisted Sputter Deposition (IASD)
- Reactive Ion Beam Sputter Deposition (RIBD)

Oxford Instruments' systems are scalable from R&D to batch production in one tool.

The Ion Beam Range

Ionfab300Plus	Etch and deposition processes in one tool
Optofab3000	Purpose made system for optical coatings
Ionfab500Plus	Specialist large-batch high precision ion beam deposition system

Typical applications and materials

- IR detectors
- CdHgTe (CMT) etch
- VO_x deposition and etch
- Metal contact and track etch
- Cu, Ni, Al...
- Noble metals: Au, Pt, Pd...
- Diffraction gratings
- SiO₂ 'blazed' etch
- Spintronics and MRAM
- AR and HR coatings for laser bars
- Telecom filters
- III-V photonics etching
- Thin film magnetic hard drive heads (TFMH)
- Ring laser gyroscope mirrors



CCTV



Fibre optic cable



Thin film magnetic heads



Night vision and security equipment

Ionfab[®]300Plus

Ionfab300Plus is a modular System designed for ion beam etching and deposition. It is used in a wide variety of processes, particularly in the Semiconductor and Optical Coating Industries

Flexibility in a single tool

- Handles from small pieces, through 100 mm (4 inch), up to 200 mm (8 inch) wafers
- Wafer handling options
 - Manual loading for one-off trials
 - Load-lock for faster trials, increased throughput and improved particulate control
 - Cassette-to-cassette loading/unloading for batch production
 - Clusterable with other process tools including Oxford Instruments' **Plasmalab[®]** plasma etch, deposition and sputtering tools, and **FlexAL[®]** atomic layer deposition (ALD) tools
- Simple upgrade options to add an etch or deposition source

Leading ion source and grid set technology

- Grids are designed to suit specific applications: high uniformity, high rate and/or low energy
- Specific deposition grid sets to suit multiple targets, offer superior utilisation of target material with minimisation of contamination

Easy to site, use and maintain

- Through-wall interface options allow the system to be sited in "grey area"
- Ease of access to process chamber via doors at either end
- Ease of maintenance with door-mounted ion sources
- Compact footprint reduces cleanroom space required



Optofab[®]3000



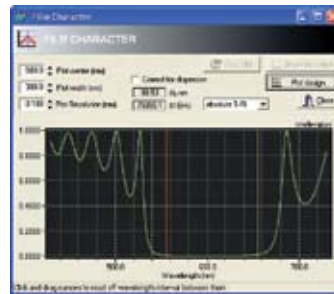
Specifically developed for high quality optical applications, including High Reflective and Anti Reflective Coatings

High speed specimen holder with uniformity shield



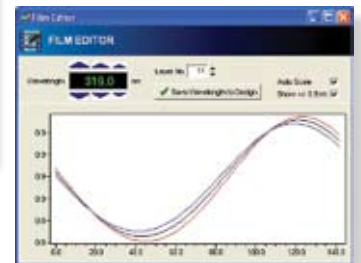
Optofab3000 is based on the proven architecture of the **Ionfab300Plus** – offering the same features and benefits as the **Ionfab300Plus** but with added capabilities.

- The high speed 8" specimen holder fitted to the system, delivers uniformity of $< \pm 1\%$, and very good layer to layer repeatability. The option to use uniformity shields is available with this system, offering further improvements in layer uniformity.
- A high deposition rate is achievable through the use of the 15cm ion source, with a tailor made dished molybdenum 3 grid design. In addition excellent refractive index control may be achieved with the use of an assist source.
- The option to use a white light optical monitor is available with the **Optofab3000** patented specimen holder. This is essential in ensuring that each layer is applied at the correct thickness, thereby achieving the specified optical characteristics of narrow band filters, for example.



Simulation of a high performance optical filter by an integrated software package

In-situ monitoring of optical coating deposition by an integrated software package



Multi-layer optical coating design by an integrated software package

A screenshot of a software interface displaying a table with multiple columns and rows of data, likely representing the parameters of a multi-layer optical coating design.

BEAM

Process and materials capability

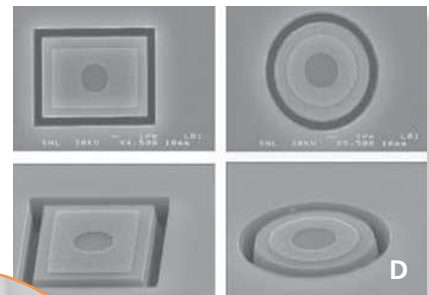
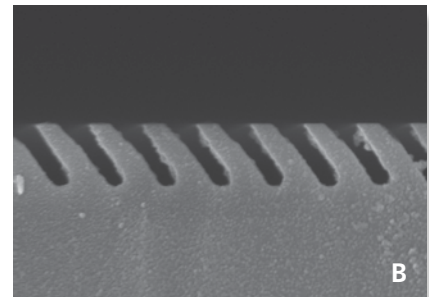
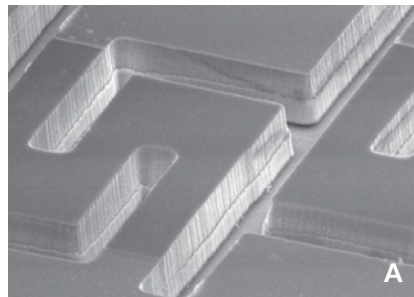
Ionfab300Plus and Optofab3000

Etch and deposition in one tool via single or dual-beam technology

- 15cm and 35cm source options available
- Dual beam configurations (etch plus deposition source) offer the possibility to add capping layers immediately after etch, without exposing the process chamber or wafer to atmosphere
- Increased deposition rates or improved material properties by using etch source as a plasma radical or assist source (IASD or RIBD)
- Deposit different material layers without breaking vacuum
- 4", 6" and 8" target sizes available

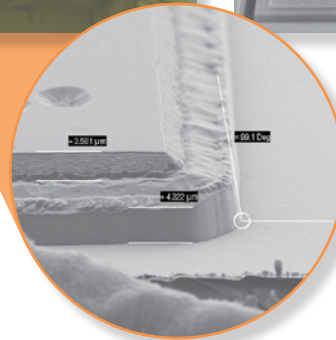


Interior of the **Ionfab300Plus**



Vacuum options to suit process

- Turbo-pump fitted as standard
- Cryo-pump option for moisture-sensitive applications
- Additional water vapour cryo trap option



A. CdHgTe (CMT) etch for infrared detector applications

B. 'Blazed' quartz etch for diffraction grating

C. LiNbO₃ etch

D. RIBE of GaAs and AlGaAs.
Courtesy of Chalmers University, Sweden

Process control

Ionfab300Plus and Optofab3000



Flexibility in a single tool

- Tiltable substrate holder can be angled from -90° (load position) up to +65° (depending upon configuration)
 - Enables 'blazed' gratings
 - Allows sidewalls to be cleaned off or etched
- Allows excellent control of deposition uniformity
- Allows directional deposition for step coverage

Platen rotation speed

- Standard and high speed platen options

Substrate cooling

- Prevents degradation of substrate and devices structures/other materials already in place
- Option for wafer backside cooling with He (turbo-pump) or Ar (cryo-pump)

Process monitoring

- Etch endpoint monitoring by SIMS for multi-material applications
- Deposition process monitoring
 - Crystal monitor (single or dual head)
 - White Light Optical Monitor (WLOM)
- Chamber gas identification, partial pressure control and leak checking via RGA

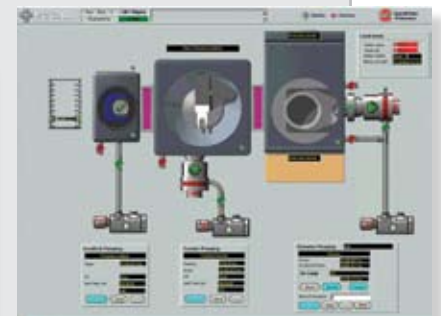
Process tool software

The intuitive, user-friendly **PC3000™** graphical interface and control software for the **Ionfab300Plus** offers:

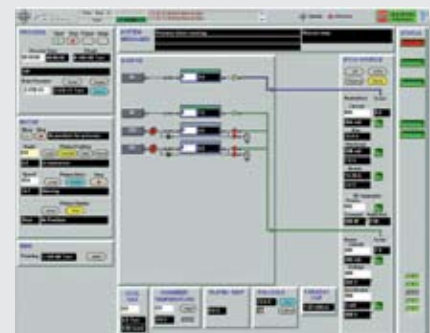
- Fast user learning
- Full process recipe editing
- Real-time visibility of process data including SIMS endpointing
- Automatic process and system data logging during runs
- Multi-level password-controlled user access for safe and secure operation



The **PC3000** graphical interface showing chamber and load lock status



Screen shot of system including cassette loading & robotic handling



The process page provides complete control and visibility of the process being run

Specialist high-precision ion beam deposition system

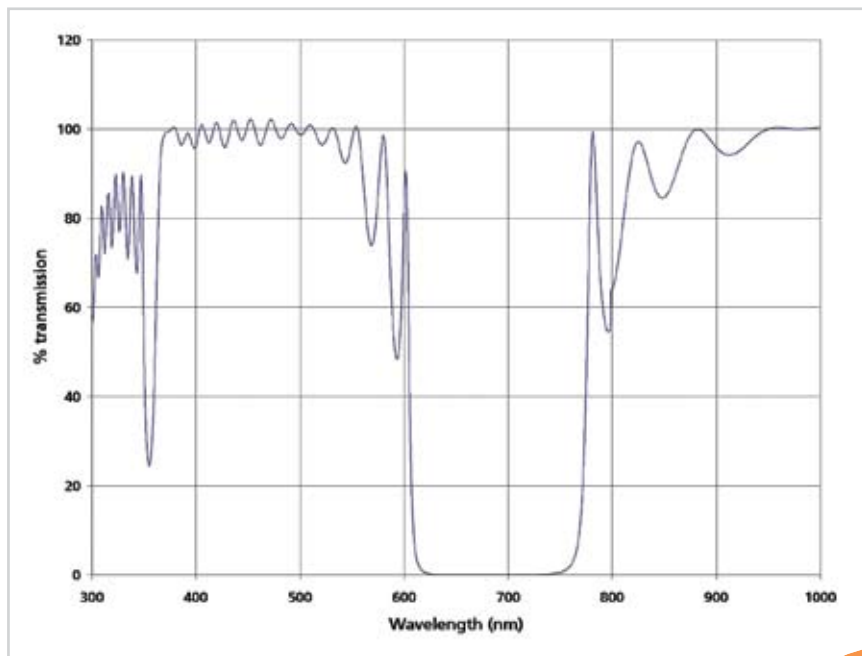
Ionfab[®]500Plus: Designed for ultra high quality optical thin films

The **Ionfab**500Plus was first supplied in 1983 and was the world's first commercial ion beam sputter deposition system for ring laser gyroscope manufacture. In recent years customers have demonstrated mirrors exhibiting < 20ppm on a commercially available system using the **Ionfab**500Plus.

The **Ionfab**500Plus has been developed for the requirements of customers demanding high throughput. This is delivered by

the use of the 4 x 10" planetary substrates and the ability to use 14" targets.

Another key benefit to customers requiring high throughput is the use of up to 3 targets, meaning that different material layers may be deposited without breaking vacuum.



Transmission spectrum of a mirror designed for 633 nm at 45°, deposited in the **Ionfab**500Plus, showing:

- Mirror loss < 40 ppm
- Uniformity < ± 0.0005
- Surface Roughness < 0.11 nm

Excellent refractive index (RI) control and uniformity provides high product yield



Low loss mirrors produced by Ion Beam sputter deposition are incorporated into this inertia sensor assembly which incorporates three ring laser gyroscopes. Image courtesy of Marconi Electric Systems

Designed for ultra high quality optical thin films!

ION BEAM

For further information about Ion Beam, please contact your local Oxford Instruments office

Worldwide Service and Support

Oxford Instruments is committed to supporting our customers' success. We recognise that this requires world class products complemented by world class support. Our global service force is backed by regional offices, offering rapid support wherever you are in the world.

We can provide:

- Tailored service agreements to meet your needs
- Comprehensive range of structured training courses
- Immediate access to genuine spare parts and accessories
- System upgrades and refurbishments



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