The FDG range of hot filament ion sources, are the premium product when you need to: clean metals and semiconductors\(^1\)-\(^4\)) or undertake XPS Depth Profiling, ISS/LEIS experiments or as a <15eV Charge Neutralization source.

All variants operate as standard with Argon gas but other noble gases, Hydrogen or Oxygen are also fully compatible.

Both ion sources are made of completely non-magnetic materials and are compatible with high-resolution electron spectroscopy.

An ultra clean ion beam is ensured by an indirect filament, a direct gas inlet for minimizing dead volume and effective differential pumping.

The power supply can be fully controlled with the front panel or via a TCP/IP interface. ProIon, an easy to use LabVIEW™ – based PC software is provided.
FDG 15
VARIABLE FOCUS ION SOURCE

- Differential pumping
- Non line-of-sight filament
- Integrated port aligner
- 30 - 300 mm working distance
- Variable spot size
- Down to 10 eV kinetic energy (optional)

A dedicated ion focusing optics allows to reduce the spot size down to 300 µm @ 50 mm working distance for sputtering of small crystals and to adapt for large working distances up to 300 mm. Alternatively a broad spot profile can be chosen for homogeneous large area sputtering.

The optional low energy mode provides a comparable large ion current of > 1 µA @ 50 eV.

It has been found that ion sputtering at low energies of semiconductors close to the threshold energy is critical to minimise ion implantation and surface damage\(^1\)-\(^4\).

Lower energy ion sputtering, at 50 eV, has been shown to even maintain the sample magnetisation during XPS depth profiling\(^5\).

The source can be operated with or without differential pumping. The latter provides improved residual gas pressure of typ. 10\(^{-8}\) mbar.
FDG 150
FINE FOCUS SCANNING ION SOURCE

- Spot size 150 µm @ 50 mm working distance.
- Scanning up to 10 mm x 10 mm
- Keystone correction
- XPS Depth Profiling
- Down to 10 eV kinetic energy

The FDG 150 provides all features of the FDG 15 and in addition dedicated depth profiling with a rasterized small spot down to less than 150 µm @ 50 mm working distance for XPS and Auger spectroscopy, charge neutralization for ESCA applications and sensor cleaning in scanning probe microscopy.

**a)** Image of the argon ion spot scanned across a 50 µm aperture.

**b)** Cross section along the red line of a) showing a minimum spot size @ 5 keV and 1.6 µA. Apt. corrected real width: (76.4±0.4)µm

**c)** Illustration of keystone correction:
In order to achieve a homogeneous sputter rate across the sputtered sample area any tilt φ or rotation θ, between ion source and sample, can be compensated to maintain an undistorted raster field.

**d)** XPS depth profiling through a 100 nm SiO2 layer on Si (001): The cross-over position of the Oxygen peak (O1s) and Silicon peak (Si2p) intensities indicates the thickness of the oxide layer. The FDG 150’s small spot size of 150 µm and the Keystone correction are essential to achieve high precision in depth resolution. To shorten measurement time both features allow to adjust the sputter area with the Energy Analyser’s field of view as well as the x-ray source spot size.
Specifications | FDG 15 & power supply | FDG 150 & power supply
---|---|---
Mounting flange | DN 40 CF |  
Working Distance (WD) | 30 to 300 mm |  
Min. beam diameter (D) | < 300 μm (@ 5 keV and 50 mm WD) | < 150 μm (@ 5 keV and 50 mm WD)  
Beam energy 1 | 500 eV to 5 keV |  
Beam energy 2 | optional | 10 eV to 500 eV; > 1 μA @ 50 eV  
Beam current density | > 4 mA/cm² with > 5 μA, D < 350 μm (@ 5 keV and 50 mm WD) | > 4 mA/cm² with > 5 μA, D < 200 μm (@ 5 keV and 50 mm WD)  
Scan area | not available | up to 10 mm x 10 mm (@ 5 keV and 50 mm WD)  
Beam current regulation | ✓ | ✓  
Integrated Port Aligner | ✓ | ✓  
Current measurement | ✓ | ✓  
TCP/IP Interface | ✓ | ✓  
LabVIEW based software | ✓ | ✓  
Fully non-magnetic | ✓ | ✓  
Yttria coated tungsten filament (compatible with O2) | ✓ | ✓  
Tungsten filament (compatible with H2) | optional | optional  
Leak Valve | optional |  

*Differential pumping improves the beam purity and saves significant time during outgasing and when changing gas flow to different values. Alternatively to full differential pumping a passive by-pass to main chamber with gate valve is recommended.


2) Dongwan Seo et al. „Behavior of GaSb (100) and InSb (100) surfaces in the presence of H2O2 in acidic and basic cleaning solutions”, doi.org/10.1016/j.apsusc.2016.12.114


5) B. J. McMorran et al., Measuring the effects of low energy ion milling on the magnetization of Co/ Pd multilayers using scanning electron microscopy with polarization analysis. Appl. Phys. 107, 09D305 (2010); https://doi.org/10.1063/1.3358218