COMPONENTS FOR SURFACE ANALYSIS

Ion Source IQE 12/38

- Fine focus and scanable ion source
- Differentially pumped
- Small spot size
- Large scan area

Applications

- Sample cleaning
- Depth profiling
- ISS/LEIS
- SIMS

SPECS®

Features

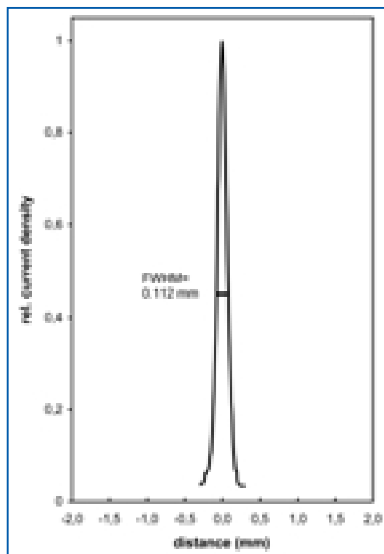
The IQE 12/38 is an extractor type ion source, mounted on a rotatable DN38CF (2 3/4" O.D.) flange.
At its standard flange-to-sample distance of 186 mm, which corresponds to a working distance of 23 mm, it generates a beam current up to 0.8 µA at a spot size of 125 µm.
The two lens system of the source allows easy changing of the spot size, which is continuously variable from 125 µm to 1000 µm. For a spot size of 800 µm the ion current is up to 8 µA. The corresponding current density is 1-4 mA/cm^2 depending on the spot size.
This performance data has been proven in the field and can be considered as conservative. Operation of the IQE 12/38 at larger flange-to-sample distances (with a correspondingly larger exit aperture-to-sample distance) still provides satisfactory performance.
It can be operated over a primary energy range of 0.2 to 5 keV. Because of its very slim outline and a housing cone angle of 50° it is ideally suitable for tight environments.
The filament is non-line-of-sight to the sample, thereby minimizing contamination from the source. It is field replacable with non-critical alignment and long lifetime which makes the source serviceable by the user and hence economical.

Due to this special cathode type (Y_2O_3 coated Ir filament) the operation temperature of the ionizer is considerably lower than for other sources, hence reducing ion beam contamination. Additionally the cathode allows therefore operation with reactive gases like O_2, H_2 and hydrocarbons. Argon is normally used as the operating gas, while Oxygen for example is used for shallow implantation studies and SIMS applications, giving enhanced sensitivity.
The scanned area is 10 x 10 mm^2 at the standard working distance of 23 mm. Over this area the sputter crater is extremely flat. This results in precise depth profiles with maximum depth resolution.
There are two ports for differential pumping. Usually the first differential pumping stage is linked with the pumping line of the second differential stage via a valve acting as a throttle. The second differential stage is connected to a UHV pumping system. This way the pressure in the analysis chamber can be maintained in the 10^{-8} mbar range while the source is operating at the specified maximum beam current .
The source can be supplied complete with an UHV gas inlet with leak valve and a differential pumping system. As an option an additional Wien Mass Filter can be retrofitted to the source.

Further details at **www.specs.de**

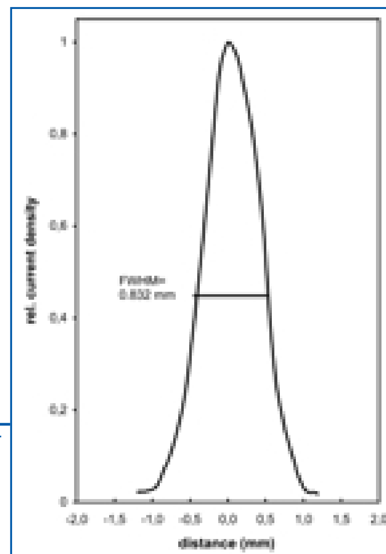
Beam Profile

Fine Focus Mode



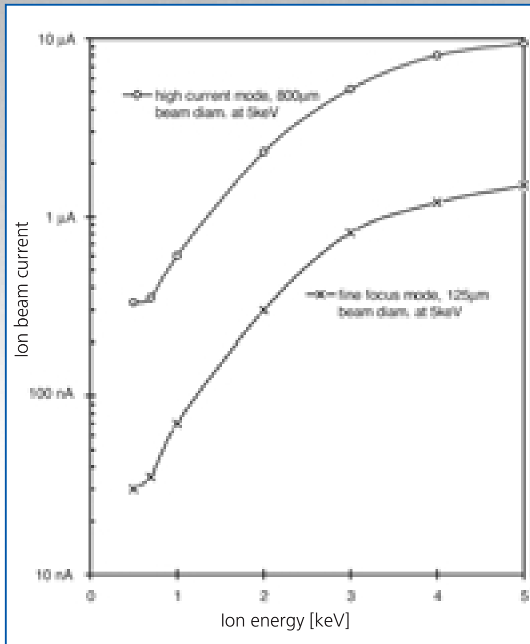
Operation Conditions
gas/pressure: Ar/ 9.8 x 10^{-7} mbar
working distance: 23 mm
emission current: 10 mA
energy: 5 keV
total sample current: 1.006 µA

High Current Mode



Operation Conditions
gas/pressure: Ar/ 4.0 x 10^{-7} mbar
working distance: 23 mm
emission current: 10 mA
energy: 5 keV
total sample current: 9.2 µA

Performance



Sputter Rate

The fine focus mode is commonly used for XPS and AES depth profiling. A typical set of parameters for this application is 1 µA ion current, 150 µm beam diameter and 5 keV ion energy with Argon as the process gas. For a Ag surface this gives a sputter rate of about 50 Monolayer/s.

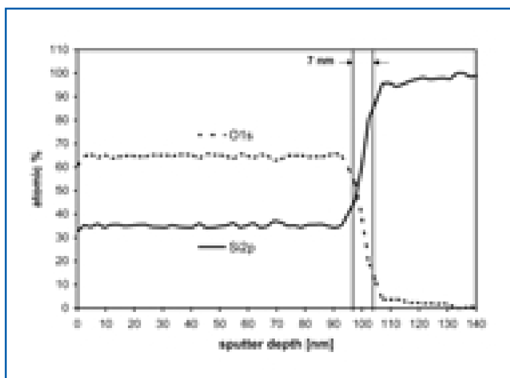
If the beam is scanned over an area of 10 x 10 mm^2 the resulting sputter velocity is reduced by a factor of about 10^4.

Performance Curve
Ar^+-ion beam current at various energies and constant beam diameters (FWHM)

Applications

Depth Profiling

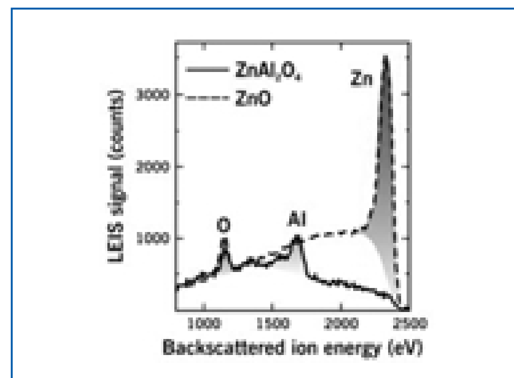
Example: 100 nm SiO_2 layer on Si wafer;
(standard sample for depth calibration)



Elementary layer compositions and depth profiles measured with XPS with the SPECS compact ESCA system SAGE 150.
Shown is the atomic concentration for Silicon and Oxygen elements calculated from the XPS intensity of the Si 2p and the O 1s element lines.
The interface between the SiO_2 layer and the Si wafer substrate is visible as a sharp edge. With a width of 7 nm (20 % to 80 %).

LEIS/ISS

Example: Revealing the catalytically active site in a Spinel Oxide Powder $ZnAl_2O_3$



Spinel surfaces can widely be found in heterogeneous catalysis. Spinels have the general formula AB_2O_4, where in a normal spinel the A atoms are tetrahedrally coordinated, while the B atoms are octahedrally coordinated. LEIS measurements revealed that only the B cations were exposed to the surface which correlated directly to the catalytic activity.
With kind permisson of :
Calipso · LEIS Expertise Center · **www. calipso.nl**

S P   C S®

Large working distance:
23 mm to 100 mm
Small cone angle of 50¡:
fits almost everywhere
DN38CF (2 3/4Ò OD)
rotatable
base flange

ISO 9001 Certificate