Defined Area XPS with the PHOIBOS Analyzer using an Iris Aperture

Application Notes

In many applications photoelectrons emitted by the sample holder can lead to incorrect results. To suppress these photoelectrons, the PHOIBOS analyzer has a variable iris aperture at the front of the lens. By closing the iris photoelectrons from the surrounding can be eliminated (see Fig. 1).

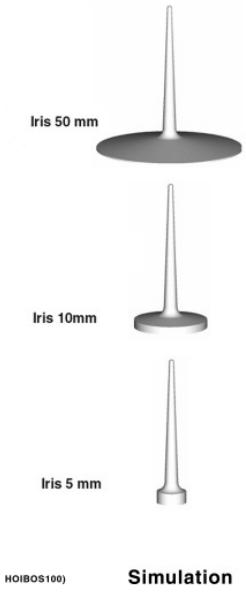

Fig. 1: Simulation of intensity-position function

The intensity-position function for such an analyzer is in general a Gaussian function but with superimposed higher intensities in the tail regions. By the use of the iris aperture these intensities can be suppressed. The low tail intensity forms a disc where the integrated intensity can reach the same order of magnitude like the intensity of the peak itself. By using the iris aperture, the "tail" intensities will primarily be suppressed.

The optimum settings for the iris aperture depend on the slit size and the desired quality of the analysis area.

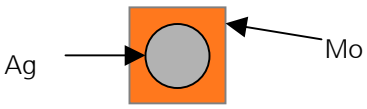

Fig. 2: Sample covered by molybdenum aperture

To demonstrate the effect of the iris aperture a polycristalline silver sample (12mm × 15mm) was covered by a molybdenum plate with 10 mm hole in it. This would represent a sample in its holder. This sample was irradiated by X-ray source (Mg Kα, 300W). The emission angle was 0°. Photoemission spectra of the Ag $3d_{5/2}$ and Mo $3d_{5/2}$ region were recorded at different iris openings.

Resolution (eV)	0.85	0.90	1.00	1.40
Ag $3d_{5/2}$ (kcps)	960	1460	3100	7000
Mo $3d_{5/2}$ (kcps)	12	16	37	105

Tab. 1: Iris setting 20 mm, intensity of Mo always < 3%

Resolution (eV)	0.85	0.90	1.00	1.40
Ag $3d_{5/2}$ (kcps)	800	1230	2560	5840
Mo $3d_{5/2}$ (kcps)	<1	<1	2	3

Tab. 2: Iris setting 15 mm, intensity of Mo always < 0.3%

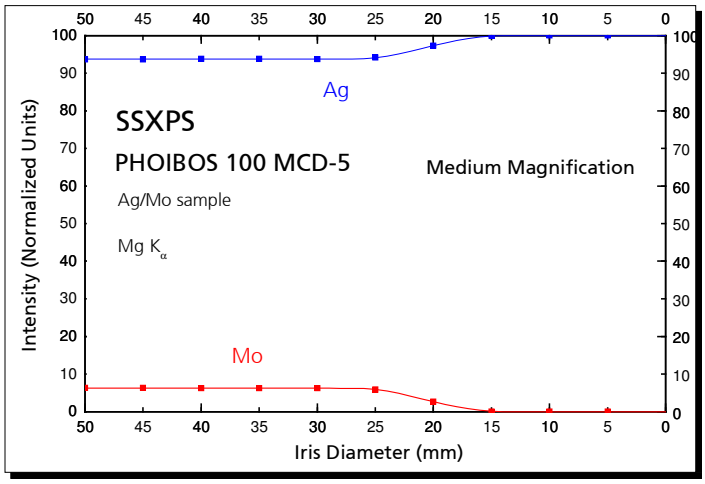

Fig. 3: Ag and Mo intensities (weighted with sensitivity) versus Iris setting

By closing the Iris aperture to diameters in the acceptance angle region of the lens mode (<20 mm, see table), one can use the Iris aperture to limit the acceptance angle as well. The angular acceptance of the Magnification Modes can be continuously adjusted between ±1° and ±6° while keeping the acceptance area on the sample nearly constant.

Acceptance Angle	Iris ∅ (HM)	Iris ∅ (MM)	Iris ∅ (LM)
±1°	3 mm	3 mm	4 mm
±2°	6 mm	6 mm	8 mm
±3°	9 mm	9 mm	12 mm
±4°	12 mm	12 mm	
±5°	15 mm	15 mm	
±6°	18 mm		

SPECS GmbH
Surface Analysis
and Computer Technology
Voltastrasse 5
13355 Berlin
Germany

Phone: +49 30 467824-0
Fax: +49 30 4642083
E-mail: support@specs.de
http://www.specs.de

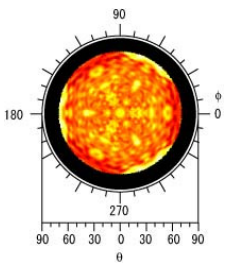

Fig. 4: Spectrum of Si 2*s* excited by Mg K_α using a PHOIBOS 150 MCD-9 analyzer. The angular resolution was set with the Iris to 1° (data with courtesy of T. Matsushita, A. Agui and A. Yoshigoe, Spring-8, Japan)