XPS Imaging on a MRS-3 test sample

Technical Note

XPS imaging is a powerful analytic tool because it enables specific information on both elements and bonding to be recorded on a two-dimensional distribution map. In this technical note we describe an imaging XPS technique we called SlabImaging. It will be applicable to any kind of specimen that can be analyzed in a conventional XPS system. It makes use of the dispersion properties of a hemispherical analyzer and applies a two-dimensional electron detection device for decoding the energy and emission position of an analyzed photoelectron (Delay-Line or CCD Detector).

Using the PHOIBOS analyzer with the SlabMode the lens operated to give a spectromicroscopic image in one slab of the sample, with the lateral information along one axis and energy distribution along the other on the 2-D detector. This method allows fast parallel acquisitions, in contrast to small spot XPS, where the lateral resolution originates from a focused spot light source that is scanned across the sample. A second advantage is that the charge compensation operates in a global context.

The chemical distribution over an extended area is determined by moving the manipulator position in the direction across the slit. The single slabs will be stitched together forming the image. To diminish aberration errors in the imaging mode and get maximum spatial resolution, the lens acceptance angle is reduced by the Iris aperture.

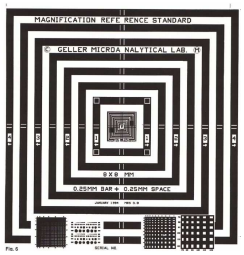


Figure 1: MRS-3 test sample. The pattern is ITO on anti reflective chromium (30nm of CrO_2 over 70nm of Cr) over quartz.

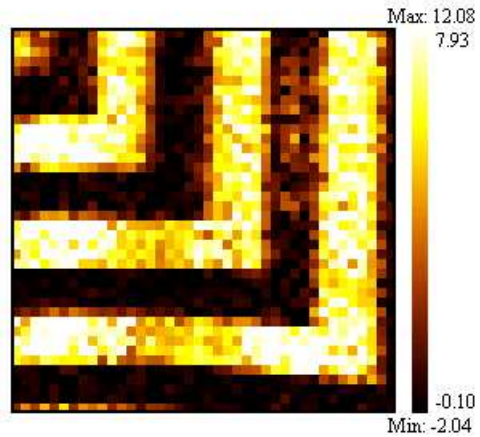


Figure 2: 2x2 mm² Image of the MRS-3 test sample. The intensity of the In 3d5/2 peak is plotted in two lateral directions. The image intensities of the delay line detector in the non energy direction are splited into 40 channels forming one slab of the image. 40 slabs are acquired in 45 min using a automatic stepper control with step widths of 50 mm. The acquisition setting were HM2 lens mode (M=10) with 0.5x20 mm slit size, 5 mm Iris aperture and 165 eV pass energy.

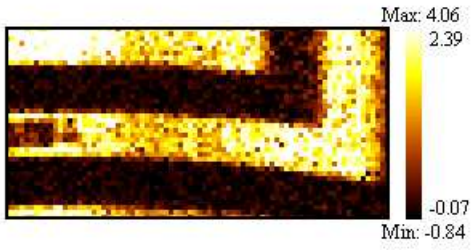
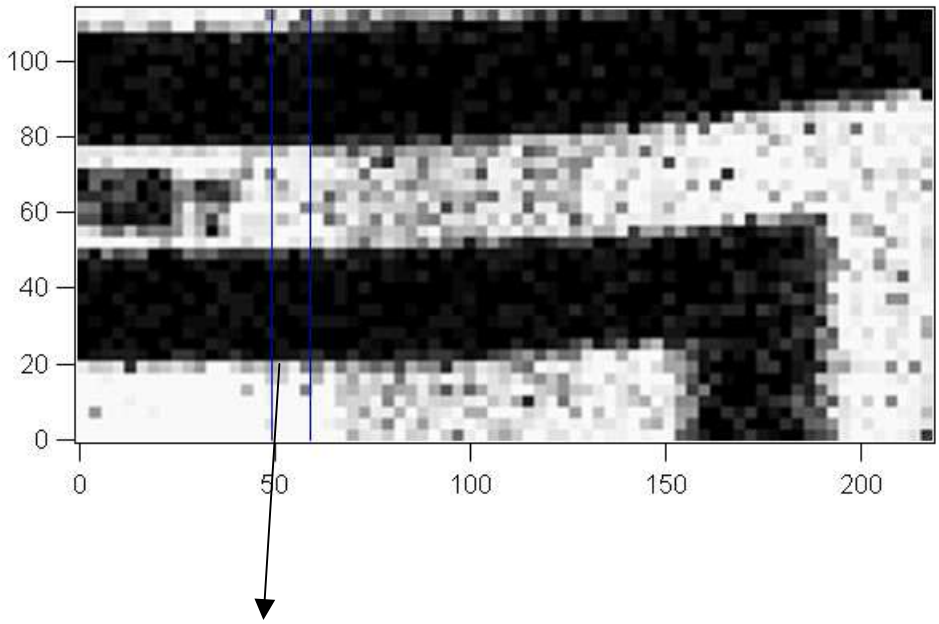


Figure 4: 1x2 mm^2 Image of the MRS-3 test sample. The intensity of the In $3d_{5/2}$ peak is plotted in two lateral directions. The image intensities of the delay line detector in the non energy direction are splited into 80 channels forming one slab of the image. 40 slabs are acquired in 90 min using a automatic stepper control with step widths of 25 mm. The acquisition setting were HM2 lens mode (M=10) with 0.2x20 mm slit size, 5 mm Iris aperture and 165 eV pass energy. The image is curved in one direction. This is due to the used curved slit. It could be calibrated out if necessary.



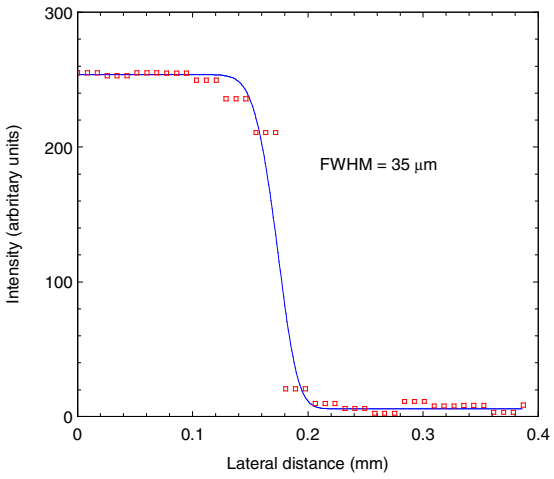


Figure 5: The lateral resolution 12 to 88% is about 35 µm as expected. The estimation of the FWHM is limited by the step width of 25 µm.

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