

# PHOIBOS 225 HV used for Rutherford Electron Backscattering at 15 keV

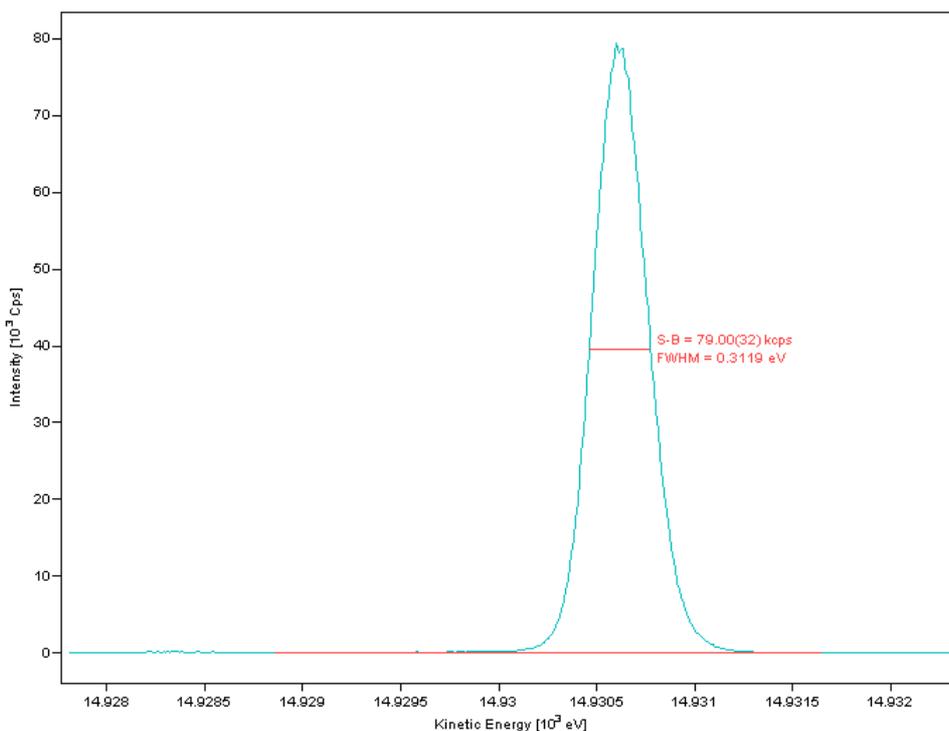
## Technical Notes

The elastic scattering of keV electrons can be used to determine the surface composition of relatively thick layers (up to 100 nm) in a way similar to ion scattering experiments. These electron scattering experiments share much of the underlying physics of electron spectroscopy and ion scattering. For this reason the technique is called electron Rutherford backscattering [1-2].

We present test results with the PHOIBOS 225 HV analyzer and a Kimball Physics electron source EMG-4212 operated at 15 keV. The BaO cathode in the electron source facilitate a low energy spread of the primary beam of 300 meV.

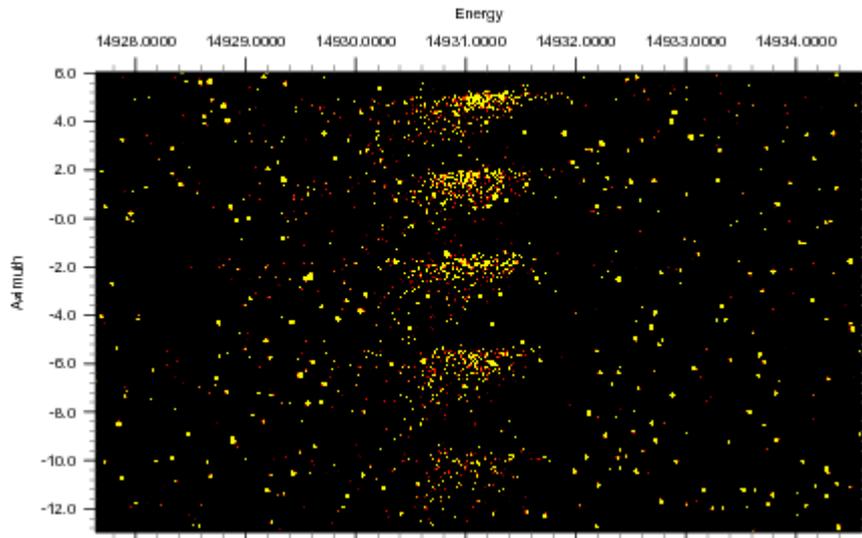
The overall resolution  $\Gamma$  is determined by correcting the measured line width  $\Gamma_M$  against the known thermal broadening from the electron emitter. Considering an electron emitter contribution  $\Gamma_S$  of about 300 meV the overall resolution is  $\Gamma_A = 86$  meV.

$$\Gamma_A = \sqrt{\Gamma_M^2 - \Gamma_S^2} = \sqrt{312^2 - 300^2} \text{ meV} = 86 \text{ meV}$$



Elastic peak measured at 15 keV with a FWHM of 312 meV. The deconvoluted overall energy resolution is 86 meV. This value includes the stability of the electron source power supply, the stability of the analyzer power supply and the energy resolution of the analyzer.

The demonstration of the angular resolution capability at 15 keV can be performed using a slit aperture with slits of 2° spacing. Using the Medium Angular Dispersive Lens Mode (MAD) the angular distribution of the electrons within a range of 8° will be imaged on the detector.



Elastic peak measured at 15 keV and 65 eV pass energy using a slit aperture with slits of 2° spacing before the lens entrance.

This image depicts the angular resolution capability of the PHOIBOS 225 HV analyzer at high energy.

## References

- [1] Electron Rutherford back-scattering case study: oxidation and ion implantation of aluminum foil, M. R. Went and M. Vos, *Surface and Interface Analysis* 39 (2007), 871-876.
- [2] Rutherford backscattering using electrons as projectiles: Underlying principles and possible applications, *Nuclear Instruments and Methods in Physics Research B* 266 (2008), 998-1011.

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