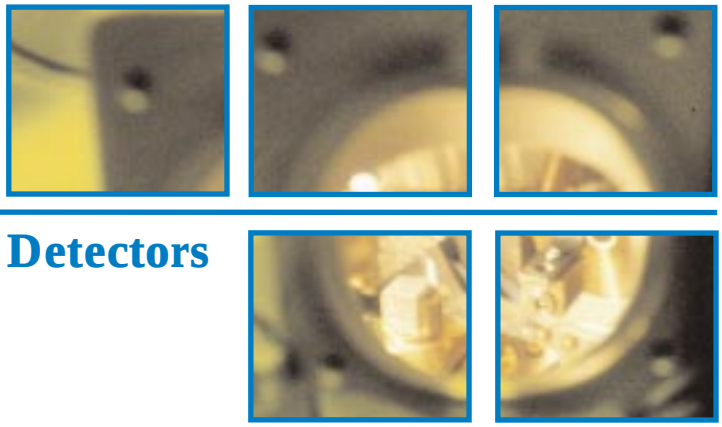
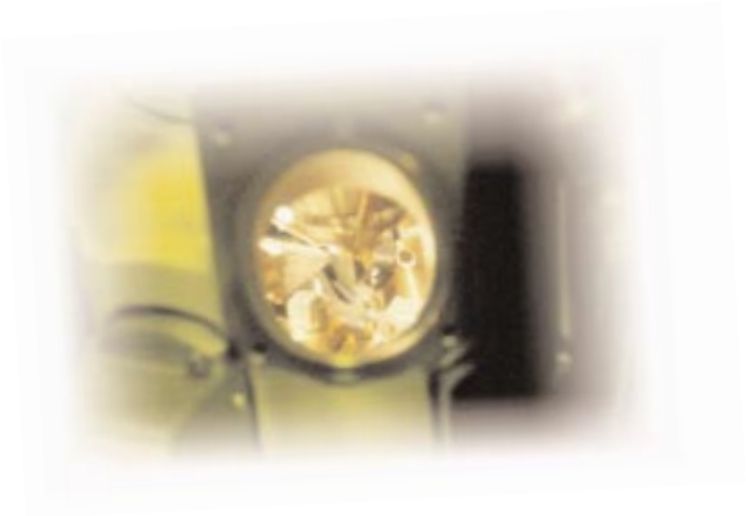


Focusing Polycapillary Optics

Ultra-High-Resolution EDS Detectors



Polycapillary optics make it possible to commercially utilize superconducting ultra-high-resolution EDS detectors.

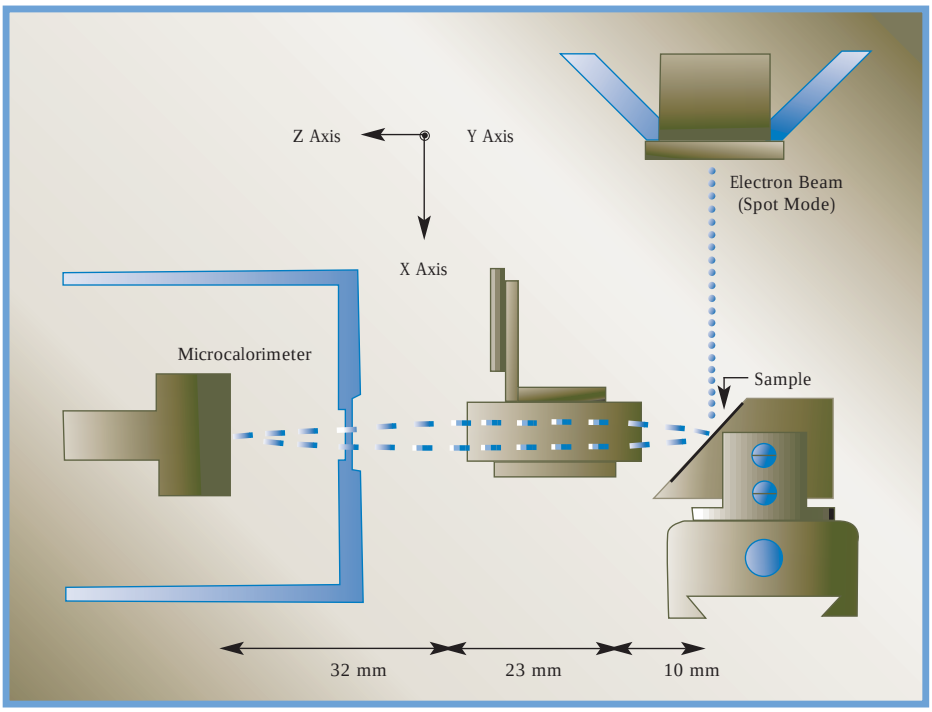


Diagram of a typical setup for Microcalorimeter and polycapillary x-ray optic inside a SEM chamber

Features:

- *Combines high energy resolution of WDS systems with parallel energy detection capabilities of EDS detectors*
- *7.2eV energy resolution @ Mn Kα (5.89 keV) [NIST transition edge sensor]*
- *Increased sensitivity for detection of low Z elements (B,C,N,O; 4eV energy resolution @ 1-1.6keV)*
- *An increase in effective detector area of >100X due to large collecting solid angle of polycapillary optic*

Benefits:

- *Energy resolution >10X compared to current EDS detectors*
- *Resolution of low energy x-ray lines*
- *Chemical state identification and quantification*
- *Small Particle (<0.1 µm) and thin film analysis without excitation of substrate by using low excitation energies*
- *Fast measurement times (no scanning required as in WDS)*

Figure 1:

The x-ray optic collects x-rays emanating from the sample and focuses them onto the detector

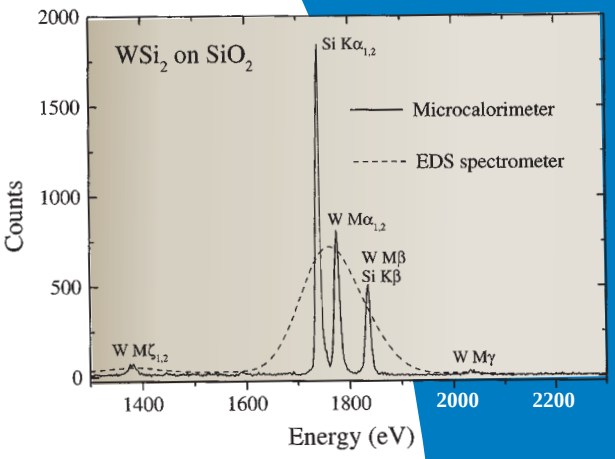
Ref: D.A.WOLLMANN et al., Journal of Microscopy. Vol. 188,196-223, [1997]

Unprecedented composition and chemical state analysis:

Figure 2:

Comparison of spectra obtained from 100 nm WSi_2 thin film on SiO_2 substrate collected with Microcalorimeter and EDS spectrometer

Closely spaced W- and Si- lines are easily resolved by the Microcalorimeter. Lines which are indistinguishable with an EDS spectrometer.

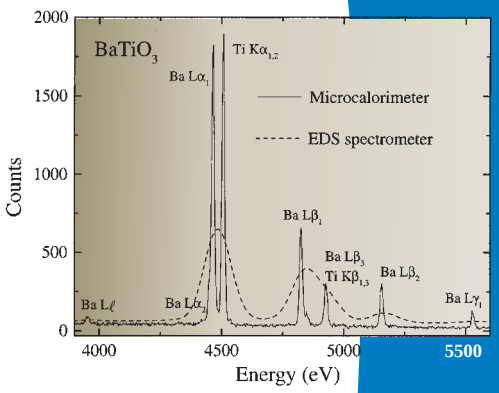


Ref: D.A.WOLLMANN et al., Journal of Microscopy. Vol. 188,196-223, [1997]

Figure 3:

Microcalorimeter and EDS spectra for $BaTiO_3$

A Microcalorimeter spectrum of the technologically important material $BaTiO_3$, compared with an EDS spectra, which again shows the superb energy resolution of the Microcalorimeter which makes it possible to almost completely resolve the Ba Lα and Ti Kα peaks

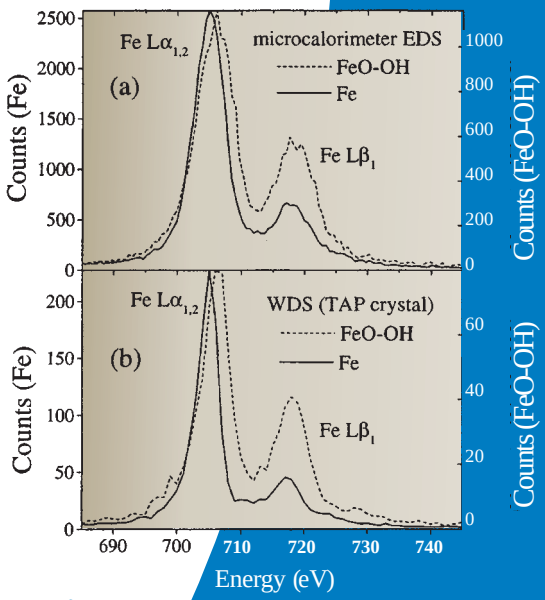


Ref: D.A.WOLLMANN et al., Journal of Microscopy. Vol. 188,196-223, [1997]

Figure 4:

Determination of chemical bonding effects in Fe and FeO-OH due to Fe $L\alpha_{1/2}$ line shifts

The improvement in achievable energy resolution of the Microcalorimeter allows Microcalorimeter EDS measurements of chemical shifts in x-ray spectra. Fig 4 shows a comparison of Microcalorimeter and WDS data.



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