

Focusing Polycapillary Optics

Ultra-High-Resolution EDS Detectors



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

Features:

- Combines high energy resolution of WDS systems with parallel energy detection capabilities of EDS detectors
- 7.2eV energy resolution @ Mn K α (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

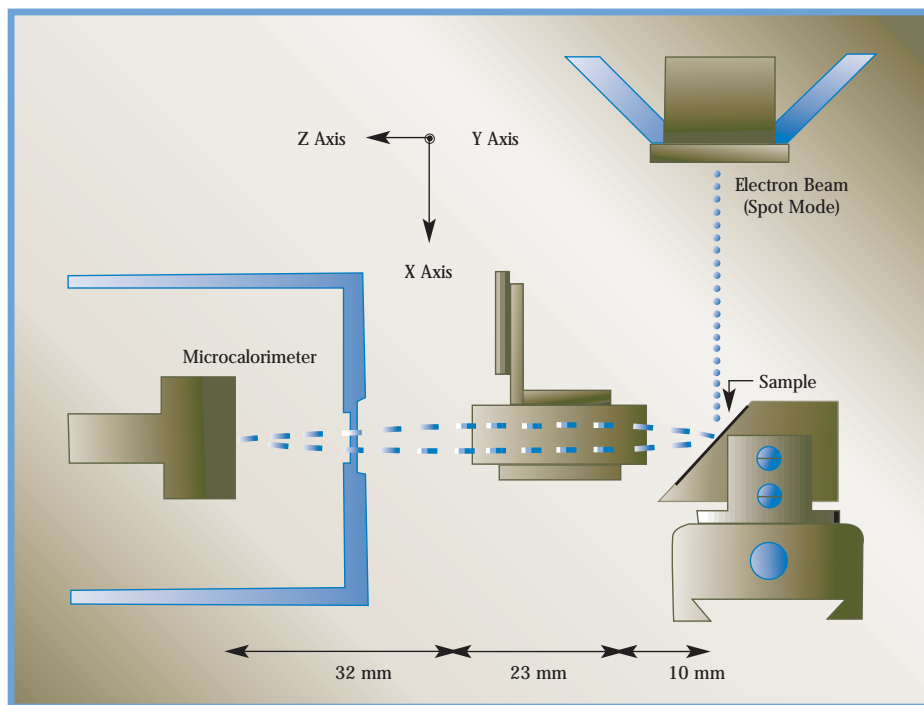


Diagram of a typical setup for Microcalorimeter and polycapillary x-ray optic inside a SEM chamber

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]

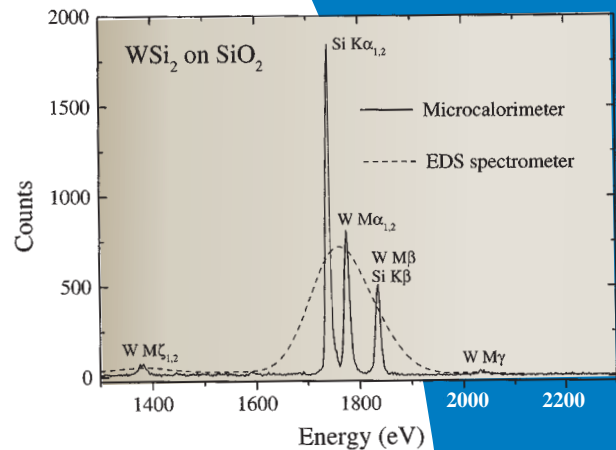


Figure 3:

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 $L\alpha$ and Ti $K\alpha$ peaks

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

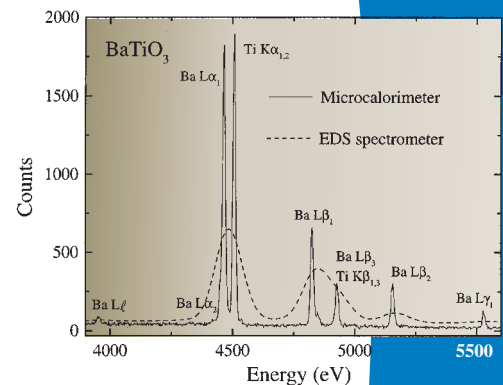
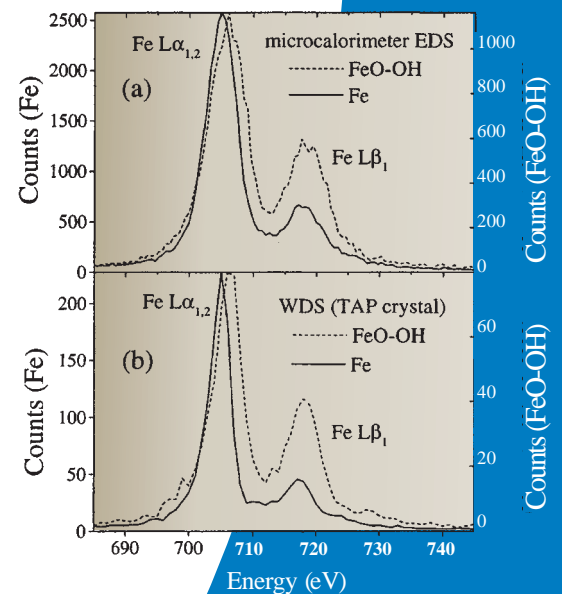


Figure 4:

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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