Micro X-Ray Fluorescence

WITH FOCUSING POLYCAPILLARY OPTICS

Improved Performance with Polycapillary Optics:

A unique state-of-the-art optic design captures a large solid angle from an x-ray source and redirects the beam into a micron-sized focal spot.

FEATURES:

- Point to point focusing of x-rays
- Large capture angle from source
- Orders of magnitude flux gain from micron-sized spot
- Broad spectral bandwidth
- Integration with compact, low-power sources provides flux equivalent to rotating anode sources.

BENEFITS:

- Extremely high flux density
- Increased spatial resolution

Advantages over Electron Probe X-ray Analysis:

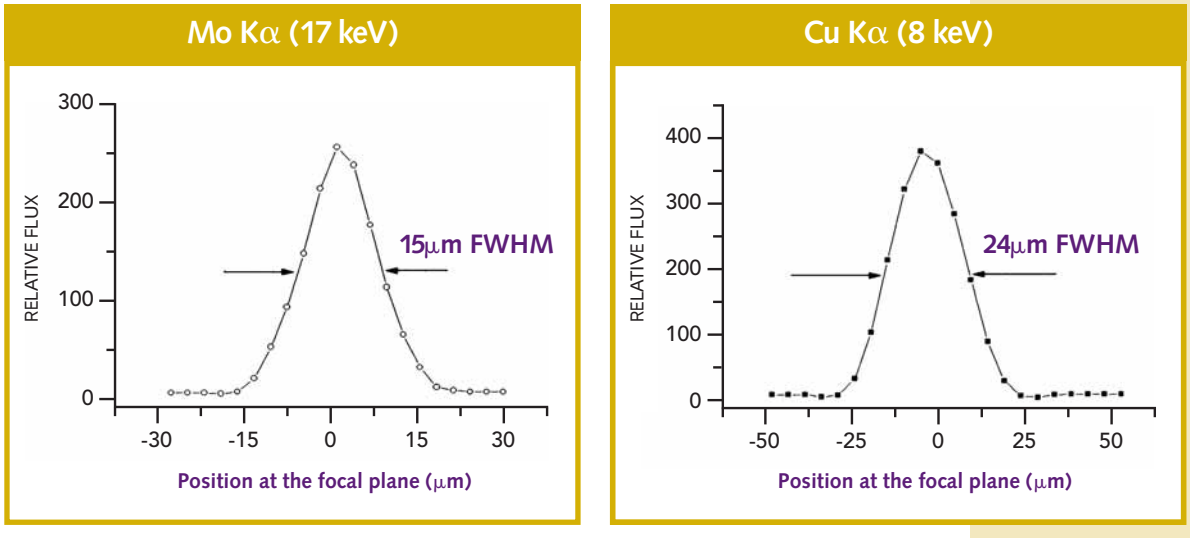
- Higher detection sensitivity
- No special sample preparation needed
- Operation in air

APPLICATIONS:

- Evaluation of small features
- Elemental mapping
- Film/plating thickness
- Detection of micro-contamination
- Multi-layered coatings for advanced circuit boards
- Small particle analysis
- Forensics

FIGURE 1
X-ray spot sizes at the focal plane for Mo Kα and Cu Kα

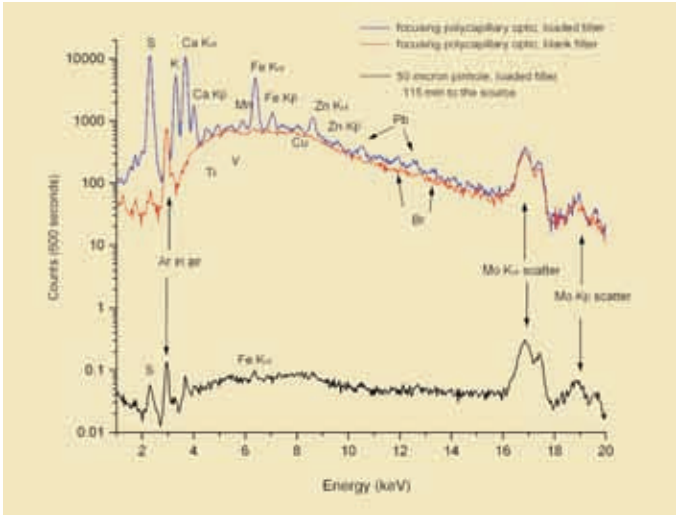
Spot sizes depend on x-ray energy. Small spot sizes range from: ≤20 μm for Mo Kα (17keV) to ≤30 μm for Cu Kα (8keV).



When characterizing small features and doing elemental mapping, focusing polycapillary optics deliver micron-sized focal spots and flux superior to conventional micro XRF. Several orders of magnitude flux gain are possible, depending on the experimental geometry.

FIGURE 2

Comparison of MXRF spectra generated using a focusing polycapillary optic and a pinhole aperture. The spectra were displayed by an air particulate sample ~ 50 μm in diameter. Mo excitation (40kV, 20W)



The polycapillary optic provides a large gain in flux density compared to a 50 μm pinhole. The greatly enhanced detection sensitivity offered by the polycapillary optic enables the compositional characterization of air particulates. The intensity of the pinhole spectrum was scaled from a 2 mm diameter aperture to a diameter equivalent to 50 μm.

FIGURE 3

Spectrum of NIST SRM 1832 standard XRF sample using a polycapillary optic. Mo excitation (40kV, 12W)

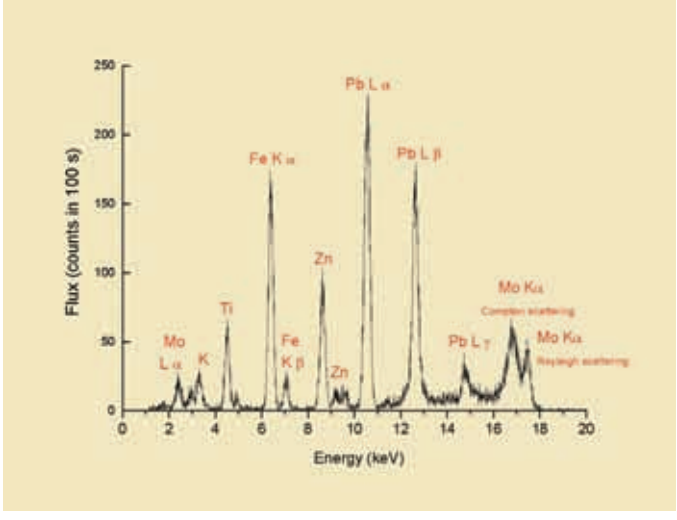


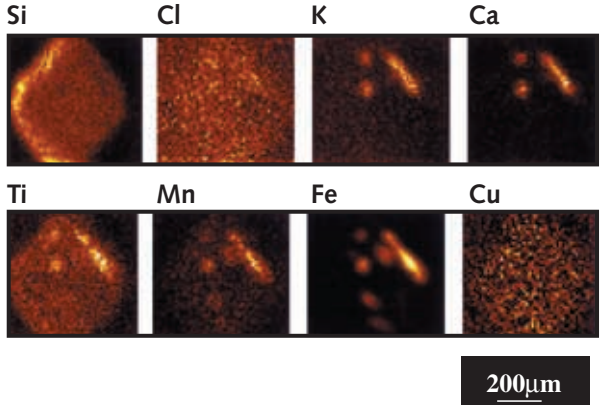
TABLE 1

Picogram detection limits are possible using the polycapillary optic for this thin film SRM sample.

Element	K	Ti	Fe	Zn	Pb
Limit of Detection (pg)	4.1	1.5	0.57	0.28	0.52

FIGURE 4

Elemental mapping of the composition of a volcanic glass reveals the spatial distribution of inclusions within quartz phenocrysts. Mo excitation (40kV, 12W)



Excellent spatial resolution of 40 μm for a wide range of elements was achieved in 14 seconds for each 10 μm step.

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