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Фокусирующая поликапиллярная оптика
Техническое описание

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Polycapillary Optics

FOR MICRO X-RAY FLUORESCENCE AND X-RAY DIFFRACTION

Improved Performance with Polycapillary Optics:

State-of-the-art optic captures a large solid angle from an X-ray source and redirects the beam into a micron-sized focal spot or highly collimated beam.

Features:

- Orders of magnitude flux gain from micron-sized spot
- Integration with compact, low-power sources provides flux equivalent to rotating anode sources
- Broad spectral bandwidth: 50 eV- 50 KeV
- Point-to-point focusing beam
- Point-to-parallel beam
- Custom designed enclosure available

Benefits:

- Extremely high flux density
- Increased spatial resolution
- Ideal for analysis of irregular shaped, unprepared, or low-Z samples

Advantages over Electron Probe X-ray Analysis:

- Enhanced 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
- Powder XRD
- Single crystal XRD

XRF and XRD with Polycapillary Optics

Custom Solutions. In XRF applications, focusing polycapillary optics deliver micron-sized focal spots and beam intensity superior to pinhole based micro XRF. Several orders of magnitude flux gain are possible, depending on the experimental geometry. In diffraction applications, polycapillary optics offer a highly collimated beam. Below are typical examples of polycapillary optics. Customized polycapillary optics based on customer requirements are available to meet specific instrument requirements.

Focusing Optics (µXRF)

OFD (mm)	2	4	9	20	50	100	200
Focal spot size (µm, FWHM, Mo Ka)	8	15	25	45	100	180	300
Intensity gain (vs a pinhole collimatior of same size, 100mm from the source)	6000	3000	2200	1200	400	160	70

Note:
1. The above performance parameters relate to 50 µm X-ray source.
2. The IFD of the optic is 20mm.

Collimating/Parallel-beam Optics (XRD/WDS)

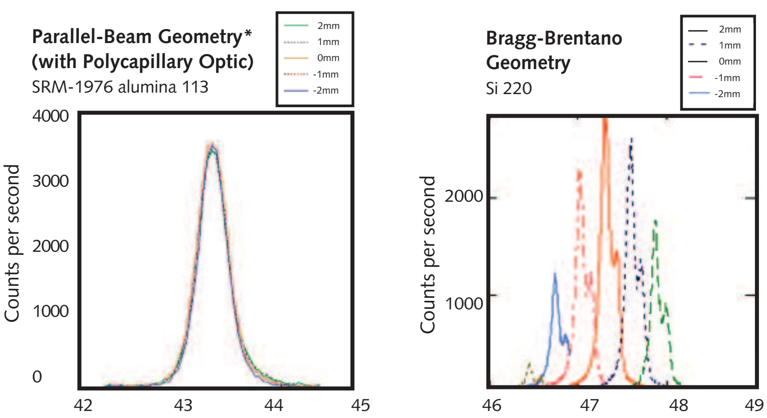
Output beam diameter (mm)	0.5	1	2	3	4	6	10	15
Intensity gain	12	45	130	250	370	470	680	850

Note:
1. The above performance parameters are for a 50µm X-ray source at 8keV.
2. The IFD of the optic is 18mm and the output divergent angle is 0.2 degree.
3. Intensity gain determined by comparison to pinhole configuration at same distance from source and has the same beam size and divergent angle.

Slightly-focusing Optics (XRD/XRF)

Output convergent angle (degree)	0.25	0.5	1	2
Intensity gain	25	80	260	820

Note:
* 50µm X-ray source IFD: 18mm OFD: 140mm Energy: 8keV Focal spot size: 0.5mm, FWHM.



*In Parallel-Beam Geometry no peak shifts occur.

Data measured at KRATOS Analytical, Chestnut Ridge, NY

Figure 3 Peak shift as function of sample displacement for parallel-beam geometry and Bragg-Brentano geometry.

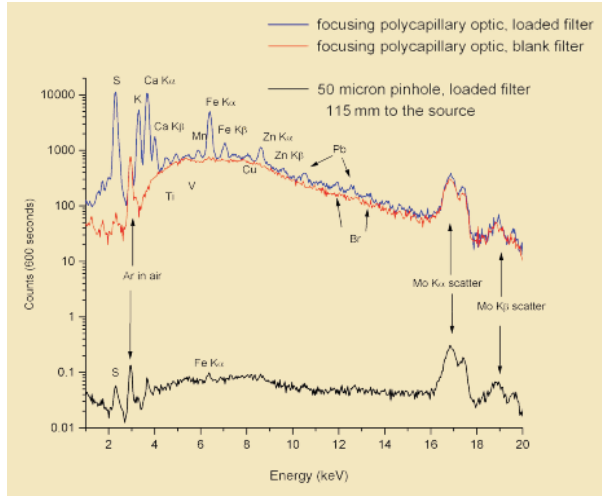


Figure 1
Comparison of µXRF spectra generated using a focusing polycapillary optic and a pinhole aperture. The spectra shown is of an air particulate sample ~ 50µ in diameter. Mo excitation (40kV, 20W).

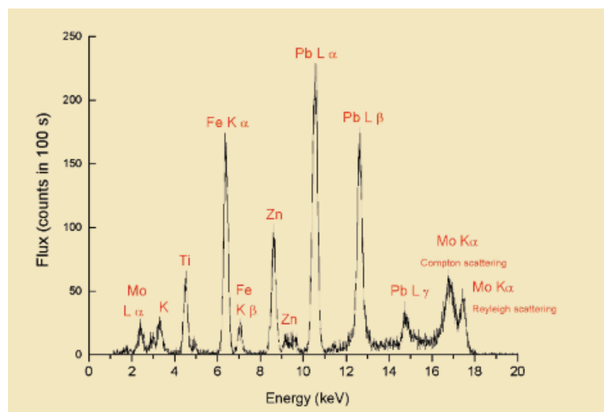


Figure 2
Spectrum of NIST SRM 1832 standard XRF sample using a polycapillary optic. Mo excitation (40kV, 12W).

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

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