Poster Presentations

[MS21-P01] Beam Conditioning in Cutting Edge X-ray Analytical Equipment.

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Nowadays, X-ray optical components, such as multilayer mirrors or scatterless apertures, are used as beam conditioning devices in nearly all state-of-the-art X-ray analytical equipment. Scatterless apertures, such as scatterfree pinholes, are usually made of oriented single crystals, and enable a beam conditioning that is free of parasitic scattering commonly associated with conventional metal apertures.[1,2] Therefore, such pinholes allow a significant improvement of small angle scattering instruments as the number of necessary pinholes can be reduced while simultaneously enlarging the beam defining pinhole size. This leads to an increased flux on the sample. Further, the use of scatterfree pinholes enables a significant reduction of the background. This improves the data quality at low resolution which is beneficial for small angle scattering, as well as for protein crystallography. Multilayer X-ray mirrors are widely used as monochromators and beam shaping devices in protein and small molecule crystallography, as well as in powder diffraction and small angle scattering.[3] Beam shaping with multilayer mirrors includes the optimization of the flux on the sample and the control over the beam shape and divergence. The mirrors comprise multilayer coatings that are deposited with a precision within ± 1% of the d spacing by physical vapor deposition techniques.[4] Very low shape errors below 100 nm and figure errors below 2 arcsec are required to ensure a superb flux density of more than 4 x 1011 phts/s/mm2 when combining multilayer mirrors with high-brightness microfocus X-ray sources, such as the novel liquid metal jet X-ray source.[5, 6]

In this contribution, we will give an overview of current developments in multilayer optics and scatterless beam components, and show their benefit in combination with high-brightness microfocus X-ray sources for typical applications in small angle scattering and single crystal diffraction.

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