Poster Presentation

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Multilayer optics and scatterless apertures for high-brilliance X-ray sources

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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, either in the home lab or at synchrotron beamlines.

Scatterless apertures, such as scatterfree pinholes, are usually made of oriented single crystals, such as Ge or Ta, and show a significant reduction of parasitic scattering commonly associated with conventional metal apertures. Therefore, such pinholes allow an improvement of X-ray analytical instruments as the number of necessary pinholes can be reduced. 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 crystallography applications. Our SCATEX pinholes are either made of Germanium for energies below 11.2 keV or of Tantalum for energies above 11.2 keV and are available with diameters ranging from 2 mm down to 20 µm and below. Therefore, these novel apertures are applicable to a wide range of different applications. We will be showing new results about development and use of these pinholes.

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. The so-called Montel optics consist of bent substrates with shape tolerances below 100 nm, upon which multilayers are deposited with single layer thicknesses in the nanometer range and up to several hundreds of layer pairs. The multilayers are designed with lateral thickness gradients within ± 1% deviation of the ideal shape. Very low shape tolerances below 100 nm and figure errors well below 5 arcsec are required for multilayer mirrors to ensure a superb flux density of more than 4x10^11 photons/s/mm^2 in combination with very high-brightness microfocus X-ray sources, such as the novel liquid metal jet X-ray source. Montel Optics are nowadays not only used in the home-lab, but also at synchrotron beamlines. We will be showing results of a combination of microfocus sources with these multilayer optics.

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