

2-20 KEV X-RAY IMAGING AND BACKLIGHTING WITH SPHERICAL CRYSTALS*

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X-ray self-emission imaging or backlighting of High Energy Density Physics experiments requires brilliant sources with several keV energies, and x-ray imaging devices with high throughput and high spatial resolution of about 10 μm . Spherically curved crystals provide the required resolution and throughput when operated at near-normal incidence (80° - 90° Bragg angle), which minimizes image aberrations due to astigmatism. However, this restriction seems to dramatically limit the available range of suitable crystal and spectral line combinations. We present results from an automated, systematic search for crystals and matching spectral lines for x-ray backlighting and self-emission imaging with energies between 2 and 20 keV, for Ge, Si, Quartz, Mica, InAs and GaAs crystals with arbitrary Miller index combinations up to $(h,k,l) = (18,18,18)$. The search revealed 1000's of matches, which were downselected by automatically calculating crystal rocking curves for each spectral line and crystal pair with a custom-written interface to the X-ray Oriented Programs (XOP)¹ software package, to determine image brightness and spatial resolution for applications at Sandia's Z Pulsed Power Facility. Selected spectral line and crystal combinations have been experimentally tested using both Sandia's 4 kJ, 2ω , nanosecond Z-Beamlet and 200 J, 1ω , picosecond Z-Petawatt laser systems.

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[1] M. Sanchez del Rio and R.J. Dejus, AIP Conf. Proc. **705**, 784 (2004).