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The Diamond Light Source Program for Crystal Inspection Using X-ray Topography

Wednesday 28 August 2024 12:00 (15 minutes)

For monochromators and phase retarders designed for X-rays of energy over 4 keV, diffracting crystals are the material of choice. However, the cleanliness of the diffracted beam and the achievable energy resolution can be degraded by defects introduced into the bulk during growth, by scratches and pits left on the surface by polishing, and by poor clamping that deforms the crystal lattice. Diamond Light Source now has a procedure for inspecting such crystals before beamline installation, and within this, X-ray topography is a critical tool. New crystal optics are examined at the versatile bending-magnet test beamline B16, which is designed to apply topographic techniques using both white and monochromatic X-ray beams to crystals mounted in any orientation. Rocking curve imaging has been performed with a range of fields of view and spatial resolutions down to 2 µm using a set of digital detectors. Maps of defects over large surfaces have been collected using both on-the-fly scans and stitching techniques, and methods to automate stitching are being developed. Monochromator crystals, including some that were fabricated using new methods or mounted in innovative ways, have been successfully tested for strain under realistic cryocooling, and the results are helping to further improve the crystal mount and cooling. Results provided by X-ray topography are being combined with visible-light measurements made at Diamond's Optical Metrology Laboratory into a full package of techniques for determining whether a new crystal optic should be accepted. Not only Diamond's own beamlines, but also industrial users and other X-ray synchrotron facilities, have profited from this combination of capabilities.

I plan to submit also conference proceedings

Yes

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