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Broader horizons for Bragg Coherent Diffractive Imaging; energy scanning and time-resolved measurements

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Bragg Coherent Diffractive Imaging (BCDI) is a technique which is rapidly gaining in popularity throughout the X-ray microscopy community. BCDI allows the characterisation of both the shape and three-dimensional deformation field of nanocrystals at spatial resolutions approaching a few nm. Typically BCDI is sensitive to displacements of < 10-4 of a lattice spacing (Abbey, JOM, 2013). Measurements are normally performed by 'rocking' a single crystal through the Bragg condition whilst recording the fine structure around one of the Bragg peaks. Current data acquisition times are on the order of tens of minutes, making the study of non-reversible processes in dynamically evolving systems extremely challenging. We have recently shown that scanning the monochromator energy such that the crystal moves in and out of the diffraction condition provides equivalent BCDI information to rocking the crystal. Building upon this idea we show here that illuminating the nanocrystal with the broadband radiation from a single undulator peak and scanning the undulator gap provides a significant increase in the available flux with a concomitant reduction in the data acquisition time. We plan to use this technique to study systems which are evolving on timescales of minutes, perhaps even seconds allowing BCDI to be applied to study a range of time-resolved processes including annealing.

Keywords or phrases (comma separated)

Bragg CDI, Partial Coherence, Strain Mapping

Summary

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