

Bragg Coherent Diffraction Imaging at the Advanced Photon Source

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ABSTRACT

The arrival of third-generation synchrotron sources, such as the APS, created new opportunities to exploit the high flux of coherent X-rays. The first demonstration of coherent “speckle” effects in hard X-ray diffraction had been demonstrated by Sutton et al [1] at the end of the second-generation era. In the original build-up of APS, Sector 8 was dedicated to X-ray Photon Correlation Spectroscopy as the first application of Coherent Diffraction. Our group, then part of UNICAT at the University of Illinois, decided to pursue the structural possibilities of Coherent X-ray Diffraction, first at ESRF, then at Sector 33. After a few successful demonstration experiments, the UNICAT consortium committed to build a dedicated station at Sector 34 in the second wave of beamline construction. This beamline had the great innovation of splitting the wavefront to provide coherent flux into two stations in parallel, capitalising on the fact that only a few percent of the area of an APS undulator beam was coherent. We built a full 6-circle diffractometer coupled to a sample vacuum chamber dedicated to Bragg Coherent Diffraction Imaging (BCDI) at 34-ID-C. The first major publication was of contact strain imaging in Pb nanocrystals, grown at the beamline [2]. This talk will present the series of technical advances that took place of the following years as BCDI was developed into a mainstream X-ray analytical method at APS.

[1] M. Sutton, S. G. J. Mochrie, T. Greytak, S. E. Nagler, L. E. Berman, G. A. Held, “Observation of speckle by diffraction with coherent X -rays”, *Nature* 352 608 (1991)

[2] M. A. Pfeifer, G. J. Williams, I. A. Vartanyants, R. Harder and I. K. Robinson, “Three-dimensional Mapping of a Deformation Field inside a Nanocrystal ”, *Nature* 442 63 (2006)