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X-ray Laue Diffraction Microscopy in 3D at the Advanced Photon Source WENJUN LIU, JONATHAN TISCHLER, RUQING XU, Argonne Natl Lab, ARGONNE NATL LAB TEAM — X-ray Laue Diffraction 3D Microscopy developed at 34-ID beamline in the Advanced Photon Source has been a unique and powerful tool for spatially-resolved structural studies at sub-micron level for materials science. It is applicable to a wide range of microstructure and evolution problems of materials at mesoscale in many diverse fields, including materials engineering, condensed matter physics, and high-pressure geophysics. With advanced focusing mirror optics and depth-resolving technique, focused polychromatic or monochromatic x-ray beams can be used to determine the local phases of crystalline materials, the local crystal orientation and therefore the grain and phase boundary structure, and the local defect distribution including elastic and plastic strains. A description of the technique will be presented with illustrations of highlighted recent applications, and the ongoing upgrade plan of pushing microdiffraction techniques towards nanodiffraction with significant improvements in smaller beam sizes and higher focusing flux, based on the new near diffraction-limited storage rings x-ray source. [1] W. Liu and G. Ice, "X-ray Laue Diffraction Microscopy in 3D at the Advanced Photon Source," in Strain and Dislocation Gradients from Diffraction, Imperial College Press, 2014, pp. 53-81. [2] F. Hofmann, et al, "X-ray micro-beam characterization of lattice rotations and distortions due to an individual dislocation," Nature Communications, 4, 2774-1-2774-7 (2013). [3] L. Zhang, et al, "Disproportionation of (Mg,Fe)SiO3 perovskite in Earth's deep lower mantle," Science 344, 877-882 (2014).

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