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TITLE: Coherent X-ray Diffraction Imaging of Zinc Oxide Crystals

ABSTRACT:

The understanding of lattice distortions created by defects, dislocations and interfaces in nanomaterials is required if their unique properties are to be harnessed. Coherent X-ray Diffraction Imaging (CDI) is sensitive to such distortions and can quantify the displacement of the lattice relative to the equilibrium lattice spacing. Using iterative algorithms we solve the "Phase Problem" to reconstruct the 3D shape and internal structure of nanomaterials, specifically Zinc Oxide rods. The reduction of ZnO rods by Fe and Co in the temperature range 200^{o}C - 600^{o}C will be discussed. In addition we have measured CDI patterns for multiple Bragg reflections from two ZnO rods with differing aspect ratios for the first time. The coherence properties of the illuminating radiation allow reconstructions from two Bragg reflections to be combined to map a 2D displacement field, providing a component of the strain tensor. Our result demonstrates how this can be generalized to the full strain tensor using three or more reflections.