Oral Contributions

[MS22-04] Coherent X-ray diffraction from single nanowires

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Synchrotron based Coherent X-ray Diffraction Imaging (CDI) is known as a characterization technique to determine shape and strain of small crystals. Due to the well know phase problem of crystallography CDI measures the diffracted intensity of the object but the phase information is lost. In the limit of kinematical scattering the square root of the diffracted intensity can be expressed as the Fourier transform of the electron density of the sample [1]. However, the scattered phase can be obtained by iterative phase retrieval algorithms [2]. These algorithms apply certain constraints in real and reciprocal space which characterizes the object to be reconstructed. We apply CDI to characterize the structure of InAs nanowires (NW) grown on silicon(111) substrate [3,4]. Speckle patterns taken at individual NWs can be used to characterize the stacking faults distribution in single nanowire, for example. For this case the phase retrieval problem can be solved based on the facts that the scattering object has finite size and that the recorded diffraction pattern is sufficiently oversampled. In order to retrieve the lost phase information we use the combination of phase retrieval algorithms which consists of error reduction (ER), hybrid input output (HIO) and shrink wrap (SW) method. For the present NWs we can show that the stacking fault distribution varies for different NWs grown under identical conditions on same substrate. Nowadays the compressive sensing (CS) approach is a new type of sampling theory with many potential applications and particularly it can be applied in phase retrieval problem [5]. CS changes the constraint in real and reciprocal space by assuming that the object which has to be reconstructed is sparse when it is represented in some basis. For example, the one-norm constraint with the iterative reweighting algorithm can be used to recover the complex function of highly strained crystals [6].

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