The University of Texas at San Antonio

UTSA Physics and Astronomy

Dr. Daniel Ugarte

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Application of Spatially Resolved Precession Electron Diffraction (SPED) to study structural distortions in individual nanostructures

Although the recent progress of electron microscopy methods, it is still quite challenging to analyze precisely defects and related lattice deformations inside individual nano-objects. The small size of nanosystems and the complex dynamical diffraction effects renders rather difficult the understanding of real- or reciprocal space studies. Associating the nanometer wide probes available in modern TEMs and the quase-kinematical diffraction intensities generated by Precession Electron Diffraction (PED), we obtain a remarkable tool to gather crystallographic information with high spatial resolution. We have performed a thorough analysis of structural distortions present in InP NWs (30-40 nm in diameter, wurtzite structure) containing a screw dislocation and a lattice torsion (Eshelby twist). The measured crystal rotation is larger (~1.4 times) than predictions derived from classical elasticity theory. We have been able to characterize the screw dislocation at the center of the wire with great detail (direction, sense and handedness, Burgers). Further work is under way to consider dynamical corrections in order to improve the interpretation of PED patterns.

Department Contact Information
Veronica.Castellanos@utsa.edu
http://physics.utsa.edu