MS23 Advances in electron crystallography methods

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Characterising the strain in a twisted nanowire by scanning electron diffraction

Alexander Eggeman[1], Daniel Ugarte[2], Monica Cotta[2], Luiz Tizei[3], Caterina Ducati[4], Paul Midgley[4]

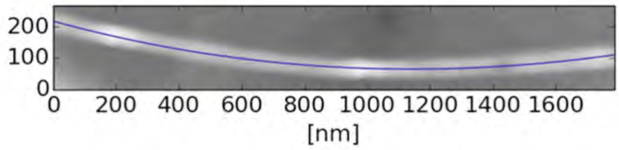
1. School of Materials, University of Manchester, Manchester, United Kingdom
2. Instituto de Fisica, Universidade Estadual de Campias, Campinas, Brazil
3. Laboratoire de Physique des Solides, Universite Paris Sud, Paris, France
4. Department of Materials Science and Metallurgy, University of Cambridge, Cambridge, United Kingdom

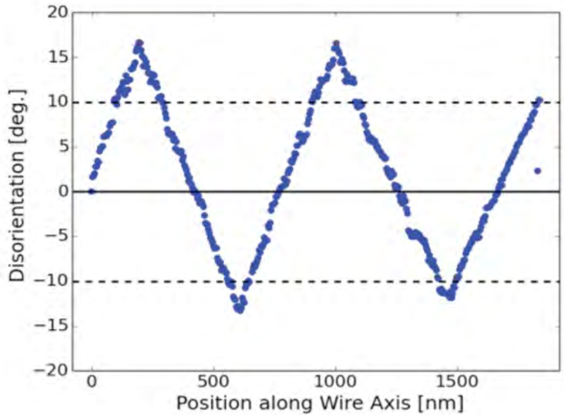
email: alexander.eggeman@manchester.ac.uk

Transmission electron microscopes offer the capability to study materials using a variety of signals at extremely high spatial resolution and with high precision. This combination is essential when considering nanoscale materials as the variations in structure and composition can occur over very short legth-scales and can have profound impact on the properties and hence the function of the material.

Here we present a detailed analysis of structural distortions present in a hexagonal indium phosphide nanowire containing a screw dislocation [1]. The wire exhibits strain varying radially from the dislocation core outwards but the free surface of the wire also results in a back torsion (the classical Eshelby twist [2]) causing a continuous twist of the crystal structure along the length of the wire. From a series of scanning precession electron diffraction [3] measurements the twist rate and the radial strain have been characterised in great detail and found to be consistent with a common Burger's vector of the hexagonal c-axis value. Validation of this analysis was performed using dynamical scattering simulations of a model twisted nanowire. In addition, information about the growth direction, dislocation handedness and even the 3D wire morphology could be extracted from the measurements.

This study highlights many of the advantages as well as some of the limitations of scanning precession electron diffraction data for studying nanomaterials.





References

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