Nanostructured materials | Jožef Stefan Institute Ljubljana, Slovenia

SEMINAR

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3D crystallography at atomic resolution

Dr. Ian MacLaren, University of Glasgow

It has long been known that high angle electron diffraction into higher order Laue zones contains 3-domensional information as the diffraction vectors are no longer perpendicular to the beam direction and therefore all diffraction events contain some information about the crystallography parallel to the beam. More recently, it became possible to use this in STEM with the advent of fast direct detectors and 4DSTEM and it was quickly shown that the signal is atomically resolved and varies from site to site in a crystal. In this seminar, after introducing the topic and explaining this background (seeing as it is still not that well known in the wider community), I will show that the atomic resolution HOLZ signal contains 3D vector information about the crystallography, which can be extracted by a simple mathematical fitting approach. This is used to map the strength and 3D orientation of antiparallel atom movements which are occurring in a complex oxide close to an interface showing atomic resolution detail on how the atomic movements are quenched close to that interface. This also reveals hitherto inaccessible information about the preferred domain orientation in the sample, which was neither determined by reciprocal space mapping nor by conventional STEM imaging in previous characterisation, nor could have been resolved by conventional dark field TEM. This work shows the advent of an entirely new paradigm for performing STEM of single crystal systems (such as epitaxial heterostructures) in which 3D crystallographic orderings are directly accessible via fitting of diffraction patterns recorded along just one major crystallographic direction.

Kindly invited.