NanoMEGAS
Advanced Tools for electron diffraction

# Precession Electron Diffraction Applications in TEM : from crystal structure determination to orientation imaging and strain mapping at nm scale

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Based on the early work by Vincent and Midgley in Bristol UK (1994) that developed the Precession Electron Diffraction (PED) technique in transmission electron microscope (TEM), PED is an essential tool for several TEM applications for nanomaterials. Beam precession has been proved to enhance the reflections quality (quasi-kinematical, similar to X-ray intensities). Today, more than 180 articles (that include PED technique) from various laboratories worldwide and dedicated issues of major scientific microscopy journals have been published the last decade.
One of the most important applications for electron crystallography , is the recently developed 3D PED diffraction tomography technique allowed from the collection of several PED patterns complete solution of various structures from complex zeolites and minerals to metals and alloys. Another very interesting application including use of PED is the ASTAR technique where is possible to obtain orientation and phase maps at 1-3 nm resolution (in case of FEG-TEM) for a variety of materials (metals, semiconductors, oxides etc.). The technique is very similar to EBSD-SEM , but in our case is based on collection of several PED patterns on an crystalline area and template matching with theoretically generated templates. Precession diffraction has been recently successfully applied to obtain Strain mapping analysis of several semiconductor materials at 1-4 nm resolution (in case of FEG-TEM, sensitivity 0.02%), based on comparison of NBD patterns from strained / reference un-strained areas. The technique is very easy to use at any TEM and provides very fast and accurate data (same order of magnitude as dark field holography) without any need to index diffraction patterns.