

Advanced methods for the analysis of nanocrystals in nm-scale using Precession Electron Diffraction techniques in TEM

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Precession electron diffraction (PED) technique in transmission electron microscope (TEM) offers advanced high resolution analysis in nanomaterial science. Among several applications, ASTAR technique provides 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 - that is similar to EBSD-SEM technique - is based on collection of several PED patterns on a crystalline area that are indexed after matching with theoretically generated templates of known structures.

PED has been recently successfully applied to obtain strain mapping analysis of 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. Both automatic techniques are straight forward, can be applied to any TEM and may provide extremely fast, accurate and reproducible results. Other applications of PED in TEM, is automatic PED based 3D diffraction tomography (ADT3D or Micro ED) for structure determination of nanocrystals, and amorphous material analysis using Pair Distribution Function (e-PDF) approach.