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Phase analysis of nano-phase materials using selected area electron diffraction in the TEM

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Nano-phase materials are in the forefront of research and the large number of nanotechnology projects worldwide forecasts its increasing importance. In analogy to X-ray power diffraction (XRD), we are developing a method to help phase identification when examining a large number of grains simultaneously by electron diffraction. Although XRD is well established, it can not be used for small quantities of materials (volumes below 1 μm^3). Examining a usual TEM sample with thickness of 100 nm and using a selected area of 1 μm in diameter, the selected area electron diffraction pattern (SAED) carries information about several thousands of grains from a material with an average grain size of about 10 nm. The accuracy of XRD can not be attained by electron diffraction (ED). However, simultaneous visual observation of the nanostructure is an additional benefit of TEM (beside the small amount of needed material).
The first step of the development project was the development of a computer program ("ProcessDiffraction") that processes digital versions of SAED patterns and presents them in an XRD-like form (intensity vs. scattering vector) [1]. In the present version (V2.0.3) phase identification is carried out by comparing the measured distribution to "Markers", i.e. data of known phases. XRD data cards are used if the detailed structure of a phase is not known. Kinematic electron diffraction intensities are calculated for phases with known atomic positions. The program can be downloaded free from the home page of the author (www.mfa.kfki.hu/~labar/ProcDif.htm). The talk will show the usage of the program in live in typical application situations. Beside others, the possibilities that make the new version of the program distinct from the previous one are: structure definition, ED calculation, usage of compare memories (with Save / Load functions), editable options, generation of result in a document and a brand new user interface of multiple document type.
Quantification of the amounts of the phases present is planned in the next step of the development.

[1] Lábár JL: "ProcessDiffraction: A computer program to process electron diffraction patterns from polycrystalline or amorphous samples", Proc. EUREM 12, Brno (Frank L and Ciampor F, Eds.) (2000), Vol III., I379-380
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