s7.m2.o3 Local Structural Characterization within Polycrystalline Bulk Materials by High Energy Synchrotron Radiation. U. Lienert[1], H.F. Poulsen[2], D. Juul Jensen[2], E.M. Lauridsen[2], S.F. Nielsen[2], L. Margulies[2], [1]*European Synchrotron Radiation Facility, BP 220, F-38043 Grenoble Cedex, France.* [2]*Risø National Laboratory, DK-4000, Roskilde, Denmark.*
Keywords: high energy synchrotron radiation, recrystallization, plastic deformation

A recently developed diffraction technique is presented that aims at the local structural characterization within polycrystalline bulk materials. Micrometer sized gauge volumes are selected within millimeter thick specimens. Single grain properties such as orientation, size, boundary topology and stress/strain state become accessible during thermomechanical processing under representative bulk conditions.

The required penetration power and spatial resolution are achieved by utilizing micro focussed high energy synchrotron radiation and two dimensional position sensitive detectors. Contrary to surface techniques, three dimensional information is required and the confinement of a gauge length parallel to the incident beam is a key issue. Simultaneous data acquisition is required to obtain statistically representative ensembles of local observations. The scope and limitations of the technique are lined out by presenting case studies.

The nucleation and recrystallization during annealing of strongly plastically deformed aluminum was investigated[1]. The volume of the growing grains was inferred from the integrated intensity of the distinct diffraction spots. The threshold radius for detection of nuclei was 1 μm. The nucleation times and growth velocities of several hundred individual grains were observed.

A ray tracing technique was developed that allows the simultaneous observation of the orientation and cross section of single grains in a plane defined by the incoming beam[2]. Typically a few minutes are required to map one layer. Applications comprise characterization of the initial state prior to plastic deformation.

Plastic deformation is also studied by *in situ* observation of the rotation and strain state of single grains during tensile deformation. While the direct observation of the activated slip planes is beyond the spatial resolution, stringent test of models is expected by the combined observation of the individual and averaged behavior.

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s7.m2.o4 Structural and analytical characterization of semiconductor quantum structures by TEM. W. Neumann, R. Schneider, H. Kirmse, *Humboldt University of Berlin, Institute of Physics, Chair of Crystallography, Invalidenstrasse 110, D-10115 Berlin, Germany*.
Keywords: semiconductors, quantum structures, transmission electron microscopy.

Semiconductor structures can be of so low dimensions that charge carriers are confined to a space of only some nm^3 and thus quantum-physical phenomena become important. The properties of so-called quantum structures essentially depend on the perfection of their structure, size, arrangement, morphology, and on the chemical composition. The paper demonstrates the potential applicability of the combination of imaging, diffraction and spectroscopical transmission electron microscopy (TEM) techniques for elucidating the above-mentioned structural and chemical peculiarities of quantum structures.

Diffraction contrast as well as high-resolution imaging (HRTEM) and analytical TEM, viz. energy-dispersive X-ray spectroscopy (EDXS), electron energy loss spectroscopy (EELS), and energy-filtered TEM (EFTEM) were applied to investigate different types of quantum wires (QWRs) and quantum dots (QDs) composed of II-VI and III-V compound semiconductors. In detail, respective results gained from the following quantum structures will be presented:

(i) (In,Ga)As QWRs grown by metalorganic chemical vapour deposition (MOCVD) on V-grooved InP substrates[1], (ii) MOCVD grown (In,Ga)As QDs on GaAs[2], and (iii) CdSe QDs attained by molecular beam epitaxy (MBE) on ZnSe[3].

For a reliable interpretation of the diffraction contrast features observed and also of the experimental HRTEM images corresponding image simulations were carried out where the structure models used were relaxed by molecular dynamics methods[4]. In addition, dedicated nanoanalytical techniques were used for determining the element distribution either along a line (X-ray line profile, series of EEL spectra), or two-dimensionally (X-ray map, EFTEM) to detect compositional inhomogeneities, which can strongly influence the materials behaviour.

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