

X-RAY QUASI-FORBIDDEN REFLECTIONS STUDY OF Be-DOPED GaAs CRYSTALS

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Gallium arsenide crystals exhibit specific electrical and optical properties important for both electronic and optical device applications. However its material characteristics are still of significant interest to the electric industry. Beryllium is commonly used as a p-type dopant in GaAs grown by molecular beam epitaxy to increase thermal stability and to shorten the lifetimes of charge carriers. The aim of the presented paper is to find how the beryllium is incorporated into gallium arsenide lattice and study the microscopic structures around the beryllium atoms. High resolution X-ray study of GaAs:Be was already reported in our paper [3] indicating that Be position in the crystal lattice may play important role. Some reflections like (002) and (006), called quasi-forbidden reflections, have very small intensity due to the small difference in scattering factors between gallium and arsenic. The integral intensity of these reflections is very sensitive to composition and hardly sensitive to crystal lattice defects. The X-ray quasi-forbidden reflection method is based on comparison quasi-forbidden reflection intensities for the investigated crystal and for the ideal reference crystal [4].

References

- [1] G. Kowalski, I. Frymark, A. Krotkus, K. Bertulis, M. Kaminska, 'On the properties of the Be-doped low temperature MBE GaAs layers', DRIP IX International Conference on Defect Recognition, Imaging and Physics in Semiconductors, September 25-28, 2001, Rimini, Italy, Material Science and Engineering B (in print).
- [2] Fujimoto Isao, Materials Science and Engineering, B14 (1992), 426-438.

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CHANCES AND CHALLENGES OF ROCK TEXTURE INVESTIGATIONS BY NEUTRON DIFFRACTION

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Rock textures are fingerprints of the earth's history by yielding information on the natural processes having caused them. Geological texture analysis and interpretation is difficult due to the complexity and frequent overprinting of geophysical and geochemical processes over millions of years. Nevertheless, neutron diffraction pole figures can help to reconstruct those geological processes. Neutrons are complementary to the well-known and widely used optical and laboratory X-ray methods owing to their high penetration capability and the large beam cross sections which allow the use of large samples and thus the evaluation of volume textures with high grain orientation statistics, even on coarse grained material. Furthermore, one can simultaneously collect data for a manifold of different pole figures and different mineral constituents of the rocks. The possibility of calculating 3-dim grain orientation distributions even for low-symmetry minerals and multiphase rocks establishes a new quality of texture analysis for many geological samples. The performance of this method is shown by presenting examples of texture studies using the texture diffractometer SV7-b at the FRJ-2 in Juelich and widely used as national service instrument, mainly for rock texture investigations. Special characteristics and challenges of geological samples are reflection-rich diffraction patterns due to both the low crystal symmetries of many minerals and the multiphase compositions of most rocks. These challenges are met by both instrumental and methodical means. Individual pole figure preparation is achieved by using an efficient position-sensitive detector and profile fitting methods for overlapping peak separation. Representative results are presented for gneiss mylonites and eclogites.

Keywords: TEXTURE ROCKS NEUTRON POLE FIGURES

MICROSTRUCTURAL CHARACTERIZATION OF STRESS-INDUCED MARTENSITES EVOLUTED AT LOW TEMPERATURE IN DEFORMED POWDERS OF Fe-Mn-C ALLOYS BY RIETVELD METHOD

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The present study considers X-ray characterization of the microstructures of deformation-induced martensites of Fe-Mn-C alloy powders of grain size ~50 micron (hand-filed) having compositions 5.6, 5.8 and 6.0 Mn and 1.0 C (mass %). The cold-worked powders were further subjected to transformation at low temperatures close to Ms and the evolved phases were again characterized microstructurally. The methodology applied for characterization involves Rietveld's whole X-ray profile fitting technique adopting the most recently developed software, MAUD (Materials Analysis Using Diffraction) which incorporates Popa model for crystallite (domain) size and microstrain (root mean square, r.m.s) and preferred orientation of the crystallites. The analysis also considers lattice defect related features of the microstructure viz. stacking, twin, compound fault probabilities and dislocation density value. The cold-worked powders (hand-filed at room temperature) revealed highest degree of transformation with 47, 43 and 42% volume fractions of martensites with increasing Mn concentration which for the bulk state of the same alloys transformed at low temperatures are 36, 40 and 47%. The same deformed alloy powders when subjected to low temperature transformation, evolved a maximum of 60, 68 and 62% volume fractions of martensites at 170 K, 175 K and 190 K. The analysis reveals occurrence of high propensity of stacking faults in the deformed austenites (10^{-2} - 10^{-3}) and high values of dislocation densities (10^{12} - 10^{13}) in the austenite and martensitic phases which assist in the formation of such high concentration of martensites in the low temperature treated deformed powder samples.

ARE THE SOLID SOLUTIONS OF Ni-Au AND Pt-Rh SHORT-RANGE ORDERED OR DECOMPOSED?

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for the solid solutions of Ni-Au (above the broad miscibility gap) and of Pt-Rh, the state of order is under discussion among experimentalists and theorists. We have employed diffuse neutron and X-ray scattering to characterize the state of order. A Ni-8.4 at.% Au single crystal (using the Ni-58 isotope) was investigated at 1083 K at a triple axis spectrometer in the elastic mode. Covering a large range of scattering vectors (0.15 to 2 r.l.u.), the increase in diffuse scattering towards small scattering vectors directly demonstrates short-range decomposition. The fitted short-range order parameters are compatible with a microstructure containing small groups of Au atoms on {111} planes as the most characteristic feature. A Pt-47 at.% Rh single crystal quenched from 920 K to room temperature was investigated using a laboratory rotating anode. The separated short-range order scattering exhibits an absolute maximum at $1/20$ and a local one at 000. The variation in scattering is very small, within 0.5 Laue units. For both alloys linear displacement scattering is clearly visible, even in Pt-Rh where the atomic size mismatch is much smaller than in Ni-Au. Therefore, scattering intensities have to be taken within a three-dimensional volume to separate short-range order scattering from displacement scattering.

Keywords: DIFFUSE SCATTERING SHORT-RANGE ORDER ALLOYS