

STRUCTURAL PROPERTIES OF MnSb LAYERS GROWN ON GaAs SUBSTRATE

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Ferromagnetic semiconductors have recently received much interest, since they hold out prospects for using electron spins in electronic devices. Although large effort has been done all over the world to prepare room temperature ferromagnetic III-V semiconductors [1], no fully satisfying material has been fabricated as so far. On the other hand, it has been demonstrated that, in effect of annealing of magnetic GaMnAs semiconductors at high temperature, of about 700 K, specific ferromagnetic MnAs precipitates are fairly easily produced, yielding multi-phase materials [2]. It has been shown that bulk MnSb has T_C of 587 K [3]. Therefore it can be considered as a good candidate to form nano-inclusions, ferromagnetic at above room temperature.

MnSb layers were grown by MBE method on the GaAs (100) substrate with the MnAs buffer layer or directly on the GaAs(111) substrate. Depth profiles of Ga, As, Mn and Sb atoms in the samples were determined by SIMS method. Structural characterization of the layers was performed using synchrotron radiation at the W1.1 beamline at DESY-HASYLAB. Monochromatic X-ray beam of $\lambda = 1.54056 \text{ \AA}$ wavelength was used.

As follows from SIMS results, the near surface layers of both samples were enriched in Ga.

To determine the crystallographic orientation of the layers, the 2θ - ω scans were made. In the case of layer grown on GaAs(100), the 2θ - ω pattern shown an existence of two hexagonal MnSb domains with the (101) and (110) orientations, respectively. The phase analysis of the near surface layers was performed using diffraction in the glancing incidence geometry (2θ scan). Polycrystalline phases of zinc-blende GaSb and of hexagonal MnSb were detected for this sample.

For layer grown on GaAs(111), the observed diffraction peaks have been indexed as 001 MnSb and 111 GaSb (Fig. 1). No diffraction peaks originating from polycrystalline inclusions were found for this sample in the 2θ patterns. The small fraction of (102)-oriented MnSb was detected for both sample kinds (Fig. 1).

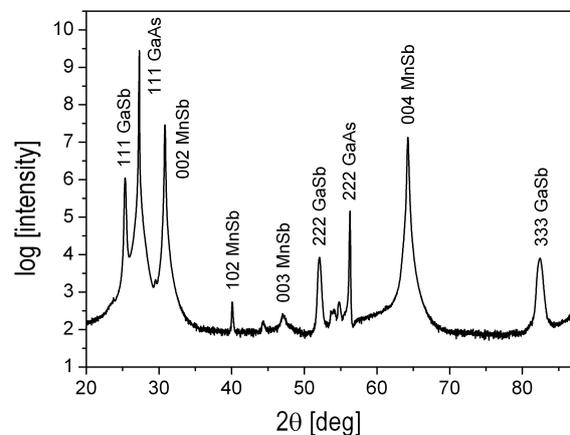


Figure 1. 2θ - ω scan for MnSb grown on GaAs (111) substrate.

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