Structural properties of GaMnAs nanowires

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Transmission electron microscopy was used for structural characterisation of MBE grown GaMnAs nanowires. The samples were grown on epiready GaAs(001) and GaAs(111)B n-type wafers. After growing a thin GaAs buffer layer, the substrate temperature was decreased to 300-350 ºC and (Ga,Mn)As growth was started. The growth was performed using As_2 molecular flux generated by a valved cracker As source, with a As:Ga flux ratio of about 2. The Mn flux was evaluated *via* RHEED intensity oscillations recorded for (Ga,Mn)As thin film calibration samples. The substrate temperature used for the growth was set to be above the maximum temperature growth of uniform (Ga,Mn)As layers. MBE growth at these conditions leads to the appearance of 3D-features in RHEED, due to formation of MnAs clusters.

Samples for TEM inspection were prepared by a cross-sectional method and by a mechanical transfer on a carbon holey film. The cross-sectional specimens were used to determine the nanowiers axis orientation in the respect to the substrates directions. Crystal structure of the nanowires was determined from analysis of selected area electron diffraction patterns and high-resolution images obtained for single nanowieres deposited on the carbon film. Qualitative analysis of the diffraction patterns from different nanowires led to conclusion that investigated nanowiers have not the same crystallographic structure. Both, cubic and hexagonal, systems were considered and discussed as possible concurrent interpretation of the results. An unequivocal, quantitative explanation of experimental diffraction patterns seems to be very difficult due to small size of the investigated objects and possible deformation of the ideal crystal lattice along nanowirs axis.

Nanowires grown with higher concentration of Mn flux revealed a branching structure, which 3D reconstruction was performed with the use of the tilting observations. The reconstruction allowed to determine geometry of the branching and to find the relations between crystallographic directions and the shape of nanowires.

The results of TEM investigations of structural and morphological properties of the GaMnAs nanowires will be presented.