HL 15: Preparation and characterization

Time: Monday 17:15–18:00 Location: H13

HL 15.1 Mon 17:15 H13

Synthesis and photoelectrical properties of CdS nanowires — •Holger Jens Böttcher, Cristina Gomez-Navarro, Marko Burghard, and Klaus Kern — Max-Planck-Institute for Solid State Research, Stuttgart, Germany

Semiconductor nanowires (NW) are emerging as versatile nanoscale building blocks of optoelectronic devices. In this context, extensive research is currently directed toward developing controlled synthesis procedures and microscopic characterization methods for NW. In this talk, the growth of Cadmium sulfide (CdS) NW via a solvothermal method will be presented. Investigations by X-ray powder diffraction (XRD), scanning electron microscopy (SEM), transmission microscopy (TEM), thermal gravimetric analysis (TGA) and μ-PL spectroscopy demonstrate that the utilised synthesis approach yields pure, structurally uniform and single-crystalline NW. Dark electrical transport measurements, complemented by spatially resolved photoconductivity experiments, were performed on individual NW in order to investigate the carrier transport in CdS NW.

HL 15.2 Mon 17:30 H13

Nano-DLTS based on SCM for spatially resolved electrical defect spectroscopy — •Andre Krtschil, Hartmut Witte, Carsten Baer, Armin Dadgar, and Alois Krost — Institute of Experimental Physics, Otto-von-Guericke-University Magdeburg, PO Box 4120, 39016 Magdeburg, Germany

Conventional techniques for electrical defect characterization like deep level transient spectroscopy (DLTS) suffer from one major problem. They only can provide information on the overall defect content in a macroscopic part of the sample. Otherwise, local defect state characteristics are requested if specific types of structural defects or distinct layers in a device stack should be analyzed.

In this contribution we describe the nano-DLTS technique which overcomes these limitations. Nano-DLTS combines the idea of macroscopic DLTS with the high spatial resolution of the scanning capacitance microscopy approach. Thus, it allows the analysis of local capacitance transients due to an external bias voltage pulse with a spatial resolution of some tens of nanometers. The thermal activation energy of the corresponding defect states can be determined from isothermal nano-DLTS scans at different temperatures.To demonstrate the broad applicability of nano-DLTS, we will show results for different semiconductor layers (silicon, zinc oxide, and gallium nitride) as well as of a more complex GaN-based light emitting diode. In the latter case, the sample is beveled to provide access to inner layers and interfaces during local defect spectroscopy experiments. Furthermore, experimental setup, advantages, and limitations of nano-DLTS will be discussed.

HL 15.3 Mon 17:45 H13

Determination of potential microdistributions in semiconductors by means of Electron Holography — •Andreas Lenk[1], Petr Formanek[1], Daniel Wolf[1], Hannes Lichte[1], and Uwe Mühle[2] — [1]Institute of Structure Physics, Triebenberg Laboratory, Technische Universitaet Dresden, 01062 Dresden, Germany — [2]Qimonda Dresden GmbH & Co. OHG

Nowadays, FIB systems and TEM's are commonly used tools for physical failure analysis in both semiconductor industry and materials research. As a promising extension of TEM, electron holography provides indispensable additional information, such as 2D profiles of variations of the local electrostatic potential in the semiconductor matrix. The distribution of dopants in the material can be calculated from those profiles.

However, like normal TEM, electron holography delivers 2D projections of 3D object information. Artefacts on the object's surface, which were introduced e.g. by the 30kV gallium ions of the FIB during preparation, falsify such projections. For quantitative measurement, it is very important to distinguish between true material properties and artificially generated features.

Therefore, FIB-lamellae have been cross-sectioned and investigated with electron holography. It is shown that the gallium ions of a FIB do not only amorphize the crystalline silicon laterally, but also decrease the electric potential near the surface of the lamella. To understand the corresponding effects on 2D projections, electron holography was combined with tomographic imaging techniques.