Time: Tuesday 15:00–16:15 Location: H15

**HL 46.1 Tue 15:00 H15**

Cathodoluminescence spectroscopy of single GaN/AIn quantum dots directly performed in a scanning transmission electron microscope — Frank Bertram¹, Gordon Schmidt¹, Markus Müller¹, Silke Pietzold¹, Peter Verr¹, Jürgen Christen¹, Aparna Das², and Eva Monroy²  — Institute of Experimental Physics, Otto-von-Guericke-University Magdeburg, Germany

1 CEA/CNRS group Nanophysique et Semiconducteurs, INAC/SP2M, CEA-Grenoble, France

In this study we will present a nanoscale optical and structural characterization of a III-nitride based quantum dot (QD) heterostructure. A 1 μm thick AIn layer grown on a sapphire substrate using metal organic vapor phase epitaxy (MOVPE) serves as a template for the further growth process. Subsequent, a stack of 10 GaN QD layers, each embedded in 50 nm thick AIn barrier, were grown under an optimized plasma-assisted molecular beam epitaxy process on an AIn-MOVPE/sapphire template. The cross-section high angle annular dark field image (HAADF) in a scanning transmission electron microscope (STEM) clearly reveals the GaN QD layers. The comparison of the HAADF image with the simultaneously recorded panchromatic cathodoluminescence mapping at 16 K exhibits a spot-like luminescence distribution of the upper six QD layers solely, indicating no formation of the first four intentionally grown QD layers. Addressing a very few to single QDs we observe a broad luminescence between 3.0 eV and 4.0 eV originating from the superposition of the single emission lines.

**HL 46.2 Tue 15:15 H15**

Epitaxial grown InP quantum dots on a GaAs buffer realized on GaP/Si(001) templates — Walter Hartwig, Michael Wiesner, Elisabeth Koroknay, Matthias Paul, Michael Jetter, and Peter Michler — Institut für Halbleiteroptik und Funktionele Grenzflächen and Research Center SCuPE, Universität Stuttgart, Allmandring 3, 70569 Stuttgart, Germany

The increasing necessity of higher computational capacity and security in the information technology requires originally technical solutions, which today’s standard microelectronics, as their technical limits are close, can’t provide anymore. One way out offers the integration of III-V semiconductor photonics with low-dimensional structures in current CMOS technology, enabling on-chip quantum optical applications: quantum cryptography or quantum computing. Challenges in the heteroepitaxy of III-V semiconductors and silicon are the mismatches in material properties of the both systems. Defects, like dislocations and anti-phase domains (APDs), inhibit the monolithic integration of III-V semiconductor on Si. We present the growth of a thin GaAs buffer on CMOS-compatible oriented Si(001) by metal-organic vapor-phase epitaxy. To circumvent the forming APDs in the GaAs buffer we use a GaP/AlN/GaN/GaAs/GaP stack, which today’s standard microelectronics, as their technical limits are close, can’t provide anymore. One way out offers the integration of III-V semiconductor photonics with low-dimensional structures in current CMOS technology, enabling on-chip quantum optical applications: quantum cryptography or quantum computing. Challenges in the heteroepitaxy of III-V semiconductors and silicon are the mismatches in material properties of the both systems. Defects, like dislocations and anti-phase domains (APDs), inhibit the monolithic integration of III-V semiconductor on Si. We present the growth of a thin GaAs buffer on CMOS-compatible oriented Si(001) by metal-organic vapor-phase epitaxy. To circumvent the forming APDs in the GaAs buffer we use a GaP/AlN/GaN/GaAs/GaP stack.

**HL 46.3 Tue 15:30 H15**

Measurement of thermoelectric properties of indium arsenide nanowires — Philipp Messch¹, Sigfried Karg², Bernd Gottsmann³, Heinz Schmid³, Pratyush Das Kanungo¹, Volker Schmid³, Hesham Ghoniem¹, Michael Böök¹, Valentina Troncaldi¹, and Heike Riel¹. — IBM Research, Switzerland — QuNano AB, Sweden

Low-dimensional semi-conducting nanostructures are promising systems to achieve a high figure of merit (ZT) for thermoelectric devices. We report on the thermoelectric properties of indium arsenide (InAs) nanowires (NWs). High ZT values for thin InAs and other III-V NWs are predicted from simulations [1]. We present temperature-dependent measurements of ZT - determining the electrical conductivity σ and the Seebeck coefficient S and the thermal conductivity κ using thermo-electric test structures for single NWs. NWs were grown by MOCVD and in-situ doped with sulfur. They were transferred to SiO2 or Polyimide coated substrates. A resistive heater and four contacts to the NW, each of them serving as resistive thermometer, were structured by electron beam lithography, deposition of a nickel/platinum bilayer and lift-off technique. $S$ and $κ$ were measured for different doping levels with $σ$ ranging from 30 S/cm to 2000 S/cm. $S$ ranges from 10 $μ$V/K for the highest doped NWs up to 180 $μ$V/K for undoped NWs. Using a self-heating technique [2], a thermal conductivity of $κ = 1.8 W/mK$ was determined, being a factor of 30 lower than in bulk InAs.


**HL 46.4 Tue 15:45 H15**

The investigation of alloy formation during InAs nanowires growth on GaAs (111)B substrate — Markus Müller, Christen, Markus Müller¹, Silke Pietzold¹, Peter Verr¹, Jürgen Christen¹, Aparna Das², and Eva Monroy². — Institute of Experimental Physics, Otto-von-Guericke-University Magdeburg, Germany

INAC/SP2M, CEA-Grenoble, France

Epitaxial grown InP quantum dots on a GaAs buffer realized on GaP/Si(001) templates — Walter Hartwig, Michael Wiesner, Elisabeth Koroknay, Matthias Paul, Michael Jetter, and Peter Michler. — Institut für Halbleiteroptik and Funktionele Grenzflächen and Research Center SCuPE, Universität Stuttgart, Allmandring 3, 70569 Stuttgart, Germany

HL 46.5 Tue 16:00 H15

Imaging the local density of free charge carriers in doped InAs nanowires — Benedikt Hauer¹, Kamil Sladek², Fabian Haack¹, Thomas Schäpers¹, Heike Riel¹, and Thomas Taubner¹. — 1 Institute of Physics (IA), RWTH Aachen University, Sommerfeldstraße 14, 52074 Aachen, Germany — 2 Peter Grünberg Institute (PGI-9), Forschungszentrum Jülich, 52425 Jülich, Germany

Semi-conductor nanowires are promising candidates for future electronic devices. While the bottom-up approach for their growth could simplify the device fabrication, their quantitative characterization remains challenging. We use scattering-type scanning near-field optical microscopy (s-SNOM) to investigate the local density of free electrons in Si-doped InAs nanowires grown by selective-area metalorganic vapor phase epitaxy (SA-MOVPE) [1].