HL 65: Nitrides: AlGaN

Time: Wednesday 17:00–18:00 Location: POT 51

HL 65.1 Wed 17:00 POT 51

Si Doping Studies in AlGaN — •Kamran Forghani[1], Mohammadreza Gharavipour[1], Ferdinand Scholz[1], Benjamin Neuschl[2], Tobias Meisch[2], Ingo Tischer[2], Klaus Thonke[2], Oliver Klein[3], and Ute Kaiser[3] — [1]Institute of Optoelectronics, Ulm University, 89069 Ulm, Germany — [2]Institute of Quantum Matter, Ulm University, 89069 Ulm, Germany — [3]Transmission Electron Microscopy Group, Ulm University, 89069 Ulm, Germany

Realization of n-type conductivity in AlGaN is essential for the growth of deep-UV LED devices. For MOVPE grown layers, we have investigated the relation between Si concentration and carrier concentration at different Al contents up to about 45%. For higher Al contents, the samples suffer from micro cracks as the doping concentration increases. The cracks could be suppressed by growing the Si-doped AlGaN layers on short period super lattice buffer structures. In order to determine the dopant ionization energy, we have performed temperature-dependent Hall measurements on the samples with different Al content, Si concentration, and crystal quality. Moreover, we performed TEM, XRD, and AFM to quantify threading dislocations behavior, crystal quality and surface properties, respectively. The photoluminescence from GaN quantum wells grown on these doped layers was used as a monitor to evaluate their influence on future UV-LED device performance.

HL 65.2 Wed 17:15 POT 51

Growth and characterization of highly reflective AlInN/AlGaN Bragg reflectors — •Christoph Berger, Jürgen Bläsing, Armin Dadgar, Thomas Hempel, Jürgen Christen, and Alois Krost — Otto-von-Guericke-Universität Magdeburg, Deutschland

We report on the growth of distributed Bragg reflectors (DBRs) with up to 40 periods based on lattice matched $Al_{0.85}In_{0.15}N/Al_{0.2}Ga_{0.8}N$ layers. Using an $Al_{0.2}Ga_{0.8}N$ buffer, which is directly grown on the c-plane sapphire substrate, stress relief through crack formation or by relaxation processes can be prevented, which is confirmed by Nomarski microscopy and X-ray reciprocal space maps. The structures exhibit homogenous layer thicknesses and sharp interfaces, as revealed by FE-SEM images, in-situ reflectivity measurements and high resolution X-ray diffraction. These properties allow the growth of DBRs with reflectivities higher than 99 % at a wavelength of ≈360 nm. Such mirrors are very promising for the use in high Q-factor microcavities for the subsequent realization of GaN-based VCSELs or the observation of strong exciton-photon coupling.

HL 65.3 Wed 17:30 POT 51

Ultraviolet photoluminescence excitation spectroscopy of AlGaN and AlN — •Martin Feneberg[1,2], Benjamin Neuschl[2], Tobias Meisch[2], Klaus Thonke[2], Robert Metzner[1], Bernd Garke[1], and Rüdiger Goldhahn[1] — [1]Abteilung Materialphysik, Otto-von-Guericke-Universität Magdeburg — [2]Institut für Quantenmaterie/ Gruppe Halbleiterphysik, Universität Ulm

We present first results of photoluminescence excitation spectroscopy on AlN thin films and high aluminum content AlGaN layers. These studies were performed at the DORIS III synchrotron, DESY, Hamburg. The origin of observed deep emission bands in AlN can be distinguished between substrate and epilayer. In high aluminum content AlGaN, position and shape of the ordinary absorption edge can be observed. These data are compared to the ordinary dielectric function obtained by spectroscopic ellipsometry and to low temperature photoluminescence spectra obtained by ArF excimer laser excitation ($\lambda = 193nm$). We discuss possible origins of so-called "near band-gap" luminescence in AlGaN. Furthermore, the experimental data allows insight into energy positions of semi-core level states in AlGaN, which opens a way to determine the Fermi level energy in these materials.

HL 65.4 Wed 17:45 POT 51

Factors affecting the excitation process of Europium(Eu^{+3}) ion in Europium-implanted AlGaN — •Jayanta Kumar Mishra[1], Torsten Langer[1], Uwe Rossow[1], Kirill Trunov[2], Andreas Wieck[2], and Andreas Hangleiter[1] — [1]Institut für Angewandte Physik, TU Braunschweig — [2]Angewandte Festkörperphysik,Ruhr-Universität Bochum, Germany

Rare earth ions implanted into GaN are promising for optoelectronic applications. They show luminescence in the visible range while the luminescence from this material system is sharper as well as independent of temperature due to intra 4f transition of rare earth ions. To improve the emission efficiency we implanted Europium in GaN codoped with Mg at dose range from $10^9 cm^{-2}$ to $10^{14} cm^{-2}$ with an energy of 100keV. The red emission from ${}^5D_0 \rightarrow {}^7F_2$ of europium was remarkably enhanced by Mg codoping. When we tried Eu implanted AlGaN, Eu^{3+} shows more promising luminescence. The transition probability or the energy transfer efficiency enhances the Eu^{3+} luminescence in AlGaN. We show that Eu occupies a C_{3v} symmetry site in AlGaN but in case of Mg doped GaN, Eu occupies a different site. The energy transfer from the host to Eu ions depends on the position of Eu ions in the host lattice. We also investigated the role of carriers (electrons/holes) in the excitation process of Eu ion by doping AlGaN with different kind of carriers (p-type and n-type).