HL 8: Interfaces/ surfaces

Time: Monday 14:00–15:00 Location: EW 201

HL 8.1 Mon 14:00 EW 201

Influence of group-V exchange processes and Sb segregation on the interface quality of GaSb/GaAs quantum wells — •Rainer Timm[1], Andrea Lenz[1], Lena Ivanova[1], Holger Eisele[1], Ian Farrer[2], David A. Ritchie[2], Ganesh Balakrishnan[3], Diana L. Huffaker[3], and Mario Dähne[1] — [1]Institut für Festkörperphysik, Technische Universität Berlin, Deutschland — [2]Cavendish Laboratory, University of Cambridge, UK — [3]Center for High Technology Materials, University of New Mexico, Albuquerque, USA

GaSb nanostructures in GaAs show a staggered type-II band alignment with a large hole confinement, making them very promising for optoelectronic and charge storage device applications. For such devices, however, the correct chemical composition of the nanostructures and the abruptness of their interfaces are both crucial and challenging [1]: While intermixing at the GaSb-on-GaAs interface can partly be controlled using an Sb soaking step, atomic exchange processes leading to strong Sb segregation upon GaAs overgrowth of a GaSb layer are even more difficult to avoid.

Using cross-sectional scanning tunneling microscopy [2], we were able to study the interfaces of various MBE-grown GaSb/GaAs quantum wells at the atomic level, including the wetting layers between quantum dots. By systematically varying the growth conditions, the influences of Sb soaking, intermixing effects, As-for-Sb exchange upon GaAs overgrowth, and Sb acting as surfactant could be distinguished.

[1] I. Farrer et al., J. Crystal Growth **251**, 771 (2003).

[2] R. Timm et al., Appl. Phys. Lett. **85**, 5890 (2004).

HL 8.2 Mon 14:15 EW 201

Nano- and atomic-scale potential fluctuations in two-dimensional semiconductors — •Sebastian Landrock[1], Ying Jiang[1], Kehui Wu[2], Enge Wang[2], Knut Urban[1], and Philipp Ebert[1] — [1]Institut für Festkörperforschung, Forschungszentrum Jülich GmbH, 52425 Jülich — [2]Chinese Academy of Science

As the size of semiconductor devices is shrinking, not only the positioning of dopants is challenging, but also the knowledge on nanoscale potential fluctuations induced by inhomogeneities and the discrete nature of dopant atoms is becoming most critical. Therefore, we used scanning tunneling microscopy to measure the magnitude and extent of local potential fluctuations in a two-dimensional semiconductor with atomic resolution. On the one hand, we were able to prove that the limit of a macroscopic description of local nanoscale potential fluctuations is about 6×10^{13} dopants/cm^2. On the other hand, we found significant deviations from a microscopic description based on screened Coulomb potentials only. The potential consists rather of the superposition of extended potential fluctuations, defined by the charge carrier distribution in the bands, and local deviations from the spatial average of the screened Coulomb potentials arising from electron-electron interactions.

HL 8.3 Mon 14:30 EW 201

Deoxidation and surface structure of InGaN(0001) — •C. Friedrich[1], V. Hoffmann[2], N. Esser[3], M. Kneissl[1], and P. Vogt[1] — [1]TU Berlin, Institut für Festkörperphysik, Hardenbergstr. 36, 10623 Berlin, Germany — [2]Ferdinand-Braun-Institut für Höchstfrequenztechnik, Gustav-Kirchoff-Str. 4, 12489 Berlin, Germany — [3]ISAS-Berlin, Albert-Einstein Str. 9, 12489 Berlin, Germany

$In_xGa_{1-x}N$ alloys have attracted considerable interest due to their wide range of applications in optoelectronic devices, e.g. blue and green lasers. Although the quality of In-rich epitaxial layers has improved in recent years, there is still not much known about the atomic structure of $In_xGa_{1-x}N$ surfaces. The influence of the surface structure on the growth of $In_xGa_{1-x}N$ layers and on the interface formation in hetero-structures remains unclear. Here we present our results on $In_xGa_{1-x}N$ surface properties after deoxidation under ultra high vacuum (UHV) conditions. Auger Electron Spectroscopy measurements of the chemical surface composition confirm residual contaminations such as carbon and oxygen even after annealing up to 600 °C. Further annealing at higher temperatures leads to a strong reduction of carbon and oxygen and LEED reveals a (3×3)-surface periodicity. Scanning tunnelling microscopy (STM) measurements on such prepared surfaces show atomically flat terraces and both more metallic-like and more semi-conducting areas. Based on these results surface structure models are discussed.

HL 8.4 Mon 14:45 EW 201

Schottky Barrier Height Engineering of NiSi/Si Contacts by Dopant Segregation — Christoph Urban, •Qing-Tai Zhao, Marcel Müller, Christian Sandow, and Siegfried Mantl — Institute of Bio- and Nanosystems (IBN1-IT), and CNI - Center of Nanoelectronic Systems for Information Technology, Forschungszentrum Jülich, D-52425 Jülich, Germany

Schottky barrier MOSFETs become more and more attractive for device downscaling, especially due to very low parasitic S/D resistances. However, the performance of such devices suffers from the on-current limitation due to tunneling through the high Schottky barrier at the source. The performance of such a device would be drastically improved if the effective Schottky barrier height (SBH) between the S/D metal and the semiconductor in the channel could be eliminated. A successful approach of SBH engineering is the silicidation induced dopant segregation (DS) where a thin highly doped layer is formed at the silicide-silicon interface. In this work we present a systematic study of effective SBH lowering by DS during Ni silicidation of activated and non-activated As and B implanted Si. The current-voltage characteristics of fabricated NiSi Schottky diodes show higher reverse saturation currents compared with Schottky diodes without DS. This confirms the distinct Schottky barrier lowering due to the silicide induced DS. Diodes where the dopants were not activated before silicidation show a minimum SBH of Φ=0.13eV for As and of Φ=0.14eV for B. Moreover, we observe that the diodes with dopants activated prior to silicidation show a remarkably lower SBH by about 35%.