O 38: Semiconductor substrates: clean surfaces

Time: Tuesday 15:00–16:00 Location: H40

O 38.1 Tue 15:00 H40

Angle-resolved low-energy photoemission at clean Si(111)(7x7) surface — •Wolfgang Heckel, Kerstin Biedermann, and Thomas Fauster — Lehrstuhl für Festkörperphysik, Universität Erlangen-Nürnberg, Staudtstr. 7, 91058 Erlangen

Former experiments on Si(111)(7x7) have shown the existence of three filled surface states below the Fermi level [1].

For a detailed investigation of these states we carried out angle-resolved photoemission experiments (ARUPS) with high energy and momentum resolution at a photon energy of 6.20 eV using the fourth harmonic from a Ti-sapphire laser. The light was incident at an angle of 80° relative to the surface normal so states of Λ_1 and Λ_3 symmetry could be distinguished unambiguously by switching the light polarisation between p and s. All measurements were undertaken under flat band condition at 90 K.

Several new bands are identified and their dispersion along the $\overline{\Gamma M}$ and $\overline{\Gamma K}$ symmetry lines is presented.

[1] R. I. G. Uhrberg et al., Phys. Rev. B **58**, R1730 (1998)

O 38.2 Tue 15:15 H40

SHG Spectroscopy of Si(100)(2x1) Interband Transitions — Dominic Gerlach, Björn Braunschweig, Gerhard Lilienkamp, and •Winfried Daum — Institute of Energy Research and Physical Technologies, TU Clausthal, Leibnizstr. 4, 38678 Clausthal-Zellerfeld, Germany

It is well established that optical second-harmonic generation (SHG) at Si surfaces and interfaces with fundamental photon energies above 1.5 eV results from resonant excitation of Si interband transitions. Nevertheless, apart from the contribution due to electric-field-induced SHG in the space charge region the origin of SHG interband resonances is not well understood. We present results of the first SHG experiments on the bare Si(100)(2x1) surface with excitation of transitions for a wide range of energies. Much different to Si(100)/SiO2 systems, the SHG spectrum of the bare Si(100)(2x1) surface does not show interband excitations with energies different from the bulk-type E1 and E2 transitions. Moreover, the surface contribution to the E1 band observed for undoped Si(100)(2x1) is much stronger than that of oxidized surfaces and comparable to the bulk contribution from the space charge region of doped samples. Implications of our spectra for Si bonding at the bare and oxidized Si(100) surface are discussed.

O 38.3 Tue 15:30 H40

Cleaning of GaN($\bar{2}$110) surfaces by Ga deposition and desorption — •Simon Kuhr, Christian Schulz, Timo Aschenbrenner, Jan Ingo Flege, Thomas Schmidt, Detlef Hommel, and Jens Falta — Institute of Solid State Physics, University of Bremen, Germany

Cleanliness of substrates is a key issue in fabrication of optoelectronic devices since impurities sensitively affect atomic structure, electronic properties and reactivity of the surfaces being the basis of semiconductor devices. One promising cleaning technique concerning especially the removal of oxygen and carbon on polar GaN(0001) surfaces is the deposition of several monolayers of metallic gallium followed by thermal desorption (Schulz et al., pss (c), **6** (2009)). We present first results of the application of this technique to non-polar GaN($\bar{2}$110) surfaces heteroepitaxially grown on r-plane sapphire substrates by metalorganic vapor phase epitaxy. The cleaning process has been monitored by x-ray photoelectron spectroscopy measurements in order to perform a quantitative analysis of the reduction of contaminations and of the surface stoichiometry. In the course of investigation we have developed a cleaning cycle combining thermal degassing and Ga deposition/desorption steps leading to an effective reduction of the contaminants oxygen and carbon. In addition, the impact of the cleaning method on atomic structure and surface roughness has been investigated by low-energy electron diffraction as well as scanning tunnelling microscopy.

O 38.4 Tue 15:45 H40

The role of Hydrogen for the formation of the GaP(001) surface — •Marcel Ewald[1,2], Michael Kneissl[1], Norbert Esser[1,2], and Patrick Vogt[1,2] — [1]ISAS Berlin, Albert-Einstein-Str.9, 12489 Berlin, Germany — [2]TU Berlin, Institut für Festkörperphysik, Hardenbergstr.36, 10623 Berlin, Germany

Previous investigation have shown that the preparation of InP(001)(2×1) refers to a hydrogen terminated surface structure which gives rise to a very specific zig-zag pattern in STM. Hence, it is formed under MOVPE growth conditions but not in standard MBE where no reactive hydrogen is present. Also for the GaP(001)(2×1) such structures have been observed by STM for MOVPE grown samples, suggesting a similar H-termination as found for the InP(001). However, it has not been shown that this surface structure is indeed stabilized by hydrogen. We have prepared GaP(001)(2×1) under MBE-like conditions under supply of activated hydrogen. We find that only under these conditions a (2×1) surface is observed giving rise to a RAS signature similar to the one under MOVPE conditions. This surface is explained by a H-terminated structure model similar to the InP(001)(2×1).