growth, relaxation, and the poisson ratio of the Half-Heusler layers are discussed.

[1] A. Koveshnikov et al.: submitted to J. Appl. Phys. (2004).

O 38.9 Di 12:45 TU EB301

**Characterization of the growth peculiarities of Physical Vapor Deposited CdS on Cu(In,Ga)$Se_2$ Thin Film Solar Cells Using Kelvin Probe Force Microscopy in Ultrahigh Vacuum** — •Ferdinand Streicher, Marin Rusu, Christian A. Kaufmann, Axel Neisser, Susanne Siebentritt, Martha Ch. Lux-Steiner, and Thilo Glatzel — Hahn-Meitner-Institut Berlin, Glienicker Strasse 100, 14109 Berlin, GERMANY

High-efficiency thin-film solar cells based on Cu(In,Ga)$Se_2$ absorber material have been developed using CdS buffer layers deposited by chemical bath deposition (CBD). However, for industrial production, an in-line vacuum deposition such as, e.g. physical vapour deposition (PVD) is preferred. This contribution reports on the preparation and characterization of highly-efficient ZnO/CdS/Cu(In,Ga)$Se_2$ solar cells with PVD-deposited CdS buffer layers. The PVD-CdS preparation conditions were optimized for the deposition of the CdS layers suitable for highly-efficient (14%, AM1.5, total area) thin film solar cells. Compared to the CBD deposition the ZnO/PVD-CdS/Cu(In,Ga)$Se_2$ solar cell devices show an increased short circuit current while open circuit voltage is decreased. The surface analysis of the CdS growth process with Kelvin probe force microscopy (KPFM) reveals, that the CdS deposition is retarded at the grainboundaries of the absorber which could be a reason for the observed device behavior.

# O 39 Nanostrukturen IV

Zeit: Dienstag 10:45–13:00 Raum: TU EB420

O 39.1 Di 10:45 TU EB420

**Formation and decay of Si/Ge nanostructures at the atomic level** — •Bert Voigtländer, Neelima Paul, Vasily Cherepanov, and Josef Mysliveček — Institut für Schichten und Grenzflächen (ISG 3) and cni - Center of Nanoelectronic Systems for Information Technology, Forschungszentrum Jülich, 52425 Jülich, Germany

The step-flow growth mode is used to fabricate two-dimensional Si and Ge nanowires with a width of ≈3.5 nm and a thickness of one atomic layer (0.3 nm) by self-assembly on a Si(111) surface. Alternating deposition of Ge and Si results in the formation of a nanowire superlattice covering the whole surface. Also different kinds of two-dimensional Si/Ge nanostructures like alternating Si and Ge nanodots and nanorings having a width of 5-10 nm were grown. One atomic layer of Bi terminating the surface is used to prevent intermixing between Si and Ge and to distinguish between these elements. A difference in apparent height is measured in scanning tunneling microscopy (STM) images for Si and Ge, respectively. The method to distinguish between Si and Ge allows to study intermixing on the nanoscale and to identify the fundamental diffusion processes giving rise to the intermixing.

O 39.2 Di 11:00 TU EB420

**STM contrast between Ge and Si atoms incorporated in the Si(111)-$\sqrt{(3)} \times \sqrt{(3)}$-Bi surface** — •Josef Mysliveček, Neelima Paul, and Bert Voigtländer — Institut für Schichten und Grenzflächen (ISG 3) and cni - Center of Nanoelectronic Systems for Information Technology, Forschungszentrum Jülich, 52425 Jülich, Germany

The termination of the Si(111) surface by 1 ML Bi prevents intermixing between subsequently deposited Ge and Si atoms that incorporate below the Bi layer. At the same time, apparent height difference between the incorporated Ge and Si monolayers is observed in the scanning tunneling microscope, allowing the control of the formation of lateral Ge-Si nanostructures on the Si(111)-$\sqrt{(3)} \times \sqrt{(3)}$-Bi surface. Using scanning tunneling spectroscopy techniques we study the origin of this apparent height difference. While the densities of electronic states measured over the incorporated Ge and Si layers do not differ significantly, a significant lowering of the inverse decay length is observed for the unoccupied electron states over the incorporated Ge layer. This indicates, that the presence of the incorporated Ge layer on the Si(111)-$\sqrt{(3)} \times \sqrt{(3)}$-Bi surface decreases the electron affinity on this surface.

O 39.3 Di 11:15 TU EB420

**Strukturelle Untersuchungen von Dysprosiumsilizid-Nanodrähten auf vizinalen Si(001)-Oberflächen mittels Rastertunnelmikroskopie und LEED** — •N. Tschirner, S. K. Becker, H. Eisele und M. Dähne — Technische Universität Berlin, Institut für Festkörperphysik, PN4-1, Hardenbergstr. 36, 10623 Berlin

Seltenerdsilizid-Nanodrähte zeichnen sich durch eine geringe Schottkybarriere auf der Si(111)- und der Bildung von Nanodrähten auf der Si(001)-Oberfläche aus. Wie aus früheren Untersuchungen bekannt[1], lassen sich durch Anpassen der Präparationsbedingungen verschiedene Arten von Drähten bilden. Bei niedrigen Temperaturen bilden sich dünne Drähte mit einer 2×7-Uberstruktur, bei höheren Temperaturen formen sich breitere und längere Drahttypen aus.

Auf vizinalen Oberflächen kann man ein paralleles Wachstum der Drähte aufgrund von Doppelstufen beobachten. Diese Drähte wurden mit LEED als auch mit STM untersucht und ihre atomare Struktur für unterschiedliche Wachstumstemperaturen und Dysprosium-Bedeckungen analysiert.

[1] C. Preinesberger, S. Vandré, T. Kalka, and M. Dähne. J. Phys. D: Appl. Phys **31**, L43 (1998)

O 39.4 Di 11:30 TU EB420

**Local electronic properties of the one-dimensional Si(557)-Au surface** — •M. Sauter[1], M. Schöck[2], R. Hoffmann[1], C. Sürgers[1], and H. v. Löhneysen[1,3] — [1]Physikalisches Institut and DFG Center for Functional Nanostructures (CFN), Universität Karlsruhe, D-76128 Karlsruhe, Germany — [2]Institut for Fysik og Astronomi, Aarhus Universitet, DK-8000 Århus, Denmark — [3]Forschungszentrum Karlsruhe, Institut für Festkörperphysik, D-76021 Karlsruhe, Germany

The local electronic properties of the Si(557)-Au surface, obtained by deposition of 0.2 monolayers Au on vicinal Si(111) and subsequent annealing, are investigated by scanning tunneling microscopy (STM) and spectroscopy at different temperatures. Images taken at room temperature show the characteristic surface structure of chains adjacent to diffuse stripes. At $T = 77$ K the images show a voltage dependent contrast which disagrees with the previously reported interpretation in terms of a Peierls-like transition occurring below 260 K [1]. The voltage-dependent contrast is is confirmed by atomically-resolved tunneling spectra which indicate metallic or semiconductor-like behavior depending on the type of protrusion. The results are discussed by comparison with a recent calculation of the electronic surface-band structure of Si(557)-Au [2].

[1] J. R. Ahn et al., Phys. Rev. Lett. **91**, 196403 (2003)
[2] D. Sánchez-Portal et al., Phys. Rev. Lett. **93**, 146803 (2004)

O 39.5 Di 11:45 TU EB420

**Lead on hydrogen terminated Si(111)1x1: STM and surface x-ray diffraction** — •C. Rettig[1], V. Chamard[2], T.-L. Lee[3], J. Zegenhagen[3], and H. Hövel[1] — [1]Universität Dortmund, Experimentelle Physik I, D-44221 Dortmund — [2]CNRS, laboratoire de thermodynamique et physico-chimie metallurgique, B.P. 75, F-38402 St Martin d'hères — [3]European Synchrotron Radiation Facility (ESRF), B.P. 220, F-38043 Grenoble

We studied the growth of Pb on Si(111):H 1x1. The hydrogen termination leads to a chemically inert surface and results in a well defined modification of the Pb/Si interface if we compare our data to experiments for Pb on Si(111)7x7 deposited at T<270K in UHV. Recently for this system a uniform-height island growth was observed due to quantum well states, which lead to energy minima every second ML in height [1]. We characterised the growth mode of Pb on Si(111):H 1x1 at room temperature, changing the deposition amount from 2ML to 20ML, by using STM and SXRD (Surface X-Ray Diffraction) without breaking insitu UHV conditions. The SXRD data show the growth of exclusively Pb(111) planes parallel to the Si(111) plane and exhibit a beating pattern similar to the results of Pb on Si(111)7x7 [2], which may indicate a quasibilayer growth of the Pb clusters already at room temperature. In addition we characterised the morphology for different deposition temperatures (10K, 50K, 150K, 300K) with STM at 77K. In all cases we observed a 3D island structure of the Pb deposit.