

## O 32: Semiconductor Substrates

Time: Tuesday 15:45–17:30

Location: H39

O 32.1 Tue 15:45 H39

**Dynamics and energetics of Ge(001) dimers** — ●HAROLD ZANDVLIET, ARIE VAN HOUSELT, RAOUL VAN GASTEL, and BENE POELSEMA — Physical Aspects of NanoElectronics & Solid State Physics, MESA+ Institute for Nanotechnology, University of Twente, P.O. Box 217, 7500 AE Enschede, The Netherlands

The dynamic behavior of surface dimers on Ge(001) has been studied by positioning the tip of a scanning tunneling microscope over single flip-flopping dimers and measuring the tunneling current as a function of time. We observe that not just symmetric, but also asymmetric appearing dimers exhibit flip-flop motion. The dynamics of flip-flopping dimers can be used to sensitively gauge the local potential landscape of the surface. Through a spatial and time-resolved measurement of the flip-flop frequency of the dimers, local strain fields near surface defects can be accurately probed.

O 32.2 Tue 16:00 H39

**Interlayer interaction and electronic screening in multilayer graphene** — ●KARSTEN HORN<sup>1</sup>, TAISUKE OHTA<sup>2</sup>, AARON BOSTWICK<sup>2</sup>, JESSICA MCCHESENEY<sup>3</sup>, THOMAS SEYLLER<sup>4</sup>, and ELI ROTENBERG<sup>2</sup> — <sup>1</sup>Fritz-Haber-Institut der MPG, Berlin — <sup>2</sup>Advanced Light Source, LBL Berkeley — <sup>3</sup>Montana State University, Bozeman, Montana — <sup>4</sup>Inst. F.Physik der Kondens. Materie, Universität Erlangen-Nürnberg

Much recent attention has been given to the electronic structure of multilayer films of graphene, the honeycomb carbon sheet which is the building block of graphite, carbon nanotubes, C60, and other mesoscopic forms of carbon. Recent progress in synthesizing or isolating multilayer graphene films has enabled access to their physical properties, and revealed many interesting transport phenomena, including an anomalous quantum Hall effect, ballistic electron transport at room temperature, micron-scale coherence length, and novel many-body couplings. The unusual transport properties of graphene originate from the effectively massless Dirac Fermion character of the carriers derived from graphene's valence bands, which exhibit a linear dispersion degenerate near the so-called Dirac point. We determine the shape of the  $\pi$  bands and their characteristic splitting, and the transition from a pure 2D to quasi-2D behavior for 1 to 4 layers of graphene by angle-resolved photoemission. By exploiting the sensitivity of the  $\pi$  bands to the electronic potential, we derive the layer-dependent carrier concentration, screening length and strength of interlayer interaction by comparison with tight binding calculations, yielding a comprehensive description of multilayer graphene's electronic structure.

O 32.3 Tue 16:15 H39

**High energy femtosecond UV photo desorption dynamics of NO from HOPG at FLASH** — ●TIM HOGER<sup>1</sup>, BJÖRN SIEMER<sup>1</sup>, CARSTEN THEWES<sup>1</sup>, MARCO RUTKOWSKI<sup>1</sup>, HELMUT ZACHARIAS<sup>1</sup>, STEFAN DÜSTERER<sup>2</sup>, and ROLF TREUSCH<sup>2</sup> — <sup>1</sup>Universität Münster, Physikalisches Institut, Wilhelm-Klemm-Str. 10, 48149 Münster — <sup>2</sup>DESY, Hasylab, Notkestr. 85, 22603 Hamburg

The interaction of nitric oxide under high energy irradiation is an important issue in understanding the heating of the atmosphere and the formation of acid rain. At low temperatures NO adsorbs on dust grains or Mi particles. We present recent results of the interaction of NO adsorbed on graphite with high energy radiation. The desorption is achieved by the free electron laser at Hamburg (FLASH) supplying femtosecond pulses of up to 100  $\mu$ J with a photon energy of 57 eV. All internal energies of NO molecules desorbing from a highly oriented pyrolytic graphite (HOPG) sample are resolved in a pump-probe experiment. Highly excited molecules with a vibrational temperature around  $T_{vib} \approx 2500$  K and a high rotational excitation up to  $T_{rot} \approx 1200$  K are detected. Possible excitation and desorption mechanisms in this high energy regime are discussed.

O 32.4 Tue 16:30 H39

**Photoisomerization of Stilbene on Si(100): Gaining further insight by combined theoretical and experimental C 1s NEXAFS spectra** — ●CHRISTINE KOLCZEWSKI<sup>1</sup>, KLAUS HERMANN<sup>1</sup>, RALPH PÜTTNER<sup>2</sup>, PHILIPP MARTIN SCHMIDT<sup>1</sup>, THORSTEN KAMPEN<sup>1</sup>, and KARSTEN HORN<sup>1</sup> — <sup>1</sup>Fritz-Haber-Institut der Max-Planck-Gesellschaft, Faradayweg 4-6, 14195 Berlin, Deutschland — <sup>2</sup>Freie Universität Berlin, Institut für Experimentalphysik, Arnimallee

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Stilbene is a prototype molecule for studying photoinduced cis-trans isomerization. To gain further insight into the isomerization of stilbene at the Si(100) surface the system was investigated by several spectroscopic methods such as UPS and NEXAFS.

In this work, we present density-functional theory (DFT) calculations of both stilbene isomers on Si<sub>14</sub>H<sub>28</sub> clusters simulating the reconstructed Si(100) surface. Both isomers bind to Si with their central C=C double bond but differ in the arrangement of their phenyl rings with the overall binding being quite strong (binding energy of 3-4 eV). The obtained geometries have been used to calculate theoretical polarization-resolved C 1s NEXAFS spectra which are compared with recent experimental data and yield excellent agreement. This confirms the identification of both isomers for a further investigation of the isomerization process.

In addition, theoretical and experimental C 1s NEXAFS spectra of the free stilbene molecules are used to study adsorption induced changes in geometry and electronic structure.

O 32.5 Tue 16:45 H39

**Identifying isomerization - combined experimental and theoretical NEXAFS studies** — ●PHILIPP MARTIN SCHMIDT<sup>1</sup>, RALPH PÜTTNER<sup>2</sup>, CHRISTINE KOLCZEWSKI<sup>1</sup>, KLAUS HERMANN<sup>1</sup>, KARSTEN HORN<sup>1</sup>, and THORSTEN KAMPEN<sup>1</sup> — <sup>1</sup>Fritz-Haber-Institut der Max-Planck-Gesellschaft, Berlin, Germany — <sup>2</sup>Freie Universität Berlin, Institut für Experimentalphysik, Berlin, Germany

When studying the isomerization of molecules, identification and distinction of the different isomers is a critical issue. Here cis- and trans-Stilbene are a model system for "molecular switches". We have investigated their adsorption on Si(100) and Au(111) surfaces, and for comparison, in gas-phase. In this work we demonstrate the use of NEXAFS-spectroscopy as a versatile tool to investigate the interaction of the molecules with the surface and the arising consequences for isomerization. NEXAFS-spectra of the molecules in gas-phase show spectral features in the  $\pi^*$ -resonance that allow for a clear distinction of the isomers. Upon adsorption on surfaces these spectral features remain unchanged - thus clearly identifying the isomers - while the  $\sigma^*$ -resonances and the higher  $\pi^*$ -resonances undergo changes. In combination with theoretical calculations these changes can be used to identify the interaction of the molecules with the substrates and to reveal the adsorption geometry. Furthermore the implication of adsorption on the photoinduced isomerization, especially the inhibition of the isomerization-pathways known for gas-phase and solution, is explained.

O 32.6 Tue 17:00 H39

**Individual molecules of hexaphenyl on Si(100)-2x1** — ●MARION CRANNEY, MARTA MARTIN, ANDREW MAYNE, DAMIEN RIEDEL, and GÉRALD DUJARDIN — Laboratoire de PhotoPhysique Moléculaire, Orsay, France

Hexaphenyl molecules are very attractive for applications in molecular opto-electronics since they have quite interesting electrical and optical properties.

We have worked with a LT-STM at 5 K in order to study the structural properties of individual hexaphenyl molecules on Si(100)-(2x1). We observed that this molecule is weakly chemisorbed on Si(100) when deposited at 5 K. We analysed carefully STM pictures of each conformation in order to understand how the molecule of hexaphenyl interact with silicon dimers.

Moreover we have investigated the electronic and dynamical properties of these molecules with the LT-STM by exciting each phenyl ring of different conformations of the molecule with voltage pulses. The molecule change its conformation reversibly without diffusing across the surface. The location of the pulses on the molecule determines the molecular dynamics. This is due to different interactions of each phenyl with the silicon atoms, an effect that is shown by measurements of scanning tunneling spectroscopy.

O 32.7 Tue 17:15 H39

**Investigations of Ga adsorption on Si(113) with scanning tunneling microscopy** — ●MORITZ SPECKMANN, THOMAS SCHMIDT, SUBHASHIS GANGOPADHYAY, DAVID KRUEGER, TORBEN CLAUSEN, and

JENS FALTA — Institute of Solid State Physics, University of Bremen,  
High index surfaces are of strong interest in today's research because they are supposed to be a candidate for self-assembling systems, for example nano wires.

In this work the adsorption of Ga on Si(113) has been investigated in dependence on the growth temperature. After Ga adsorption one discovers two kinds of facets on the surface. We used scanning tunneling microscopy (STM) and low energy electron diffraction (LEED) to characterise the facets regarding their properties like length, height, width, and their tilt to the (113) surface as well as surface reconstructions.

tions.

The facets grow in  $[\bar{1}10]$ -direction. Depending on temperature a very regular arrangement of facets can be achieved. Due to their tilt towards the (113) surface and their surface reconstructions they are identified as (112) and (115) facets. We observed mainly  $(6 \times 1)$  and  $(4 \times 1)$  reconstructions on the (112) facets and on the (115) facets, respectively. Regarding their dimensions both facets are found to be strongly influenced by the growth temperature, whereas the (112) facets seem to be thermally more stable than the (115) facets. The STM images and the corresponding LEED images give hints that the (115) facets merge into (114) or (227) facets at temperatures of 600°C and higher.