

## O 63: Semiconductor substrates: Adsorption

Time: Friday 11:15–13:00

Location: SCH A118

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**Magnetic Molecules on GaN Studied by Low Temperature STM** — ●KENDAL CLARK, DANDA ACHARYA, VIOLETA IANCU, ERDUNG LU, ARTHUR SMITH, and SAW-WAI HLA — Ohio University, Physics and Astronomy Department, Athens, Ohio 45701, USA.

Spin electron interactions involving magnetic molecules and semiconductor surfaces are of great interest for the development of molecular spintronic devices. Due to its wide range of applications, GaN (0001) surface has received a special attention for the development of novel electronic devices. Here, we studied electronic and structural properties of TBrPP-Co molecules deposited on a freshly grown nitrogen polar GaN (0001) surface using a scanning tunneling microscopy and spectroscopy at 4.6 K under an ultra-high-vacuum condition. The TBrPP-Co molecule has a spin-active cobalt atom caged at the center of porphyrin unit and four bromo-phenyl groups are attached to its four corners. On GaN(0001), the molecules bind the surface through the bromo-phenyl units and form a saddle conformation, in which the central part of the molecule is bent by lifting the two pyrrole units of the porphyrin macrocycle. The molecules self-assemble and formed ordered clusters on GaN(0001) surface. Within the self-assembled molecular clusters, the molecules are aligned either parallel or 90 degree rotated to each other. In the presentation, we will discuss the spin-electron coupling of this molecule-surface system. This work is supported by the Ohio University BNNT, National Science Foundation NSF-DMR 0304314, NSF-PIRE: OISE 0730257, NSF-EMT: CCF-0622158, and the United States Department of Energy, DE-FG02-02ER46012 grants.

O 63.2 Fri 11:30 SCH A118

**Self assembled organic monolayers on silicon carbide** — ●MARCO HOEB, IAN D. SHARP, CARLOS A. DIAZ ALVAREZ, SEBASTIAN SCHOELL, MARTIN STUTZMANN, and MARTIN S. BRANDT — Walter Schottky Institut, Technische Universität München, Am Coulombwall 3, 85748 Garching, Germany

Because of its remarkable properties such as its biocompatibility or the possibility of bandgap engineering using its different polytypes, silicon carbide (SiC) is a promising substrate material for applications in the field of biosensors. One requirement for stable biosensors based on organic-inorganic hybrids is a covalent attachment of functional organic layers to the semiconductor surface. Here, we demonstrate high quality monolayers of 1-octadecene ( $C_{18}H_{36}$ ) on both Si- and C-polar 6H-SiC surfaces. Organic monolayer self-assembly in the well-known case of silicon is typically achieved via hydrosilylation, a process where a hydrogen-terminated surface is required. The double-bonded carbon atom of the alkane directly attaches to the silicon surface and results in a Si-C bond. In contrast, SiC surfaces are OH-terminated following etching in hydrofluoric acid and are, therefore, in principle not appropriate for this reaction. Nevertheless, the hydroxylated surfaces form dense and chemically stable alkene layers on both crystal faces. We show by X-ray photoelectron spectroscopy (XPS) and Fourier transform infrared (FTIR) spectroscopy that the bridging between the organic molecule and SiC occurs via an oxygen atom that is not present in the case of hydrosilylated silicon. We discuss this reaction in the framework of Markownikow addition.

O 63.3 Fri 11:45 SCH A118

**Long-lived excitonic desorption of NO from  $C_{60}/Cu(111)$**  — TIM HOGER and ●HELMUT ZACHARIAS — Westfälische Wilhelms-Universität Münster

The desorption of NO molecules from a  $C_{60}/Cu(111)$  surface is initiated by a 7 ns UV laser pulse (355 nm). The NO molecules are rotational state selectively detected by a frequency-doubled dye-laser (226 nm) by (1+1) REMPI. In a TOF mass spectrometer the arrival time spectrum shows two channels, one fast direct one and a slow one. This is confirmed by measuring directly the velocity distribution of the desorbing NO. The fast channel refers to a DIET process with a hot rotational distribution and a moderate vibrational excitation with a strong rotational-translational coupling. In the slow channel the velocity distribution does not depend on the particular detection time after initiating the desorption by the 355 nm pump pulse. The recorded velocities are further faster than expected from the detection time. It is thus concluded that the desorption occurs time-delayed

with respect to the excitation. The lifetime of this excitation can be estimated to approximately 125  $\mu$ s, in good agreement with lifetimes of triplet excitons in  $C_{60}$ . Triplet excitonic states in  $C_{60}$  are possible energy reservoirs for this desorption.

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**STM study of the adsorption of coronene on Si(111)-(7x7)** — ●JESUS MARTINEZ-BLANCO, MAX KLINGSPORN, and KARSTEN HORN — Fritz Haber Institut, Berlin, Germany

The adsorption of organic molecules on silicon surfaces is of interest in the control of their preparation and processing for applications in device fabrication. The (7x7) reconstructed silicon (111) surface presents a rich array of electronically inequivalent reaction sites, due to its unique electronic properties of reactive adatoms, rest atoms, and corner holes on the surface, which has been investigated with respect to molecular adsorption, and provides a rich playground. Here we report on the adsorption of coronene ( $C_{24}H_{12}$ ) on the Si(111)-(7x7) surface. Coronene is a polycyclic aromatic hydrocarbon (PAH) consisting of seven peri-fused benzene rings. We use Scanning Tunneling Microscopy (STM) to investigate the local long range structure. Upon room temperature adsorption, we find that the coronene molecules preferentially adsorb on the unfaulted half of the 7x7 unit cell. Molecules adsorbed on different sites can be induced to move to the preferential sites by the action of the tip in repeated image scans. Imaging of the molecules is strongly bias dependent, and also critically depends on the adsorption site. We discuss the structure of coronene on Si(111)-(7x7) on the basis of our data and in comparison with STM studies of coronene on the Si(001)-(2x1) surface where long range order is not observed.

O 63.5 Fri 12:15 SCH A118

**Site-selective reactivity of ethylene on hydrogen pre-covered Si(001)** — ●GERSON METTE<sup>1</sup>, MICHAEL DÜRR<sup>1,2</sup>, and ULRICH HÖFER<sup>1</sup> — <sup>1</sup>Fachbereich Physik und Zentrum für Materialwissenschaften, Philipps-Universität Marburg, D-35032 Marburg — <sup>2</sup>Fakultät Angewandte Naturwissenschaften, Hochschule Esslingen, D-73728 Esslingen

The reactivity of a semiconductor surface is expected to correlate not only with the concentration of dangling bonds but also with the local electronic properties of the dangling-bond states. For  $H_2$  dissociation on Si(001), a strongly activated process, site-selective reactivity at locally distorted configurations was demonstrated, e.g. by pre-adsorption of atomic hydrogen [1]. In this study, site-selective adsorption of ethylene on Si(001) has been investigated by means of STM. Two ethylene adsorption geometries were found on clean Si(001) with ethylene adsorbed on one and two dimers, respectively. Distortion of the electronic configuration by pre-adsorption of atomic hydrogen is found to increase the reactivity of the two-dimer adsorption site by a factor of 50. Thus, locally distorted dangling-bond configurations show site-selective reactivity also in the case of barrierless, non-dissociative adsorption of an organic molecule. The results are discussed with respect to a precursor mediated adsorption pathway and the control of the adsorption barrier between precursor and chemisorbed state.

[1] M. Dürr and U. Höfer, Surf. Sci. Rep. **61**, 465 (2006)

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**XPD-Measurement of the Si/SiO<sub>2</sub>-interface on Si(110)** — ●TOBIAS LÜHR<sup>1,2</sup>, DANIEL WEIER<sup>1,2</sup>, FRANK SCHÖNBOHM<sup>1,2</sup>, SVEN DÖRING<sup>1,2</sup>, ULF BERGES<sup>1,2</sup>, and CARSTEN WESTPHAL<sup>1,2</sup> — <sup>1</sup>Fakultät Physik - Technische Universität Dortmund, Otto-Hahn-Str. 4, D 44221 Dortmund, Germany — <sup>2</sup>DELTA - Technische Universität Dortmund, Maria-Goeppert-Mayer-Str. 2, D 44227 Dortmund, Germany

In the past, the investigation of the silicon (100) surface was in the center of many research activities. However, the structure of the interface for the Si(110)-surface is still unknown. In order to determine the structure of the oxidized Si(110)-surface XPS and angle-scanned XPD experiments were conducted. The experiments were performed at the synchrotron storage ring DELTA (Dortmund). In order to investigate the interface structure, we recorded high resolution photoemission spectra of the Si 2p signal with a photon energy of  $h\nu = 180$ eV. The spectra contain seven components which correspond to photoemission from emitters located in the interface region and in the bulk. Polar

angle depending intensity plots of the recorded signals reveal the relative positions of their respective emitters in the interface. The  $\text{Si}^{1+}$  and  $\text{Si}^{2+}$  components are located in the same layer close to the bulk. The  $\text{Si}^{4+}$  atoms are part of the silicon oxide film at the surface. The diffraction patterns clearly indicate a crystalline interface structure below the amorphous  $\text{SiO}_2$ -layer. In order to determine the structure it is necessary to compare the experimental diffraction patterns with simulated XPD-patterns for structure models. A genetic algorithm was developed for the structure model optimization.

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**Interaction of as-grown InN(0001) surfaces with oxygen** —  
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The interaction of oxygen with clean (2x2) reconstructed InN(0001) surfaces is investigated by in-situ photoelectron spectroscopy (XPS,

UPS). InN thin films were grown by plasma assisted molecular beam epitaxy. Directly following the growth an in-situ characterization of the pure InN samples as well as the investigation of the oxidation of the non-contaminated surfaces without any preparation was performed. Differences between the core levels as well as the valence band spectra of the clean in-situ grown and the oxygen treated InN samples will be presented. The comparison of the valence band structure shows the appearance of two electronic structures at 5.2 eV and 10.3 eV that can be assigned to oxygen adsorbates due to the impurity-free preconditions. Furthermore, the oxygen exposure leads to the disappearance of the InN(0001)-(2x2) surface reconstruction as well as the related surface state close to the Fermi level. This can be explained by the distortion of the (2x2) adatom reconstruction. In XPS two different states are observed in the O1s emission. Based on the detected chemical shifts, the chemical state of the adsorbed oxygen will be discussed. Furthermore, the oxidation has only minor influence on the position of the valence band maximum and the work function.