of Physics, University of Münster, Germany

Organic semiconductors have attracted intensive research over the last years. Especially the adsorption of π-conjugated organic molecules on metal substrates in view of potential applications in organic and molecular electronics gained a lot of interest. One of the most studied molecules is 3,4,9,10-perylenetetracarboxylic-dianhydride (PTCDA) and it has been investigated on a wide range of substrates.

Noncontact atomic force microscopy (ncAFM) experiments with PTCDA adsorbed on Cu(111) revealed, that the intramolecular contrast of PTCDA-molecules depends strongly on the local adsorption environment [1]. Here we present experimental ncAFM results of 3-dimensional force and dissipation spectroscopy experiments of PTCDA adsorbed on Ag(111) with submolecular resolution. The dissipation is understood as a hysteresis of forces between approach and retraction of the tip and is caused by bistabilities in the potential energy surface of the tip-sample system. Therefore the dissipation signal can reveal information about the mechanical properties of individual molecules.

[1] B. Such, D. Weiner, A. Schirmeisen and H. Fuchs Applied Physics Letters 89 (2006), 093104

O 40.5 Wed 16:00 SCH A316

Static and Sliding Friction of Nanoparticles — •Dirk Dietzel, Michael Feldmann, and André Schirmeisen — Institute of Physics and Center for Nanotechnology, University of Münster, Germany

We present a new approach for identifying static and sliding friction during atomic force microscopy (AFM) manipulation of nanoparticles [1]. In this approach the AFM-tip is centered on top of an antimony nanoparticle, which is weakly bound to a graphite surface. Depending on the normal load of the cantilever two scan modes are then possible: At low normal forces the tip will scan on top of the particle, whereas higher normal forces can lead to a movement of the particle simultaneously with the tip. We measure the lateral force during this transition, which allows us to extract values for static as well as sliding friction. We find that the static friction is reproducible during several subsequent manipulation events of the same nanoparticle. Once the particle is moving, further increase of the normal force might also make load dependent friction measurements possible.

O 40.6 Wed 16:15 SCH A316

A low-temperature high resolution scanning tunneling microscope with a three-dimensional magnetic vector field operating in ultra-high vacuum — •Marco Pratzer, Torge Mashoff, and Markus Morgenstern — II. Institute of Physics B, Otto-Blumenthal-Straße, RWTH Aachen and JARA-FIT, 52074 Aachen

Scanning tunneling microscopy and spectroscopy at low temperatures lead to a detailed microscopic understanding of electronic interactions. The combination of a low-temperature spin-polarized STM with a rotatable magnetic vector field, in addition, allows to determine the full map of magnetic anisotropies for individual nano-entities. Moreover, complex noncollinear spin structures of nanoclusters could be mapped by appropriately aligning the relative magnetization axis of probe and sample with the help of the external fields.
We present a low-temperature ultra-high vacuum scanning tunneling microscope setup with a combination of a superconducting solenoid coil and two split-pair magnets, providing a rotatable magnetic field of 500 mT applicable in all spatial directions. An absolute field maximum of B=7 T (3 T) can be applied perpendicular (parallel) to the sample surface. The instrument is operated at a temperature of 5 K. Topographic and spectroscopic measurements on tungsten carbide and indium antimonide revealed a z-noise of 600 fm_{pp} even in magnetic field. The energy resolution is, at least, below 6.5 meV. In addition the microscope is equipped with a tip exchange mechanism and a lateral sample positioning stage.

O 40.7 Wed 16:30 SCH A316

Intrinsic and extrinsic corrugation of monolayer graphene deposited on SiO_2 — •Viktor Geringer[1], Marcus Liebmann[1], Tim Echtermeyer[2], Sven Runte[1], Matthias Schmidt[1], Reinhard Rückamp[1], Max Lemme[2], and Markus Morgenstern[1] — [1]II. Physikalisches Institut, RWTH Aachen and JARA-FIT, Otto-Blumenthal-Straße, 52074 Aachen — [2]Advanced Microelectronic Center Aachen (AMICA), Otto-Blumenthal-Straße 25, 52074 Aachen

Using scanning tunneling microscopy (STM) in ultra high vacuum and atomic force microscopy, we investigate the corrugation of graphene flakes deposited by exfoliation on a Si/SiO_2 surface. While the corrugation on SiO_2 is long-range with a correlation length of about 25 nm, some of the graphene monolayers exhibit an additional corrugation with a preferential wave length of about 15 nm. A detailed analysis shows that the long range corrugation of the substrate is also visible on graphene, but with a reduced amplitude, leading to the conclusion that the graphene is partly freely suspended between hills of the substrate. Thus, the intrinsic rippling observed previously on artificially suspended graphene can exist as well, if graphene is deposited on SiO_2 [1].

[1] J. C. Meyer, A. K. Geim, M. I. Katsnelson, K. S. Novoselov, T. J. Booth, and S. Roth, Nature 446, 60 (2007).

O 40.8 Wed 16:45 SCH A316

Cross-sectional Scanning Tunneling Microscopy across a Metal-Semiconductor Interface - Structural and Electronic Properties on the Atomic Scale — Lars Winking, Martin Wenderoth, •Tim Ifflländer, Thomas Druga, and Rainer G. Ulbrich — IV. Physikalisches Institut, Georg-August-Universität Göttingen

Understanding the formation of Schottky barriers has been a major theme of surface science for more than half a century. However, the various mechanisms that determine the barrier height are still subject to discussion. To a large part this is due to the lack of appropriate experimental techniques with atomic resolution and the difficulties associated with preparing well-defined epitaxial interfaces.

We report scanning tunnelling spectroscopy (STS) across a cleaved epitaxial GaAs(110)/Fe interface. It provides information on the structural as well as the electronic properties of the heterointerface on the atomic scale. Furthermore, in combination with 3D simulations of the tip induced band bending we are able to quantify both the local Schottky barrier height and the influence of single dopant atoms on the electrostatic potential landscape representing the space charge layer in the semiconductor. Our experimental data are discussed in the context of existing theoretical models for Schottky barrier formation, like the advanced unified defect model or the metal-induced gap states model.

This work was supported by the SFB 602 TP A7.

O 40.9 Wed 17:00 SCH A316

Plasmon enhanced luminescence from fullerene molecules using a scanning tunneling microscope — •Frédéric Rossel, Marina Pivetta, François Patthey, and Wolf-Dieter Schneider — Ecole Polytechnique Fédérale de Lausanne (EPFL), Institut de Physique des Nanostructures, CH-1015 Lausanne, Switzerland

Luminescence from supported C_{60} and C_{70} molecules induced by tunneling electrons in a scanning tunneling microscope (STM) has been observed. The fullerene nanocrystals were electronically decoupled from the Au(111) substrate by an ultrathin NaCl film. Intramolecular fluorescence and phosphorescence associated with the transitions between the lowest electronic excited state and the ground state of C_{70} molecules were identified, demonstrating the capability of this technique for chemical recognition on the nanometre scale. Moreover we show that the molecular luminescence is selectively enhanced in the STM tip-sample gap by localized surface plasmons excited in an inelastic electron tunneling process.

We acknowledge financial support of the Swiss National Science Foundation.

O 40.10 Wed 17:15 SCH A316

Manipulating surface diffusion ability of single molecules by scanning tunneling microscopy — Dingyong Zhong[1,2], Jörn-Holger Franke[1], •Tobias Blömker[3], Gerhard Erker[3], Harald Fuchs[1,2], and Lifeng Chi[1] — [1]Physikalisches Institut, Universität Münster, Wilhelm-Klemm-Str. 10, 48149 Münster, Germany & Center for Nanotechnology (CeNTech), Universität Münster, Heisenbergstr. 11 , 48149 Münster, Germany — [2]Institut für Nanotechnologie, Forschungszentrum Karlsruhe, 76021 Karlsruhe, Germany — [3]Organisch-Chemisches Institut, Universität Münster, Corresstr. 40, 48149 Münster, Germany

The bonding of single diferrocene [Fc(CH2)14Fc, Fc = ferrocenyl] molecules on a metal surface can be enhanced by partial decomposition of Fc groups induced by the tunneling current in scanning tunneling microscopy. Although the isolated intact molecule is mobile on the terrace of Cu(110) at 78 K, the modified molecule is immobilized on the terrace. Calculations based on density functional theory indicate that the hollow site of the Cu(110) surface is the energetically favorable adsorption site for both ferrocene and the Fe-cyclopentadienyl complex, but the latter one possesses a much higher binding energy with the substrate.