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The atomic resolution imaging performance of a dynamic scanning force microscope in the ultra-high vacuum critically depends on several technical parameters related to the excitation and detection of the cantilever oscillation. We designed a testing stage allowing the easy insertion and removal of a set of twelve commercial standard cantilevers for quality control prior to measurements. Resonance curves are taken by excitation of a piezo stage with a variable frequency oscillator and detection with a Lock-In amplifier. The Detection of the cantilever motion is based on a deflected laser beam coupled into the vacuum by an optical fibre and focused by an in-vacuo lens. As a laser source we use a current and temperature stabilised low noise laser diode. For low noise detection of the cantilever deflection signal, an in-vacuum quadrant detector connected to a home-built pre-amplifier was used. The detection sensitivity of this set-up and commercially available SFM set-ups used in our group are measured by analysing the thermally excited vibration of the cantilever and noise in the vicinity of the cantilever with a Fourier analyser.

O 15.5 Mon 15:15 H41

Increasing the Q-factor in the constant-excitation mode of frequency-modulation atomic force microscopy in liquid — •Daniel Ebeling[1,2], Hendrik Hölscher[1,2], Jan-Erik Schmutz[1,2], and Boris Anczykowski[3] — [1]Center for Nanotechnology (CeNTech), Heisenbergstr. 11, 48149 Münster — [2]Physikalisches Institut, Wilhelm-Klemm-Str. 10, 48149 Münster — [3]nanoAnalytics GmbH, Heisenbergstr. 11, 48149 Münster

The application of dynamic force spectroscopy in vacuum allows the mapping of tip-sample forces down to the atomic-scale. It has been shown that dynamic force spectroscopy works also in ambient conditions [1] and liquids [2] enabling the precise measurement of tip-sample forces.

By adding a Q-Control electronics to the set-up of the constant-excitation mode of the frequency-modulation atomic force microscope we are able to increase the effective Q-factor of a self-oscillated cantilever in liquid to values comparable to ambient conditions. During imaging of soft biological samples adsorbed on a mica substrate we observed an increased corrugation of the topography with increased Q-factors. This effect is caused by the reduction of tip-sample indentation forces as demonstrated by numerical simulations and an analytical approach [3].

[1] H. Hölscher and B. Anczykowski. Surf. Sci. **579**, 21 (2005).
[2] T. Uchihashi et al., Appl. Phys. Lett. **85**, 3575 (2004).
[3] D. Ebeling, H. Hölscher, B. Anczykowski, Appl. Phys. Lett. **89**, 203511 (2006).

O 15.6 Mon 15:30 H41

Influence of the Local Adsorption Environment on the Intra-Molecular Contrast of Organic Molecules in Non-Contact Atomic Force Microscopy — •Andre Schirmeisen[1], Bartosz Such[2], Domenique Weiner[1], and Harald Fuchs[1] — [1]Center for Nanotechnology (CeNTech), University of Münster, Heisenbergstr.11, 48149 Münster, Germany — [2]Marian Smoluchowski Institute of Physics, Jagiellonian University, Reymonta 4, 30-059 Krakow, Poland

Organic molecules have fascinating electrical and optical properties making them promising candidates as fundamental building blocks for miniaturized and high-capacity electronic devices. In the effort to exploit the opportunities offered by organic molecules, however, one has to take into account that the local chemical environment of the molecule may strongly influence its properties. Thin epitaxial layers of the organic molecule 3,4,9,10-perylenetetracarboxylic dianhydrite (PTCDA) on a Cu(111) surface were imaged using non-contact atomic force microscopy in ultrahigh vacuum [1]. The second layer molecules show a distinct intra-molecular structure, which is compared to the internal charge distribution of the molecule. The molecules in the first layer, though, exhibit no detectable intra-molecular features. This effect is discussed with respect to the presence of the metallic substrate for the first layer molecules, which demonstrates the strong influence of the local adsorption environment on the internal electronic properties of organic molecules. [1] Such et al., Appl. Phys. Lett. 89, 093104 (2006)

O 15.7 Mon 15:45 H41

Kelvin Probe Force Microscopy on Electrically Inhomogeneous Fe/W(001) Films — •Ung Hwan Pi, Rene Schmidt, Alexander Schwarz, and Roland Wiesendanger — Institute of Applied Physics, University of Hamburg, Jungiusstrasse 11, 20355 Hamburg

Noncontact scanning force microscopy can give information about the real topography of the sample. However, this is valid only when the dominant tip-sample interaction is due to the van der Waals force. If the sample is electrically inhomogeneous, e.g., the sample has an inhomogeneous electric charge distribution, it causes additional electrostatic forces between tip and sample, which prevent real topography measurement. To nullify the electrostatic effect, the tip bias can be regulated with a special feedback scheme called Kelvin probe force microscopy. Here we applied Kelvin probe force microscopy to the pseudomorphic Fe thin film grown on W(001). In this highly strained film, the electric properties depend on the number of layers, yielding different contact potentials in each layer. The samples were prepared and measured in-situ under ultra high vacuum condition without exposing them to the atmospheric environment. When the tip bias was not regulated, the apparent step height of the film changed depending on the tip-sample bias, and a reliable measurement of topography was impossible. With Kelvin probe force microscopy, the contact potentials different in each layer could be compensated, and the real topography image could be obtained.

O 15.8 Mon 16:00 H41

Contact area dependence of friction on the nanoscale — •Dirk Dietzel[1,2], Tristan Mönninghoff[2], Andre Schirmeisen[2], Harald Fuchs[1,2], and Udo Schwarz[3] — [1]Forschungszentrum Karlsruhe (FZK), Karlsruhe, Germany — [2]Institute of Physics, University of Münster, Münster, Germany — [3]Department of Mechanical Engineering, Yale University, New Haven, CT, USA

A promising approach to analyze the fundamentals of friction on the nanometer scale is the lateral manipulation of small adsorbed islands by atomic force microscopy. In our case, the samples under investigation were metallic islands with diameters between 50-500 nm grown by thermal evaporation of antimony on highly oriented pyrolytic graphite (HOPG). With a newly developed manipulation procedure, which relies on contact-mode AFM operation, we have a simple and straightforward technique to manipulate the islands. Thereby, the lateral force signal of the AFM cantilever gives direct and quantitative information about the additional friction forces induced by the island pushing process. Using this technique, we focused on the contact area dependence of friction forces on the nanometer scale. By pushing a large variety of islands of different sizes, we found that the system shows a very clear behaviour with a linear dependence between the friction force and the contact area, thus reinforcing Amonton's law on the nanometer scale.

O 15.9 Mon 16:15 H41

Design of a High-Frequency Electric-Force Scanning Force Microscope for Vibration Spectroscopy at Single Macromolecules — Patrick Steffen, Ivo Knittel, and •Uwe Hartmann — Fachbereich Experimentalphysik, Im Stadtwald, Geb. C6.3, 66041 Saarbrücken

Mechanical properties of single macromolecules on timescales down to sub-nanoseconds are relvant to the understanding of the biological function of cell components. For an effective mechanical spectrocsopy at single macromolecules, a local excitation, with high amplitude and narrow bandwidth is necessary. In addition, detection should as well be local, and with narrow bandwidth. A complete microscope design is discussed in this contribution. A mechanical resonance of a sample macromolecule is excited by a charged AFM-tip. The oscillating sample molecule leads to an additional static force because of nonlineal tip-sample interaction. The size of this force is estimated by analytic and numerical methods. For the force modulation, signal-to-noise ratios and stabiltiy are investigated for several variants. The optimized design is suggested, incuding a suitable waveguide, and a suitable modulation of the exciting microwave.

O 15.10 Mon 16:30 H41

Optimum Excitation Conditions for SNOM-based Particle-enhanced Fluorescence Microscopy — •Thomas Härtling, Phillip Reichenbach, Marc-Tobias Wenzel, Phillip Olk, and Lukas Eng — Institut für Angewandte Photophysik, TU Dresden

Tip-enhanced microscopy, carried out for example by using a scattering near-field optical microscope (s-SNOM), is a powerful tool for nano-optical investigations. In this context, the manipulation of the fluorescent behavior of molecules with the help of single metal nanoparticles attached to the apex of a dielectric SNOM tip has been followed in the last years. This technique not only offers the advantages of high