O 79: Experimental methods

Time: Thursday 16:00–17:45 Location: A 060

O 79.1 Thu 16:00 A 060

Scanning tunneling potentiometry on the Au/Ge(001) surface — •Christian A. Bobisch[1], Mark R. Kaspers[1], Alexander M. Bernhart[1], Mateusz Wojtaszek[2], Franciszek Krok[2], Marek Szymonski[2], and Rolf Möller[1] — [1]Faculty of Physics, Center for Nanointegration Duisburg-Essen, University of Duisburg-Essen, 47048 Duisburg, Germany — [2]Department of Physics of Nanostructures and Nanotechnology, Jagiellonian University, 30-059 Krakow, Poland

Recently many studies focus on self organized Au atom wires on the Ge(001) surface. This surface offers the unique opportunity to study a Tomonoga-Luttinger liquid, i.e. a one dimensional electronic system [1,2]. In order to study electron transport through such a surface, the coupling of the metallic leads to the surface is a crucial parameter. We use a multiprobe scanning tunneling microscope (STM) to analyze the lateral variation of the electrochemical potential caused by a current parallel to the surface induced by two tips. In the scheme of scanning tunneling potentiometry a third STM tip measures the topography and the electrochemical potential μ_{ec} of the surface simultaneously [3]. The excess amount of Au deposited onto the Ge(001) surface condenses into crystalline islands. However, our potentiometry data reveal a discontinuity of μ_{ec} at the edges of these islands. This indicates that the islands do not couple to the electronic system of the Au reconstructed Ge(001) surface.

[1] Phys. Rev. Lett. 101, 236802 (2008). [2] Nat. Phys. 7, 776, (2011). [3] Nano Lett. 9, 1588 (2009).

O 79.2 Thu 16:15 A 060

Quantitative investigation and optimization of porous anodic alumina for surface nanostructuring beyond existing limitations — •Stefan Ostendorp[1], Jörn Leuthold[1], Yong Lei[1,2], and Gerhard Wilde[1] — [1]Institut für Materialphysik, WWU Münster — [2]Institut für Physik & IMN (ZIK) MacroNano, TU Ilmenau

Porous anodic alumina (PAA) is a versatile and cost-efficient template material for various applications in surface nano-structuring. As porous anodic alumina membranes (PAAMs), it can be used for arrays of 1-dimensional nano-structures. Arrays of nano particles can be fabricated by ultra-thin alumina membranes (UTAMs). Thereby this PAA based nano-structuring techniques allow to modify structural parameters of fabricated nano-structures such as size, shape and spacing of nano-particles as well as diameter and length of wires or tubes. The outstanding ability of creating large scale arrays of hexagonally arranged nano-structures makes this technique interesting for different fields from fundamental physical studies to applications in optics or electronics. But actually the range of fabrication conditions resulting in regular PAA was rather limited so far. Here we present our recent progress extending these limitations. By detailed studies of the formed porous structures and by applying a newly developed method for quantifying their regularity we were able to tune the fabrication conditions and realize regular PAA with structural parameters beyond the known limitations. Furthermore, we present a novel fabrication technique to realize regular UTAMs for nano-structuring purposes within the newly extended range of accessible structural parameters.

O 79.3 Thu 16:30 A 060

Development of a stress measurement for pulsed laser deposition of $BaTiO_3$ — •Jörg Premper, Dirk Sander, and Jürgen Kirschner — Max-Planck-Institut für Mikrostrukturphysik, Weinberg 2, D-06120 Halle

The structural analysis of $BaTiO_3$ monolayers on Fe(001) reveals unexpected structural relaxations near the interface and a minimum thickness for polarisation was deduced from theory to be 2 unit cells [1]. Structural relaxation and onset of polarization are expected to induce characteristic signatures of both interface and film stress of this system. To measure these stresses, we set up an optical 2-beam crystal curvature measurement, which allows stress measurements during pulsed laser deposition of $BaTiO_3$. We use a scanning mirror for the homogeneous ablation of the $BaTiO_3$ target to avoid a rotary UHV-feedthrough of a rotating target. First results on the stress measurements during PLD of $BaTiO_3$ are presented, which indicate the feasibility of reliable stress measurements. This is a comforting result in view of the plasma bloom of the ablation process hitting the thin crystal, where one might have expected a detrimental disturbance on the optical curvature measurement.

[1] H.L. Meyerheim, F. Klimenta, A. Ernst, K. Mohseni, S. Ostanin, M. Fechner, S. Parihar, I.V. Maznichenko, I. Mertig and J Kirschner: Phys. Rev. Lett. **106** (2011), 087203

O 79.4 Thu 16:45 A 060

Time-resolved Nanojoule Adsorption Calorimetry — •Ole Lytken[1], Hans-Peter Steinrück[1], Hans-Jörg Drescher[2], and J. Michael Gottfried[2] — [1]Universität Erlangen-Nürnberg — [2]Universität Marburg

In a typical nanojoule adsorption calorimeter, the average heat of adsorption of a small pulse of molecules is measured as a temperature change in a thin single-crystal sample. The temperature change is often measured using a pyroelectric polymer pressed gently against the backside of the sample. For calibration of the calorimeter, a laser beam with known intensity is used to deposit a known amount of heat in the sample. This calibration works well when the reaction studied is fast. If, however, the initial fast adsorption is followed by a slower secondary reaction, such as a slow desorption, dissociation or segregation into the sample, the shape of the measured signal and the calibration signal start to deviate. Here we will present a method to analyze calorimeter signals which include such slow reactions and extract information, not only of the total amount of heat deposited in a given pulse, but also kinetic information about the slow reaction.

O 79.5 Thu 17:00 A 060

Characterisation and compression of pJ white-light continuum pulses — •Daniel Wegkamp[1], Simon Wall[1], Daniele Brida[2], Stefano Bonora[2], Giulio Cerullo[2], Julia Stähler[1], and Martin Wolf[1] — [1]Fritz-Haber-Institute of the MPG, Dep. of Physical Chemistry, Berlin, Germany — [2]Politecnico di Milano, Dipartimento di Fisica, Milan, Italy

Pump-probe-spectroscopy using ultrashort laser pulses allows access to the temporal evolution of electron and lattice dynamics. Probing the system in spectral regions that differ from the pump wavelength can give additional insights into those dynamics. White-light continuum pulses enable probing of wide spectral regions without the need of tuning the light source and their bandwidth enables the generation of ultrashort pulses for pump-probe experiments. Compression of the white-light pulses allows us to measure spectrally resolved as well as integrated *without* the loss of temporal resolution and, furthermore, the pulses may be incorporated in *nonlinear* optical probing schemes. White-light pulses are generated by self-phase modulation due to focusing of 40 fs laser pulses (800nm, 300 kHz Ti:Sa amplifier system) into a YAG crystal. To compress the pulses we measure the wavelength-dependent group delay in a simple pump-probe-setup. On this basis, we compensate for the phase of the laser pulse by adapting a deformable mirror, which is placed in the fourier-plane of a 4-f-compressor. Near transform-limited pulses of about 10 fs duration are achieved. These are applied to measure the ultrafast dynamics of VO_2 below and above the threshold for the photoinduced phase transition.

O 79.6 Thu 17:15 A 060

Optimizing the sensitivity of energy-selective photon detectors for use in inverse photoemission: VUV-transmission properties of CaF_2 windows — •Christian Thiede, Karen Zumbrägel, Matthias Rüter, Anke B. Schmidt, and Markus Donath — Westfälische Wilhelms-Universität, Münster, Nordrhein-Westfalen

Band-pass photon detectors are widely used in inverse-photoemission experiments performed in the isochromat mode. In Geiger-Müller counters, the band-pass behavior is realized by combining the photoionization threshold of a suitable counting gas (high pass) with the transmission characteristics of an alkaline earth fluoride window (low pass). Since inverse photoemission generally suffers from a low photon yield, an optimized detector efficiency is crucial for this technique.

One of the critical parameters is the transmission characteristics of the entrance window. We present transmission measurements for CaF_2 windows in the vacuum-ultraviolet spectral range in the vicinity of the transmission cutoff as a function of crystal purity as well as surface finish, adsorbate coverage, thickness, and temperature. Our findings

reveal that the sensitivity of the photon counter depends critically on these window parameters.

O 79.7 Thu 17:30 A 060

Nanojoule Adsorption Calorimetry — •Hans-Jörg Drescher[1,2], Han Zhou[1], Ole Lytken[2], Hans-Peter Steinrück[2], and J. Michael Gottfried[1] — [1]Philipps-Universität Marburg — [2]Friedrich-Alexander-Universität Erlangen-Nürnberg

Nanojoule Adsorption Calorimetry (NAC) is a modern technique for measuring adsorption enthalpies of molecules or atoms on well-defined substrates, such as thin metal or oxide single crystals and organic thin films. Similar to previous adsorption calorimeters by Černy, King and Campbell, NAC relies on the direct measurement of tiny temperature changes induced by adsorption utilizing pyroelectric detectors. Thus, its scope extends beyond that of conventional methods such as temperature-programmed desorption (TPD), which require reversible adsorption and cannot be used if thermal decomposition occurs at a lower temperature than desorption. The apparatus is optimized for investigating well-defined metal-organic interfaces, which are models for interfaces in organic electronic devices. Specifically, this contribution covers the design considerations arising from constructing and optimizing a calorimetry apparatus with outstanding sensitivity and accuracy in the nanojoule and picomole regimes as well as first proof of concept measurements. These basic studies aim at interfaces between low-work function metals and π-conjugated semiconducting polymers playing an important role in the above-mentioned devices.

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