O 5.9 Fr 12:45 TU EB107

Dynamics of Electron Transfer, Trapping, and Solvation in D_2O/Ru(001) — •Julia Stähler, Uwe Bovensiepen, Cornelius Gahl, and Martin Wolf — Fachbereich Physik, Freie Universität Berlin, Arnimallee 14, 14195 Berlin, Germany

The dynamics of excess electrons photo-injected into ultrathin ice layers on Ru(001) has been studied by femtosecond time-resolved two photon photoelectron (2PPE) spectroscopy. The electrons' residence time in the adlayer is limited due to the transfer matrix element between substrate and adsorbate. In amorphous ice layers, this leads to subps-lifetimes of the solvated electrons. These are initially injected into the ice conduction band before they start to stabilize 2.9eV above the Fermi level [1]. In contrast, we observe excess electrons within crystalline D_2O/Ru(001) that present lifetimes up to several minutes before they relax back to the metal. Variation of the UV excitation energy shows that these electrons are transferred to the delocalized image potential state within the ice layer before they localize more than 2eV above the Fermi level into preformed traps. During their extremely long lifetime an increase of binding energy is observed, which is attributed to a rearrangement of the polar environment. The notable temperature dependence of binding energy and photoelectron intensity will be discussed.

[1] U. Bovensiepen et al., Isr. J. Chem. 45 (2005), in press

O 6 Grenzfläche fest-flüssig

Zeit: Freitag 10:45–13:00 Raum: TU EB407

O 6.1 Fr 10:45 TU EB407

Surface Stress – Charge Coefficient for Charged Nanoporous Platinum — •Viswanath Raghavan Nadar[1], Dominik Kramer[1], and Jörg Weissmüller[1,2] — [1]Forschungszentrum Karlsruhe, Institut für Nanotechnologie, Karlsruhe — [2]Universität des Saarlandes, Fachrichtung Technische Physik, Saarbrücken

If porous, nanostructured metals immersed in an electrolyte are charged electrically, volumetric expansion and contraction is induced in phase with the applied potential[1,2], with strain amplitudes comparable to those of commercial piezoceramics. Several microscopic interactions contribute to the potential dependence of the surface stress and the corresponding interfacial properties: electrostatic repulsion in the space−charge layers, changes in the bonding between metal atoms, and forces between neighboring adsorbate atoms or between adsorbates and the metal. The relative contributions of these interactions are so far not well understood. The present study is to obtain insight into this issue by studying the electrolyte concentration dependence of the surface stress − charge coefficient ζ for platinum. We compute ζ from the volumetric strain measured from in−situ dilatometer experiments and discuss the influence of specific adsorption. [1] J. Weissmüller et al, Science 300 (2003) 312; [2] D. Kramer, R. N. Viswanath, J. Weissmüller, Nano Letters 4 (2004) 793

O 6.2 Fr 11:00 TU EB407

Kompression der Au(111) Oberflächenschicht während homoepitakitischer elektrochemischer Abscheidung — •Jochim Stettner, Ahmed Ayyad und Olaf Magnussen — Institut für Experimentelle und Angewandte Physik, Christian-Albrechts-Universität Kiel, Leibnizstraße 19, 24098 Kiel

Die strukturelle Untersuchung von Metalloberflächen unter reaktiven Bedingungen ist von hoher Bedeutung für das Verständnis elektrochemischer Prozesse. Wir haben die homoepitaktische elektrochemische Abscheidung von Au(111) in wässrigen Elektrolytlösungen untersucht. Dieses System ist für grundlegende Studien aufgrund der potentialabhängigen $(p \times \sqrt{3})$ Rekonstruktion der Au(111)-Oberfläche besonders interessant. In-situ Oberflächen-Röntengenbeugungsexperimente unter streifendem Einfall zeigen im Vergleich zu entsprechenden Experimenten in Au-freien Elektrolyten oder unter UHV Bedingungen $(p \approx 22)$ eine signifikant erhöhte Kompression der obersten Au-Monolage. Die Kompression nimmt zu negativeren Potentialen hin zu und erreicht im gewählten Potentialbereich ein Maximum von 5.5% $(p \approx 18)$. Mit Hilfe eines thermodynamischen Modells kann der Kompressionseffekt semiquantitativ durch den Abbau potential-induzierter mechanischer Spannungen in der Au-Oberfläche erklärt werden.

O 6.3 Fr 11:15 TU EB407

Quantitative in-situ Video-STM study of the lateral displacements of isolated reconstruction strings on Au(100) electrodes — •Miguel Labayen, Christian Haak, and Olaf Magnussen — Institut fur Experimentelle und Angewandte Physik, Leibnizstrasse 19, Universitaet Kiel, Kiel 24098, Deutschland

The dynamic behavior of the reconstructed Au(100) surface has been studied in Cl- containing solution via in-situ electrochemical high-speed scanning tunneling microscopy (Video-STM), at image acquisition rates of 15 - 20 frames per second. The Au(100)(1x1) surface structure undergoes reconstruction of the top-most layer to a hexagonal close-packed structure at negative potentials. The elemental units of this reconstructed surface are parallel strings separated 14.5 Å. We have focused our study to the high mobility of isolated strings perpendicular to the main direction[1]. Jump distribution functions for individual strings indicate contributions by at least two different processes (jumps by one and two atomic distances). String jumps can be ascribed to small atomic displacements in the strings induced by propagating kinks. The mechanisms of kink nucleation and propagation and the corresponding energy barriers, obtained from temperature-dependent measurements, are discussed.

[1] M.Labayen, C.Ramirez, W.Schattke, O.M.Magnussen, Nature Materials 2, 783 (2003).

O 6.4 Fr 11:30 TU EB407

In Situ Observation of Adsorbates Diffusion on Au(111) using Electrochemical Video-STM — •Koji Suto and Olaf Magnussen — Institut für Experimentelle und Angewandte Physik, Universität Kiel, Kiel, Germany

The diffusion and interaction of molecular adsorbates on solid-liquid interface is an important fundamental subject of surface physics, due to its relevance for numerous surface processes, e.g. catalytic reactions, growth, or the formation of self-assembled adlayers. This time we report investigation of adsorbates motion at metal electrode - liquid electrolyte interfaces by an electrochemical Video-STM, capable of recording up to 30 images per sec and with atomic scale resolution. Full coverage of sulfate adlayers were observed to form well defined structure of $(\sqrt{3} \times \sqrt{7})$ on Au(111)-(1 × 1) surfaces at 0.8 V vs. SCE in sulfuric acid solution as reported before [1], which fluctuated strongly in slightly negative potential region due to pronounced migration of the adsorbates between neighboring domains. 1,4-butanedithiol, a strong chemisorbed organic species, were found to migrate individually on the reconstructed Au(111) surface (at 0.3 V vs. SCE) at low coverage in acidic solution. The diffusion process could not be described by simple hopping migration, but involved rotational motion and translational motion of the adsorbates on the surface.

[1] O. M. Magnussen, J. Hageboeck, J. Hotlos, R. J. Behm, Faraday Discuss., 94 (1992) 329.

O 6.5 Fr 11:45 TU EB407

Elektrochemisch präparierte ultradünne Kupfersulfidfilme auf Au(111)-Oberflächen — •Christian Schlaup, Daniel Friebel, Peter Broekmann und Klaus Wandelt — Institut für Physikalische und Theoretische Chemie, Universität Bonn, Wegelerstr. 12, D-53115 Bonn

In alkalischen Lösungen wurde die Adsorption von Sulfid $(S^{\,2-})$ auf ultradünnen Kupferfilmen durch *in-situ* Rastertunnelmikroskopie in Verbindung mit zyklischer Voltrammetrie untersucht. Hierzu wurde auf einem Au(111)-Einkristall durch Unterpotential-Abscheidung entweder eine $(\sqrt{3} \times \sqrt{3})R30^\circ$ 2/3-Monolage oder eine vollständige (1 × 1) Cu-Monolage erzeugt. Auf den so erzeugten Cu-Filmen wurde anschließend Sulfid aus 0.1 M Natronlauge (pH ≈ 13) adsorbiert. Die dabei gebildeten potentialabhängigen Adsorbatstrukturen unterscheiden sich grundlegend von den bekannten Adsorbatstrukturen von Sulfid auf Au(111) bzw. Cu(111)-Oberflächen und werden im Folgenden vorgestellt und charakterisiert.

O 6.6 Fr 12:00 TU EB407

Potentialabhängige Tracer-Diffusion von Sulfidadsorbaten auf Cu(100)-Elektroden in HCl Lösung — •Tunay Tansel und Olaf Magnussen — Institut für Experimentelle und Angewandte Physik, Christian-Albrechts-Universität Kiel, Leibnizstrasse 19, D-24098 Kiel, Germany