O 89: Poster Session - Oxide and Insulator Surfaces: Structure, Epitaxy and Growth

Time: Wednesday 18:15–20:00 Location: P2/1OG

O 89.1 Wed 18:15 P2/1OG

High Pressure Oxidation of Copper - From Thin Films to Bulklike Materials — •Alexander Gloystein and Niklas Nilius — Institute of Physics, Carl von Ossietzky University Oldenburg, Germany

Copper oxidation at UHV-compatible O2 pressures only enables the formation of few-layer thick oxide films. In contrast, arbitrarily thick layers are produced by Cu deposition onto Au(111) followed by oxidation at 20-50 mbar O2. According to XPS, the Cu completely oxidizes to Cu2O in this case, while LEED reveals a highly uniform Cu2O(111) surface. The film morphology is governed by large hexagonal crystallites, being terminated by Cu-O six rings decorated with a sqrt3 shamrock structure known from bulk Cu2O(111). The latter indicates a high reducibility of the film, and even larger Cu aggregates emerge on the oxide surface upon vacuum annealing. The oxide reduction can also be followed in STM conductance spectra that evolve from a p-type behavior with a unique acceptor state above E(Fermi) to an almost stoichiometric conductance response. Further information on the Cu2O defect structure is obtained from temperature-controlled photoluminescence spectroscopy.

O 89.2 Wed 18:15 P2/1OG

Morphological study of vanadium dioxide (VO_2) thin films grown on the different substrates using STM — •Aman Baunthiyal, Simon Fischer, Jon-Olaf Krisponeit, and Jens Falta — Institute of Solid State Physics, University of Bremen, Germany

Vanadium dioxide (VO_2) is an interesting material for sensor and memory devices due to its metal-insulator transition (MIT) near room temperature (RT) that is accompanied by a structural change between a monoclinic insulator phase and a rutile metallic phase. This temperature can be varied by the choice of the substrate: TiO_2(110) and RuO_2(110) applies in-plane tensile strain to the rutile c-axis which leads to an increase of the transition temperature of VO_2, favoring the monoclinic phase.

RuO_2(110) islands were formed on the surface of a Ru crystal by oxidizing it while observing with in-situ LEEM and LEED. Then, VO_2 was deposited using molecular beam epitaxy (MBE). VO_2 growth on TiO_2(110) substrate was grown through the same process. To study the surface morphology of VO_2 grown on RuO_2(110) and TiO_2(110), we used STM (scanning tunneling microscope) at RT. In the case of VO_2/RuO_2, the surface of VO_2 was found flat with two rotational domains separated by 60 degrees. The thickness of VO_2 on RuO_2 was measured to be about 3 to 4 nm using XRR (X-ray Reflectometry). In the case of VO_2/TiO_2, the surface was also found to be flat but showing small grains of VO_2 on the TiO_2 surface. Next, we intend to study the effect of different substrates on the MIT transition of VO_2 by variable temperature STM (VT-STM) using single-point spectroscopy.

O 89.3 Wed 18:15 P2/1OG

Surface Charge patterning and mapping on SrTiO3 thin films — •Mirco Wendt[1], Eric Andersen[1], Regina Lange[1], Sven Kraft[1], Ronny Brandenburg[1,2], Ingo Barke[1], and Sylvia Speller[1] — [1]Institute of Physics, University of Rostock, 18059 Rostock, Germany — [2]Leibniz Institute for Plasma Science and Technology, 17489 Greifswald, Germany

Perovskites such as SrTiO3 are oxides with high permittivity which show ferroelectric behaviour under certain conditions [1]. We address the question whether surface charges can be stabilised by strong substrate polarisation which would be an interesting property for controlled adsorption, e.g. via command layers, and for biological applications. We use SrTiO3 thin films grown by pulsed laser deposition on SrTiO3(100) and expose them to electron beams through a mask at different kinetic energies in a scanning electron microscope (SEM). Detection is accomplished by force microscopy methods (AFM) with the aim to map the resulting charge distributions. Alternative techniques for charge deposition, detection and imaging are discussed.

[1] HW Jang, et al, Phys Rev Lett 104, 197601(2010)

O 89.4 Wed 18:15 P2/1OG

Muscovite Mica: Cleaved in UHV, Exposed to Water Vapour, Imaged with nc-AFM — •Sebastian Brandstetter, Michael Schmid, Markus Valtiner, Ulrike Diebold, and Martin Setvín — Institute for Applied Physics, TU Wien, Wiedner Hauptstraße 8-10, 1040, Vienna, Austria

The Muscovite Mica(001) surface is used as an atomically well defined model substrate in a variety of applications ranging from imaging DNA to high resolution studies of solid/liquid interface structures. To prepare a well defined substrate purified water is commonly used to rinse freshly cleaved muscovite to dissolve potassium cations. Little is known about the hydration and mobility of surface cations at the atomic scale. Here we present non-contact AFM measurements in ultrahigh vacuum (UHV) resolving single potassium atoms on the UHV-cleaved surface. We find evidence of hydrated potassium atoms after dosing sub-monolayer amounts of molecular H_2O to the cleaved sample below temperatures of 140 K. The as-cleaved surface presents domains of uncompensated charges while the adsorption of water molecules at the surface facilitates growth of ice-like structures at temperatures below 5 K.

O 89.5 Wed 18:15 P2/1OG

Epitaxial growth of RuO_2(110) thin films on TiO_2(110) substrates by pulsed-laser-deposition — •Philipp Kessler, Matthias Schmitt, Berengar Leikert, Philipp Schütz, Martin Kamp, Michael Sing, Ralph Claessen, and Simon Moser — Experimental Physics IV, Julius Maximilian University of Würzburg

Ruthenium dioxide (RuO_2) is a functional semimetal hosting a network of Dirac nodal lines in its bulk and a flat band state at its surface. For spectroscopic and transport measurements on this material, stoichiometric films of high crystalline quality and well-ordered surfaces are needed. Here we present a growth study of rutile RuO_2(110) thin films on TiO_2(110) substrates by pulsed-laser-deposition. In situ growth monitoring by RHEED in combination with ex situ characterization based on LEED, XPS, AFM and STEM reveal defect free epitaxial films up to 10 unit cells thickness, limited by formation of volatile species at the surface. Strategies to overcome this thickness limitation will be outlined.