DS 8: Optical Analysis of Thin Films I

Time: Wednesday 12:00–13:00 Location: H3

DS 8.1 Wed 12:00 H3

Initial stages of Palladium growth on vicinal Si(001)-(2*1) surfaces — •Sandhya Chandola[1], Norbert H. Nickel[1], Julian Plaickner[2], Jörg Rappich[1], Karsten Hinrichs[1], and Norbert Esser[2] — [1]Nanoscale Solid-Liquid Interfaces, Helmholtz-Zentrum Berlin für Materialien und Energie,Schwarzschildstr. 8, 12489 Berlin, Germany — [2]Institut für Festkörperphysik, TU Berlin, Hardenbergstr. 36, 10623 Berlin, Germany

Although palladium-based silicides are of great interest in many microelectronic applications, their formation mechanisms are still not fully understood, especially for thin films where the silicidation reaction may be controlled from the initial Pd-Si interactions at the interface.

The early stages of palladium silicide formation have been investigated in ultra-high vacuum (UHV), using Reflectance Anisotropy Spectroscopy (RAS) and Raman spectroscopy on vicinal Si(001) surfaces with different degrees of ordering. Raman spectroscopy has identified silicide-like reacted phases at the Si-Pd interface upon annealing, with the appearance of several phonon modes which are in very good agreement with vibrational modes obtained from ab initio calculations for Pd incorporation into Si surface layers.

The growth morphology of the Pd-Si structures was shown to be dependent on the initial surface reconstruction with in-situ RAS and ex-situ AFM (atomic force microscopy) clearly distinguishing between two types of structures depending on the substrate template.

DS 8.2 Wed 12:15 H3

Ultrafast Charge Carrier Dynamics in Niobium Probed in the Visible Spectral Range — •Noah Stiehm[1], Shirly Espinoza[2], Mateusz Rebarz[2], Saul Vazquez Miranda[2], Erik Müller[3], Hannes Töpfer[3], Stefan Krischok[1], and Rüdiger Schmidt-Grund[1] — [1]Technische Universität Ilmenau, Fachgebiet Technische Physik I, Weimarer Straße 32, 98693 Ilmenau, Germany — [2]ELI Beamlines Facility, The Extreme Light Infrastructure ERIC, Za Radnicí 835, 25241 Dolní Břežany, Czech-Republic — [3]Technische Universität Ilmenau, Fachgebiet Theoretische Elektrotechnik, Helmholtzplatz 2, 98693 Ilmenau, Germany

With the recently developed experimental method of femtosecond time-resolved spectroscopic ellipsometry (trSE) [1], it is possible to obtain the transient dielectric function of a sample after excitation in a pump-probe scheme. We present results of applying the technique to study the ultrafast charge carrier dynamics in the transition metal Niobium. We show that it is possible to observe bleaching in the dielectric function for several 100 picoseconds and up to 1 nanosecond, depending on the pump wavelength, resulting from exciting charge carriers into higher conduction bands, where they relax into band minima and remain stable for some time until recombination.

The initial results from this study at room temperature provide valuable insight into the ultrafast charge carrier dynamics and good motivation to conduct further investigations under cryogenic conditions in the superconducting phase.

[1] S. Richter *et al.*, Rev. Sci. Instrum. 92, 033104 (2021).

DS 8.3 Wed 12:30 H3

Investigation of metal surfaces using Surface Resonant Raman Scattering — •Sarang Bhasme, Mariella Denk, Simon Kalteis, and Peter Zeppenfeld — Johannes Kepler University, Linz, Austria

We have recently demonstrated the possibility to investigate surface phonons on metals by surface resonant Raman spectroscopy (SRRS), in which the Raman cross section is significantly enhanced by resonant excitation of optical transitions involving surface electronic states [1]. Here we report new investigations regarding the phonon and electron scattering mechanism on clean and adsorbate-modified Cu(110) surfaces using SRRS and reflectance difference spectroscopy (RDS) under ultra-high vacuum (UHV) conditions and variable temperatures. We have modified the Cu(110) surface electronic states via ion bombardment and by adsorption of small molecules such as oxygen or CO to explore its effect on the Raman signals. We find that both the phonon and the electron related scattering strongly depend on the details of the surface cleanliness and structural properties, underscoring the influence of the surface electronic structure and adsorbate interactions on the Raman signatures.

[1] M. Denk et al., Phys. Rev. Lett. 128, 216101 (2022).

DS 8.4 Wed 12:45 H3

Watching hydrogen diffusion into Lutetium and Yttrium thin films with Pd cap layers — •Zahra Hojjati, Philipp Flad, and Harald Giessen — 4. Physikalisches Institut, Universität Stuttgart

Hydrogenated Lutetium is one of the materials that may have a potential to be used as high-temperature superconductor under high pressure. Recently, reports have indicated that the Lu-H-N system undergoes a phase transition to blue when hydrogenated, with unconfirmed reports suggesting superconductivity. Therefore, we investigate hydrogen-lutetium interactions and the dynamics of hydrogen diffusion within lutetium, which is influenced by the ambient temperature, crystal structure and the hydrogen concentration. Hydrogen diffusion in metals involves interstitial diffusion through the lattice and surface absorption. We find that lutetium is a good hydrogen storage material due to its diffusion properties.

We analyzed the progression of the blue hydrogenation front in Lutetium and subsequently measured the drift velocity for each sample. We calculated the activation energy required for protons to overcome the potential barrier using the Arrhenius equation. Following this, we determined the diffusion constant based on the diffusion equation. We also carry out the same experiments with Yttrium.