O 44: Poster Oxides and Insulator Surfaces: Structure, Epitaxy and Growth

Time: Tuesday 18:00–20:00 Location: P2

O 44.1 Tue 18:00 P2

The dynamic interaction of size-selected Pt clusters with CeO_2/Rh(111) — •Mina Soltanmohammadi, Johanna Reich, Barbara A.J. Lechner, and Friedrich Esch — Technical University of Munich, TUM School of Natural Sciences, Department of Chemistry, Germany

Recent studies on Pt clusters supported on ceria have revealed interesting cluster formation and redispersion processes that can be induced by cyclic redox treatments [1]. These catalysts' activity for combustion is linked to the verge of cluster formation. Here, we investigate the dynamic interaction of size-selected Pt clusters with $CeO_2(111)$ thin films at the atomic scale, using a combination of scanning tunneling microscopy (STM) and X-ray photoelectron spectroscopy (XPS). We present a preparation protocol to obtain highly clean, crystalline and stochiometric $CeO_2(111)$ thin films with extended terraces and well-defined monoatomic steps. Distinct oxygen vacancy distributions are obtained by either annealing in vacuum or reducing in a methanol atmosphere. We then systematically explore the interaction of Pt clusters with the support, particularly the mobility and sintering in dependence of the defect state. The influence of support stoichiometry and the parameters controlling the resulting cluster dispersion are presented. Finally, we present first studies of the Pt dispersion under cyclic oxidizing (O_2) and reducing (methanol) conditions at elevated temperatures, focusing on the resulting cluster configurations at the atomic scale.

[1] Farnesi Camellone et al., ACS Catal. 2022, 4859.

O 44.2 Tue 18:00 P2

Search for crystalline SiO_2 on the wet chemically treated 6H-SiC(0001) surface — •Paul Schöngrundner[1], Igor Sokolovic[2], and Ulrike Diebold[2] — [1]Department of Physical Chemistry, University of Graz, 8010, Austria — [2]Department of Applied Physics, Technical University of Vienna, 1040, Austria

A 6H-SiC(0001) surface was found to host a crystalline superstructure consisting of SiO_2 after wet chemical treatment. This surface was envisioned as a model system for surface chemistry studies. In order to replicate and optimize this film, chemical and thermal treatments were investigated systematically. Using atomic force microscopy (AFM), x-ray photoelectron spectroscopy (XPS) and low energy electron diffraction (LEED), an improved cleaning methodology was established, resulting in contaminant-free surfaces (except adventitious C), but they were terminated with amorphous SiO_2 instead of a crystalline film. If the sample was treated by repeating the original cleaning technique, which was finished with Extran and milliQ sonication, without subsequent boiling in H_2O, the original surface termination could be re-prepared. However, this was accompanied by P and Cr contamination. It is hypothesized that P and/or Cr contamination were ultimately responsible for the crystalline silicon oxide overlayer.

O 44.3 Tue 18:00 P2

Pulsed laser deposition of epitaxial hematite α-Fe_2O_3 thin films on $Al_2O_3(1\bar{1}02)$ — •Sarah Tobisch, Giada Franceschi, Michael Schmid, Gareth Parkinson, Ulrike Diebold, and Michele Riva — Institute of Applied Physics, TU Wien, Vienna, Austria

Hematite α-Fe_2O_3 is a widely used support material for catalysis due to its abundance and high stability at ambient pressures. However, the insulating nature of the material poses major challenges, as it makes it difficult to achieve sufficient conductivity for techniques such as scanning tunnelling microscopy (STM). Samples commonly consist of natural crystals that can contain a variety of impurities as well as structural defects. The former problem is hardly controllable while the latter can lead to mechanical instabilities. While the conductivity can be improved by growing Ti-doped epitaxial films, the synthesis of hematite single crystals is still in its infancy and the size of these crystals is insufficient for many surface-analysis techniques. Therefore, new strategies to ensure the growth of flat and atomically defined doped films without the need of natural-crystal substrates are highly desired.

In this work, epitaxial growth of Ti-doped Fe_2O_3 on $Al_2O_3(1\bar{1}02)$ was investigated using a pulsed-laser-deposition (PLD) system with high-pressure reflection high-energy electron diffraction (RHEED) to optimize the growth conditions and monitor the growth behavior. The morphology and composition of the film's surface was characterized using x-ray photoelectron spectroscopy (XPS), atomic force microscopy (AFM), and STM.