

The POLARIS Endstation at Beamline P22 at Petra III: Development and First Results on Catalytic Systems

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The chemical industry is heavily relying on catalyst materials that are used in the product chain to enhance the rate and selectivity of chemical reactions. In order to generate a sustainable society, hydrogenation processes related to CO and CO₂ are of great importance to generate fuels and chemicals. The related processes take place under elevated pressure of several bar and increased temperature above 100°C. Some of the most important information about the catalytic process is related to the bond breaking and bond formation of molecules at interfaces.

In my talk I will focus on the development of a new high-pressure x-ray photoelectron spectroscopy (HP-XPS) setup that is intended to give insight into the mechanistic details of those reactions.

The instrument takes advantage of a “virtual cell” which is a novel concept in which a gas stream is pointed towards the sample surface to create a localized high-pressure pillow. Synchrotron based hard x-ray excitation is used to enhance the inelastic mean free path of the electrons inside the high-pressure gas environment. Surface sensitivity is achieved by grazing incidence spectroscopy below the critical angle of total reflection.

Details on the instrument and first measurement results including results from methanol synthesis obtained at beamline P22 at Petra III will be presented.