Surface Dynamics in Model Catalysts: Insights from NAP-XPS and STM

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The NAP-XPS/STM laboratory at Charles University, Czech Republic, is designed to bridge the gap between conventional surface science and industrial catalysis. The integrated experimental setup combines complementary surface science techniques, including X-ray photoelectron spectroscopy (XPS) and scanning tunneling microscopy (STM), enabling the investigation of surface structure and chemistry while maintaining sample purity without breaking vacuum. Near-ambient-pressure (NAP) adaptations of XPS and STM further enable time-resolved monitoring of surface changes under reactive conditions.

This presentation will highlight two studies of model catalysts under reaction conditions, demonstrating how surface dynamics can differ significantly from behavior observed under ultrahigh vacuum (UHV) conditions. The first study investigates pressure-dependent CO adsorption on Ni(111) using NAP-STM over a CO pressure range of 10^{-9} to 50 mbar. The study also addresses discrepancies in the literature regarding the preferred adsorption sites of CO on Ni(111). The second study examines the dynamic redistribution of Fe in a CeO_2(111) model catalyst under reducing and oxidizing conditions, demonstrating how the redox environment influences the structure and localization of the Fe dopant in ceria.

Short bio:

František Pchálek is a PhD student in the Department of Surface and Plasma Science at Charles University in Prague. His research focuses on model studies of mixed cerium oxides under NAP conditions. He also actively participates in technical support for CERIC experiments conducted in the NAP-XPS/STM laboratory. In addition, he provides experimental and educational assistance for several bachelor's and master's theses related to his research topic, while developing his skills in small-team management.