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Seeing is believing - Novel in situ techniques for studies of model catalysts

Motivated mainly by catalysis, gas-surface interactions between single crystal surfaces and molecules has been studied for decades. Although, most of these studies have been performed in unrealistically well-controlled environments, they form the basis for the present day understanding of catalysis. We have in recent years explored the possibilities to perform experiments at conditions closer to those of a technical catalyst, in particular at increased pressures. In this contribution, results from catalytic CO oxidation over Pd and Rh single crystal surfaces using high pressure X-ray photoelectron spectroscopy (HPXPS), planar laser induced fluorescence (PLIF), and high energy surface X-ray diffraction (HESXRD) will be presented.

Armed with structural knowledge from ultra-high vacuum experiments, the presence of adsorbed molecules and gas-phase induced structures can be identified, and related to changes in the reactivity and/or to reaction induced gas-flow limitations. The strength and weaknesses of the experimental techniques will be discussed.