

Simultaneous Study of Catalyst Structure, Gas Phase and Morphology

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CO oxidation has long been studied as a model reaction for catalysis diagnosis. In recent time, increased focus has been given to study well-defined single crystal surfaces to further investigate the details of the involved reaction mechanisms[1]. During the past years, new techniques have been developed to study both the surface structure and gas phase in a semi-realistic environment such as High Energy Surface X-Ray Diffraction (HESXRD)[2] and Planer Laser Induced Fluorescence (PLIF)[3]. HESXRD is a technique well suited to gain knowledge about the surface structure, but without any macroscopic spatial resolution. Planar Laser Induced Fluorescence (PLIF) is a technique which excels at determining the structure and composition of the gas phase. One of the main advantages of this technique is its high spatial and immediate temporal resolution. Additionally, LED surface reflectance techniques have been developed, which provide a simple way of producing a macroscopic map of the entire single crystal, clearly visualizing changes on the surface[4].

In this work, the mentioned techniques were combined at the beamline P07 at PETRA III while performing CO oxidation over a Pd100 single crystal sample. We have shown a clear spatial correlation between a reduced surface reflectance and an increased CO₂ concentration in the gas phase. Additionally, through the sub-second temporal resolution of PLIF, we have determined the delay between a measurable change of the surface structure using HESXRD and a change in gas composition as the catalyst switches between high and low activity.

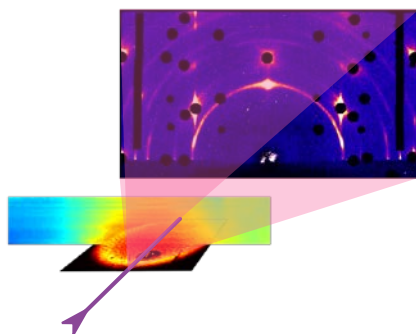


Figure 1: Schematic diagram of the HESXRD, PLIF and surface reflectance techniques.

References:

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