Lifted Reconstruction as a Feedback Mechanism in the Oscillating CO Oxidation on Pt Nanofacets: a Microscopic Evidence

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Two key phenomena lead to rate oscillations in a macroscopic CO/O/Pt(110) system: asymmetric inhibition and lifted reconstruction. Asymmetric inhibition by CO provides the bistability and "missing row" reconstruction lifted by CO adsorption works as a feedback mechanism in this reaction system [1]. Despite of the tacit assumption that this mechanism should also be valid for the (110) nanofacets on a Pt field emitter tip used as a model of a metal catalytic particle, the corresponding direct evidence has not been provided yet. Since the oscillations in the reaction rate on a nanosized sample containing a number of differently oriented facets might be induced by a complex reaction-diffusion process, alternative mechanisms related to the coupling of the different crystallographic orientations can be considered. So far the assumed reconstruction cannot be resolved experimentally in a conventional field ion microscope when the (110) facets are imaged by gas ions, such as O^{2+}, at reaction temperature. Employment of Li^+ ions as "probing particles" enables an in situ detection of the reconstruction process, as the local field desorption rate of Li^+ is highly sensitive to variations of the local electric field caused by the different arrangements of surface atoms [2]. The direct real-time information about the actual configuration of the surface during the ongoing reaction is thus provided.

[1] T.Gritsch, D. Coulman, R.J. Behm, G. Ertl, Phys.Rev.Lett. 63 (1989)1086.

[2]Y. Suchorski, V.K. Medvedev, J.H. Block, R.L.C. Wang, H.J. Kreuzer, Phys. Rev. B53 (1996) 4109

Plutonium surface oxides and hydrides - a photoemission study

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Results of the angle-integrated photoelectron spectroscopy of delta phase plutonium will be presented [1]. Measurements were performed with 60meV energy resolution on samples cleaned by laser ablation and dosed with O_2 and H_2. Two previously predicted but not seen effects were observed: (i) room temperature reduction of PuO_2 to Pu_2O_3 in vacuum, and (ii) Pu_2O_3 followed by PuO_2 growth at low temperatures. Influence of hydrogen on the bulk valence band electronic structure was also analyzed. Obtained results will be compared with theoretical model based on the novel hybrid density functional theory (DFT) and more traditional LDA and GGA approaches.

[1] M.T. Butterfield *et al.*, Surf. Sci. 571 (2004) 74-82.