Structure and reactivity of a $Pt_{25}Rh_{75}$ alloy under realistic conditions

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PtRh alloys can be used as a “three-way“ automotive exhaust gas catalysts. They have the ability of simultaneously remove CO, NO_x and hydrocarbons [1], which all are unwanted exhaust gases. A number of adsorbate-surface interaction studies on PtRh surfaces under Ultra High Vacuum (UHV) conditions have been performed, see for example refs. [2, 3]. One of the more important findings is that Pt segregates towards the surface under UHV but on the contrary, Rh segregates to the surface under oxygen rich conditions. The reason is the higher affinity to oxygen of Rh than Pt. At higher oxygen pressures under well controlled conditions, the behavior of the alloy is in principle unexplored. We have studied the interaction between a $Pt_{25}Rh_{75}$(100) alloy surface and O_2 from UHV to atmospheric pressure, with the focus on the changes of the surface structure of the alloy. In addition, the CO_2 production in a mixture of O_2 and CO at atmospheric ambient and elevated sample temperatures has been followed simultaneously with the detection of the surface phase. By the use of in-situ surface x-ray diffraction under realistic CO-oxidation reaction conditions, we show that the onset of the growth of a thin RhO_2 oxide coincide with an increasing signal of the CO_2 production.

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[2] M. Sporn, E. Platzgummer, E. L. D. Gruber, M. Schmid, W. Hofer, P. Varga, Surf. Sci. ***416*** *(1998) 384.*
[3] A. Baraldi et. al., J. Am. Chem. Soc, ***127****, (2005), 5671.*