Unexpected oxide structures on PtRh(100) during CO oxidation

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Bimetallic catalysts often show a higher activity than their single-metallic counterparts, but the origin of this promoting effect is often not known. The main aim with the here presented study was to commission the, at that point, new beamline P21.2 at PETRA III at DESY in Hamburg, Germany. For this we choose to study CO oxidation over PtRh(100), a system that we expected that we knew quite well, but still offered a possibility to learn new things, especially about the promoting effect of the alloy.

From previous studies [2], we expected that the PtRh(100) surface would behave very similarly to Rh(100) surface, with the formation of a (3x1) structure with chemisorbed oxygen, under mildly oxidizing conditions, and a c(8x2) trilayer (O-Rh-O) surface oxide, under more oxidizing conditions. Indeed, we found these structures, but a quantitative analysis reveals that the data of the c(8x2) cannot be properly reproduced by the trilayer oxide alone (see Figure 1). Instead, the data indicate that the sample exposes a mixture of oxides of different thicknesses, probably formed as a result of varying gas mixtures over the surface.

In addition, we found a c(2x2) structure that we first interpreted as an adsorption induced ordered surface alloy. Again, a quantitative analysis, however, did not agree with this. Instead the c(2x2) structure seems to extend a few layers into the substrate.

We are currently working on the final details in the analysis and hope to be able to present a conclusive interpretation of the data at the conference.

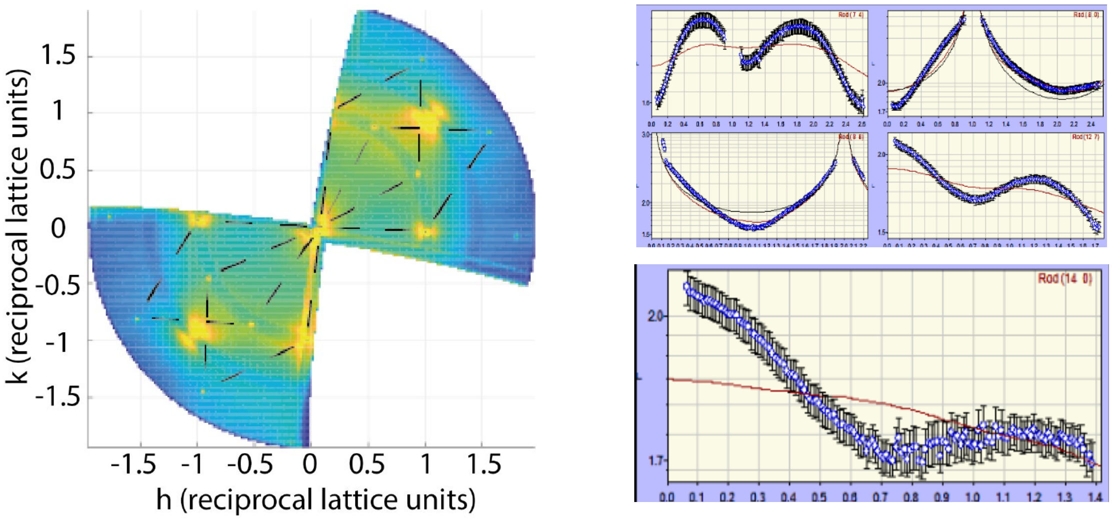

Fig. 1. SXRD of the c(8x2) surface oxide on PtRh(100) during CO oxidation. The in-plane map to the left clearly reveals the close to hexagonal oxide lattice on top of the square substrate. The plots to the right shows measured CTRs and superstructure rods together with a simulation corresponding to the expected trilayer O-Rh-O surface oxide. Obviously the agreement is not satisfying, especially for the (7/8,0) rod at the bottom (marked as (14,0) due to the larger unit cell used in the simulations.

[1] R. Westerström et al, J. Phys.: Condens. Matter 20, 184018 (2008)