



	Experiment title: In-situ x-ray scattering studies of ordered water, OH and CO structures on Pt(hkl) electrodes during surface reactions.	Experiment number: SI-344
Beamline: ID10B	Date of experiment: from: 14/5/98 to: 20/5/98	Date of report:
Shifts: 18	Local contact(s): Detlef Smilgies	<i>Received at ESRF:</i>

Names and affiliations of applicants (* indicates experimentalists):

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Report:

Abstracts from 2 papers that are in press are presented below:

Title: Atomic Structure at the Electrochemical Interface

Author(s): C. A. Lucas

Affiliation: Oliver Lodge Laboratory, Department of Physics, University of Liverpool, Liverpool, L69 7ZE, UK.

Journal: Journal of Physics D: Applied Physics, in press (1999).

Abstract text:

X-ray diffraction has become a powerful *in-situ* probe of the atomic structure at the metal/electrolyte interface. In this paper I discuss potentiodynamic measurements in which the x-ray intensity at a selected reciprocal lattice point is monitored as the applied electrode potential is cycled. This technique is termed 'x-ray voltammetry' in direct analogy to the electrochemical technique of cyclic voltammetry. The application of the technique is highlighted by examples of surface reconstruction, metal growth and the adsorption and oxidation of carbon monoxide.

Title: Electrooxidation of CO and H₂/CO Mixtures on Pt(111) in Acid Solutions.

Authors: N. M. Markovic¹, B. N. Grgur¹, C. A. Lucas² and P. N. Ross¹.

Affiliation: ¹Materials Sciences Division, Lawrence Berkeley National Laboratory, University of California, Berkeley, CA 94720, USA, ²Oliver Lodge Laboratory, Department of Physics, University of Liverpool, Liverpool, L69 7ZE, UK.

Journal: Journal of Physical Chemistry, in press (1999).

Abstract text:

Electrocatalysis of CO oxidation and the interfacial structure of the CO adlayer (CO_{ad}) on the Pt(111) surface in 0.5 M H₂SO₄ were examined by using the rotating disk electrode method in combination with in situ surface X-ray diffraction measurements. The results presented here elucidate the roles played by two different forms of CO_{ad}: one which is oxidized at lower overpotentials, in the so-called preoxidation region, we characterize as a weakly adsorbed state (CO_{ad,w}), and a strongly adsorbed state (CO_{ad,s}) which is oxidized at higher overpotentials. The CO_{ad,w} state forms at saturation coverage by adsorption at E < 0.15 V and assumes a compressed p(2x2) structure containing 3 CO molecules in the unit cell (0.75 CO/Pt). We propose that oxidative removal of CO_{ad,w} is accompanied by simultaneous relaxation of the CO adlayer, and that the remaining CO_{ad} (~0.6 CO/Pt) assumes a new bonding state which we identify as . The CO_{ad,s} state is present in a structure lacking long-range order. Despite the reduced coverage by CO_{ad}, H₂ electrooxidation is still completely poisoned at potentials below 0.6 V. The electrooxidation of CO in solution is proposed to occur via the CO_{ad,w} state at 0.6-0.8 V, and via the CO_{ad,s} state at higher potentials.