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Observing the oxidation of platinum under operando electrochemical conditions

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Platinum electrocatalyst degradation forms a large barrier for the wide-spread application of electrolyzers and fuel cells, which are crucial for a sustainable energy society. A detailed understanding of the catalyst surface structure during the chemical reaction is required to design more stable catalysts. We have developed a Rotating Disk Electrode (RDE) setup that enables a structural characterization by synchrotron High-Energy Surface X-Ray Diffraction (HE-SXRD) experiments while maintaining well-defined diffusion conditions and high catalytic reaction rates (current densities). With this setup we followed the oxidation of Pt(111) and Pt(100) model electrodes, from the Place-Exchange surface oxidation occurring around 1.1V until the formation of a (bulk) oxide at potentials relevant for the oxygen evolution reaction. In contrast with heterogenous oxidation experiments, no ordered oxide structures are observed.

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