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Operando fluorescence x-ray absorption spectroscopy studies of proton-exchange membrane fuel cell

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A test setup for membrane-electrode-assemblies (MEAs) of proton exchange membrane fuel cells which allows in-situ fluorescence X-ray absorption spectroscopy studies of one electrode with safe exclusion of contributions from the counter electrode is described. Interference by the counter electrode is excluded by geometry in which the incoming beam has a small angle of incidence with the electrode layer. The cell was constructed by introducing minor modifications to an electrochemical state-of-the-art MEA test setup, which ensures realistic electrochemical test conditions. In measurements on Pt/C and PtCo/C cathodes combined with Pt/C anodes (H₂/O₂ feed), good data quality was demonstrated both for the majority element Pt as well as for Co despite on its low surface density in the order of 0.02 mg/cm². Severe leaching phenomena of the PtCo alloy particles of the cathode were observed during use of the MEA, which set on already during potentiostatic experiments with the setup. The leaching was detected by extensive loss of long-range order around Co and significant changes also in Pt LIII EXAFS, but remained without significant influence on the cell performance.

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Heterogeneous Catalysis

Primary author: Dr SINEV, Ilya (Ruhr-University Bochum, Bochum, Germany)

Co-authors: Mr OTTO, Bruno (Ruhr-University Bochum, Bochum, Germany); Mr KULP, Christian (Martin Luther University Halle-Wittenberg, Halle, Germany); Mr OTTO, Horst (Ruhr-University Bochum, Bochum, Germany); Dr KLEMENTIEV, Konstantin (Cells-ALBA Synchrotron Light Facility, Barcelona, Spain); Dr LOPEZ, Marco (Umicore & Co KG, Hanau, Germany); Dr VAN DEN BERG, Maurits W.E. (Crenox GmbH, Krefeld, Germany); Prof. BRON, Michael (Martin Luther University Halle-Wittenberg, Halle, Germany); Ms PETROVA, Olga (Ruhr-University Bochum, Bochum, Germany); Prof. GRÜNERT, Wolfgang (Ruhr-University Bochum, Bochum, Germany)

Presenter: Dr SINEV, Ilya (Ruhr-University Bochum, Bochum, Germany)

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