



Contribution ID: 238

Type: Talk

Characterization of nanostructured iridium oxide-based electrocatalysts using advanced x-ray analytics

Wednesday, 19 September 2018 11:45 (15 minutes)

Iridium oxide (IrO_2) has been suggested as a promising candidate for efficient water oxidation, and thus catalyst materials based on nanostructured iridium (hydr)oxide have recently been developed and commercialized. In this work, we present a comprehensive spectroscopic study of commercially available iridium oxide-based electrocatalysts (“nano- IrO_2 ” and “ $\text{IrO}_2@\text{TiO}_2$ ”) using advanced x-ray analytics at the synchrotron sources BESSY II and ALS.

The spectroscopic study of these materials at the oxygen K-edge revealed a high-resolution fingerprint related to the reorganization of local electronic states presumably due to a varying degree of crystallinity, as suggested by the comparison with an extensively characterized rutile-like IrO_2 and an amorphous iridium oxide. Furthermore, detailed information about the hybridization of electronic states in the valence band was obtained combining the atom specificity of soft x-ray absorption (XAS) and emission spectroscopy (XES) with the surface sensitivity of x-ray photoelectron spectroscopy (XPS).

The study was completed comparing the spectroscopic results with diffraction and microscopy measurements, in which the heterogeneous nature of the nanostructured iridium oxide-based materials is confirmed, discerning contributions from a rutile-type structure and an amorphous phase. The latter phase has been implicated in the high catalytic activity of these materials in the sluggish oxygen evolution reaction.

Primary authors: Dr GARCIA-DIEZ, Raul (Renewable Energy, Helmholtz-Zentrum Berlin für Materialien und Energie GmbH (HZB)); Dr WILKS, Regan G. (Renewable Energy, Helmholtz-Zentrum Berlin für Materialien und Energie GmbH (HZB)); Prof. BÄR, Marcus (Renewable Energy, Helmholtz-Zentrum Berlin für Materialien und Energie GmbH (HZB))

Co-authors: Dr SIEBEL, Armin (Technische Universität München, Chair of Technical Electrochemistry, Department of Chemistry and Catalysis Research Center); Mrs WEISS, Alexandra (Technische Universität München, Chair of Technical Electrochemistry, Department of Chemistry and Catalysis Research Center); Mr BERNT, Maximilian (Technische Universität München, Chair of Technical Electrochemistry, Department of Chemistry and Catalysis Research Center); Dr YANG, Wanli (Advanced Light Source (ALS), Lawrence Berkeley National Laboratory); Prof. GASTEIGER, Hubert A (TUM)

Presenter: Dr GARCIA-DIEZ, Raul (Renewable Energy, Helmholtz-Zentrum Berlin für Materialien und Energie GmbH (HZB))

Session Classification: Parallel session 9

Track Classification: P10 Others