Synthesis and Characterization of Highly Active IrO\textsubscript{x}-Ir Nanoparticles for Oxygen Evolution Reaction in Acid Media

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Introduction
For the water splitting in PEM electrolyzers the choice of the oxygen evolution reaction (OER) catalyst employed at the anode has a profound impact on costs, lifetime, and efficiency of the device.[1;2] We have developed a highly active and stable nanostructured Ir catalyst for (OER) in acidic medium, synthesized by an environmental friendly, water free synthesis at room temperature.[3]

Method
All measurements were done for IrO\textsubscript{x}-Ir and Ir-black from Umicore, the most active, commercially available OER catalyst. IrO\textsubscript{x}-Ir shows an up to five-fold higher current density at an overpotential of 250mV, measured on an RDE at 25°C in Ar-saturated 0.5 M. H\textsubscript{2}SO\textsubscript{4} solution.

XPS
• highly metallic materials
• thin layer of oxide

XRD
• crystalline structure and size.

Transmission electron microscopy
• Particle size: 2nm
• High surface area:
  - BET IrO\textsubscript{x}-Ir: 60 m\textsuperscript{2} g\textsuperscript{-1}
  - BET Ir-black: 18 m\textsuperscript{2} g\textsuperscript{-1}
• Similar cristallin structure

Electrochemical characterization
• High exchange current density
• Five fold higher activity in A g\textsuperscript{-1}
• 6.8 time less active sites
• 13 time higher activity in A mmol\textsuperscript{-1}

 PEM electrolyzer test
A MEA with 1mg catalyst loading on the Anode site was produced on Nafion 212 by wet spraying and performed in a PEM electrolyzer test stand of 25 cm\textsuperscript{2} active area, combined with EIS measurements as an in situ characterization method. The catalyst is stable for more than 100h and shows stable performance up to 4 A cm\textsuperscript{-2}.

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