Ultrathin Iridium Oxide Catalyst on a Conductive Support for the Oxygen Evolution Reaction in Acid

University of Oregon, Department of Chemistry & Biochemistry
Nathan Stovall, Raina Krivina, Grace Lindquist, Shannon W. Boettcher

Introduction
Water Electrolysis – Hydrogen as Fuel

Water Electrolysis (Acid):
(OER) $2 \text{H}_2\text{O} \rightarrow \text{O}_2 + 4 \text{H}^+ + 4 \text{e}^-$
(HER) $2 \text{H}^+ + 2 \text{e}^- \rightarrow 2 \text{H}_2$

Water Electrolysis (Base):
(OER) $4 \text{OH}^- \rightarrow 4 \text{e}^- + \text{O}_2 + 2 \text{H}_2\text{O}$
(HER) $2 \text{H}_2\text{O} + 2 \text{e}^- \rightarrow \text{H}_2 + 2 \text{OH}^-$

Proton Exchange Membrane (PEM) Electrolysis:

Project Goal: Develop and characterize a reduced loading iridium catalyst, supported on a cheap acid-stable metal-oxide support while maintaining high activities.

Results:
Surface-limited catalyst synthesis:

UV-Vis and NMR data suggest a surface limited binding mechanism of IrCOD to metal-oxide surfaces via electrostatic interactions.

Very active, low loading catalyst

Future Directions:
- Compare dimer’s activity to existing molecular OER catalysts with oxidatively stable ligands.
- Conduct ICP-MS analyses for dissolution quantification.
- Test different reaction conditions to facilitate stronger binding interactions with metal-oxide support.