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

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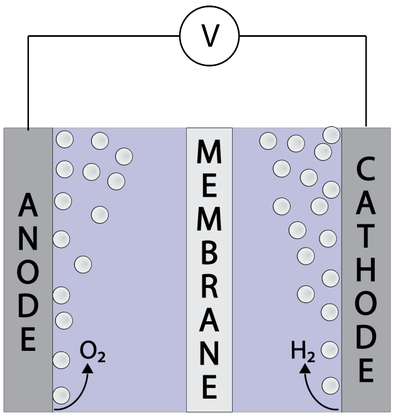
Introduction

Water Electrolysis – Hydrogen as Fuel



Water Electrolysis (Acid):

(OER): $2\ H_2O \rightarrow O_2 + 4\ H^+ + 4\ e^-$

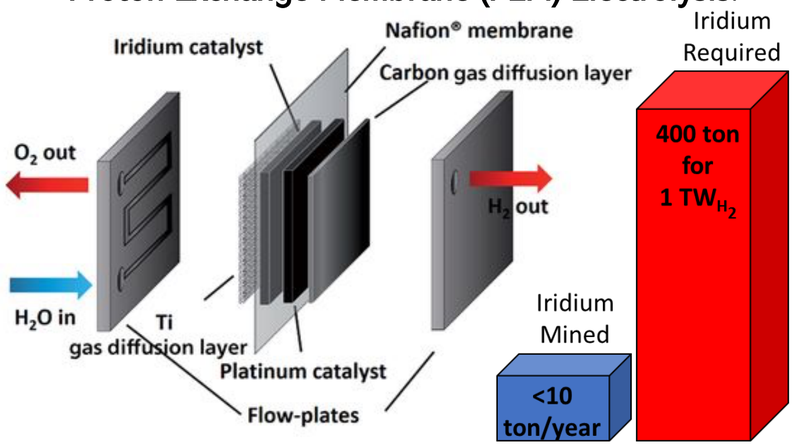
(HER): $2\ H^+ + 2\ e^- \rightarrow 2\ H_2$

Water Electrolysis (Base):

(OER) $4\ OH^- \rightarrow 4\ e^- + O_2 + 2\ H_2O$

(HER) $2\ H_2O + 2\ e^- \rightarrow H_2 + 2\ OH^-$

Proton Exchange Membrane (PEM) Electrolysis:

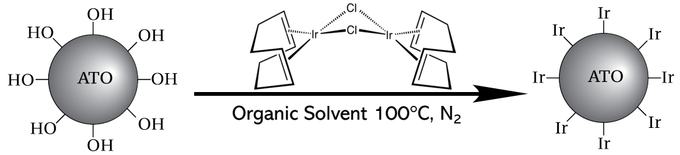


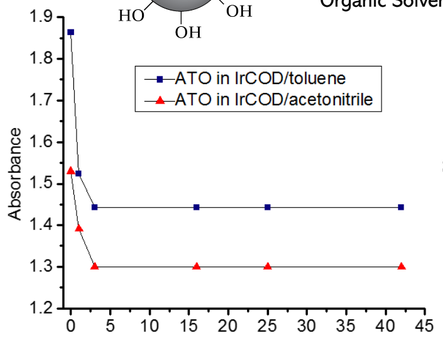
Proton Exchange Membrane (PEM) electrolyzers serve as a promising modality for water splitting but are limited by the high cost, and low abundance, of iridium.

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

Results:

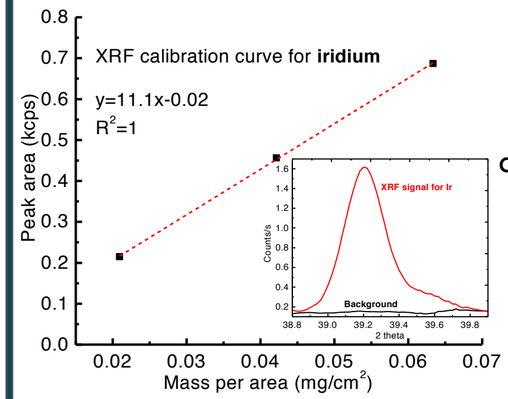
Surface-limited catalyst synthesis:





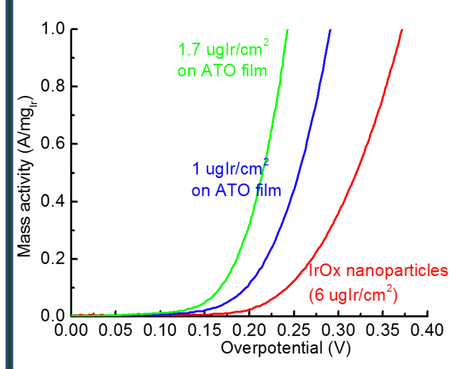
UV-Vis and NMR data suggest a surface limited binding mechanism of IrCOD to metal-oxide surfaces via electrostatic interactions.

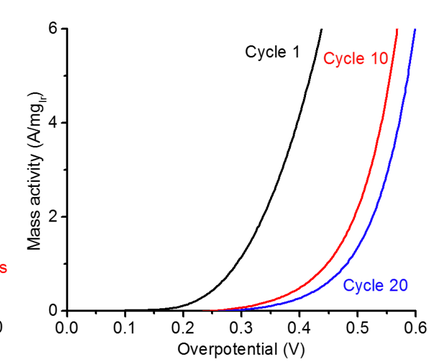
XRF Calibration Curves – Track Iridium Loading/Dissolution



X-Ray Fluorescence calibration curves allow for precise determination of catalyst loading on the electrode surface.

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.

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