Photoelectrode-Catalyst Couples for the Hydrogen Evolution Reaction

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Motivation

- Hydrogen for energy and as chemical feedstock
- Dwindling fuel reserves
- Rising concentrations of CO$_2$ in the atmosphere
Material Aspects of PEC H₂ Production

Materials must be:

Cheap & Scalable – made from abundant elements
- Currently the best catalysts are Iridium oxide (OER) and Platinum (HER)

Stable and Mutually stable

Compatibility.
- For example, Iridium oxide, the best OER catalyst when coupled with a photoanode –BiVO₄ – does not yield the most efficient PEC oxygen evolution
A Combinatorial Approach

Some known non-noble Metal Hydrogen Evolution Catalysts

Ni-Mo  
Co-Ni-Mo  
Co-Mo-N\textsubscript{x}  
MoS\textsubscript{2}  
NiP  
Fe, Co, Ni doped MoS\textsubscript{2}  
Cu-Mo Sulfides…

A capacity to study varying compositions for materials with up to four components.

Materials that can be studied include alloys, mixed oxides, mixed sulfides, mixed nitrides

By scanning on a silicon substrate, we are able to deal with the issue of compatibility of semiconductor/electrocatalyst couple
Work done so far

Increasing Pt content

Ti

Pt