

Thermodynamics and Kinetics of Proton-Coupled Electron Transfer at Cerium-Based Cluster Interfaces

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What are we trying to show?

We want :

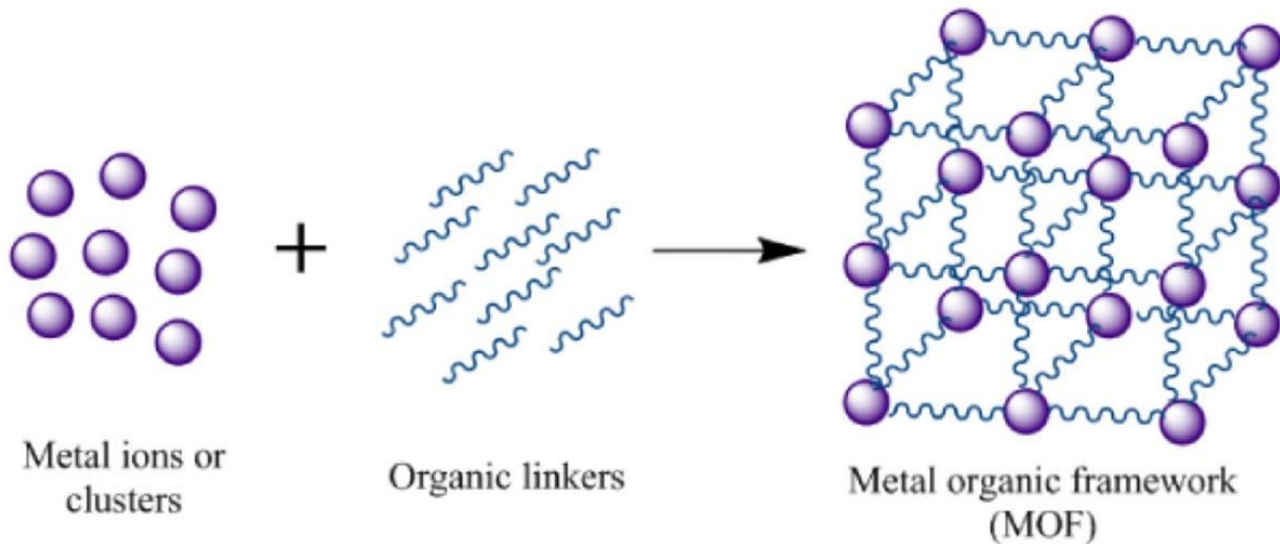
- To measure and understand how cerium-oxide clusters grab and release hydrogen atoms at their surfaces when in contact with different chemical based buffers.
- To prove that both the solid material and the liquid it sits in are equally important players in determining catalytic behavior.
- We ask whether the liquid environment surrounding the Ce-oxo centers changes how fast this hydrogen atom transfer happens.

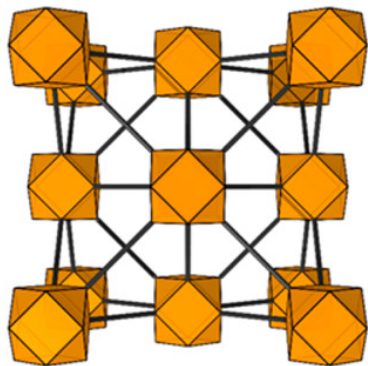


Why are we trying to show this?

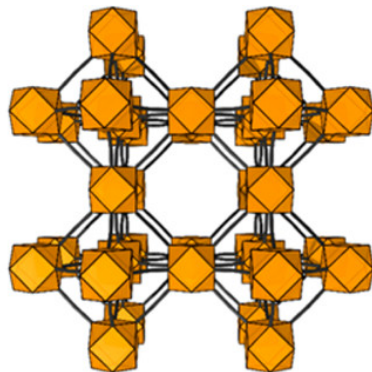
- Clean energy production, like splitting water or reducing CO_2 , depends on catalysts that can efficiently transfer both protons and electrons simultaneously.
- This process, called proton-coupled electron transfer (PCET), is important to how energy is stored in chemical bonds.

Metal Organic Frameworks (MOFs)

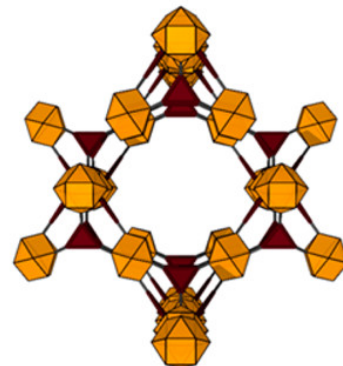




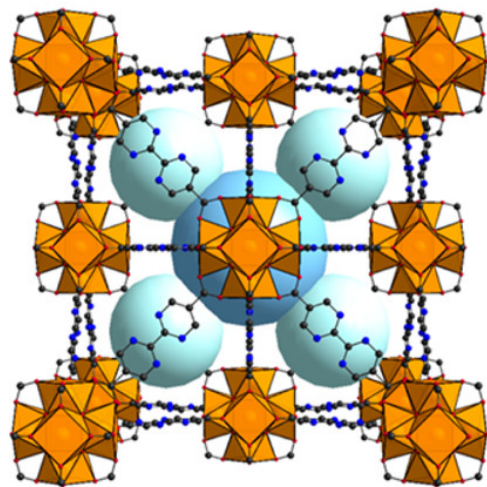
fcu



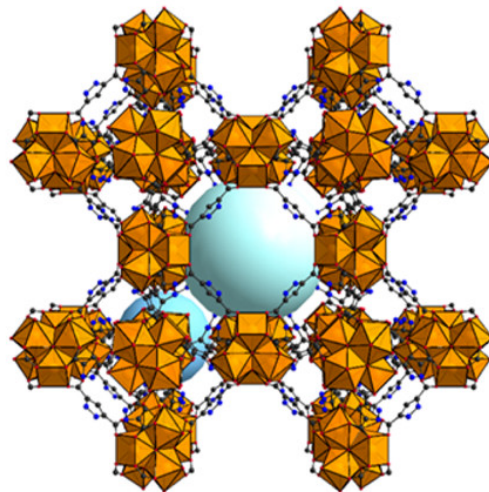
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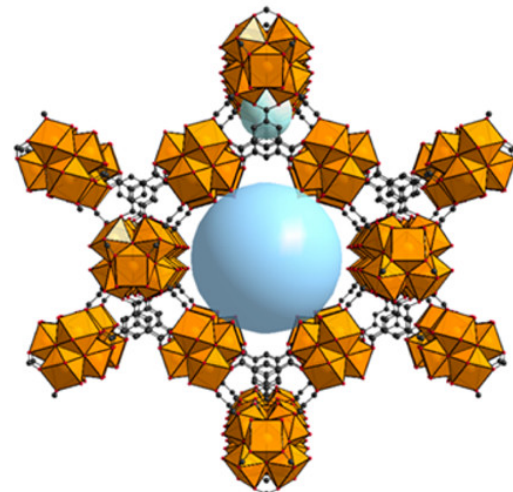
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Ce-UiO-66-BPyDC

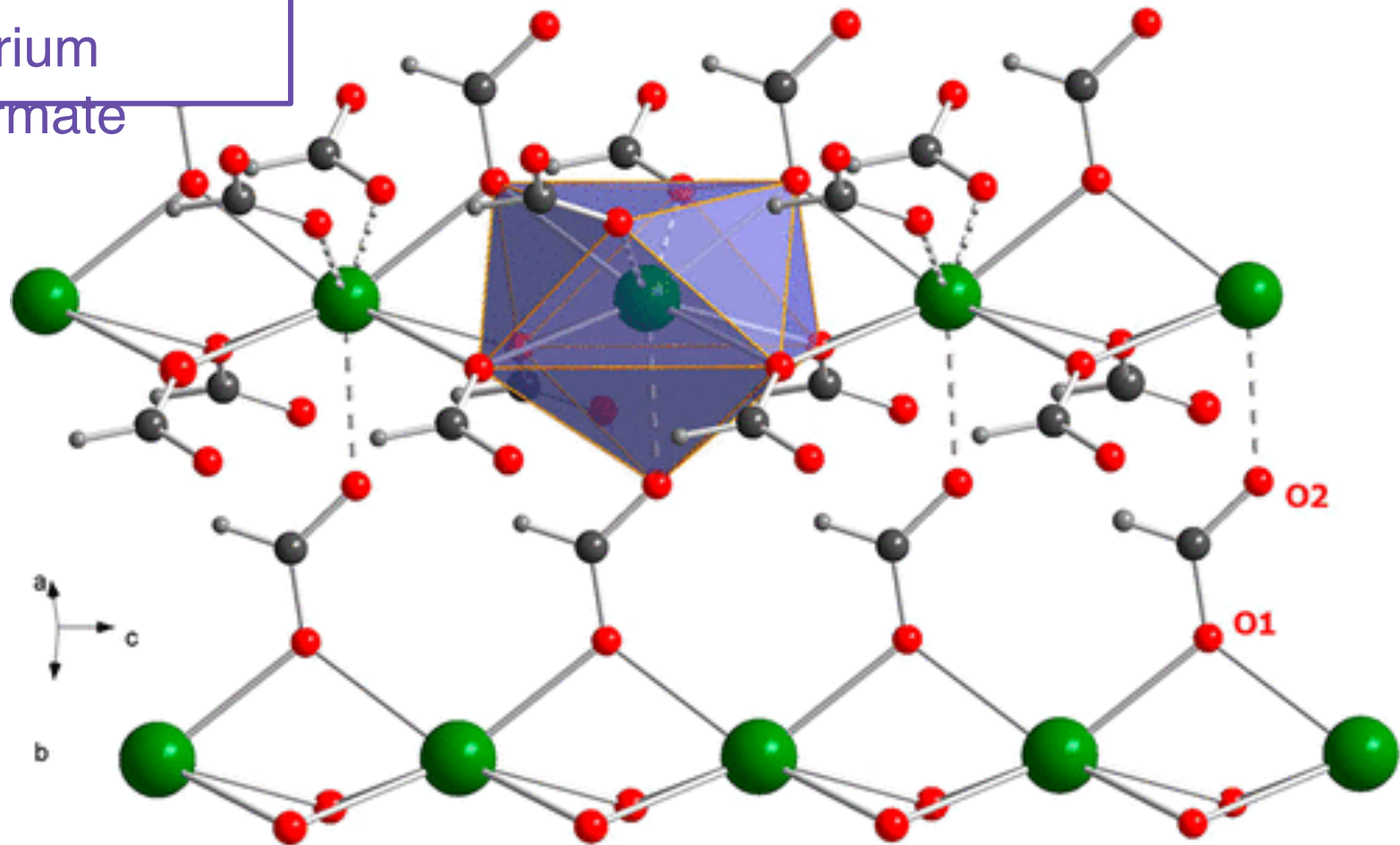


Ce-DUT-67-PZDC



Ce-MOF-808

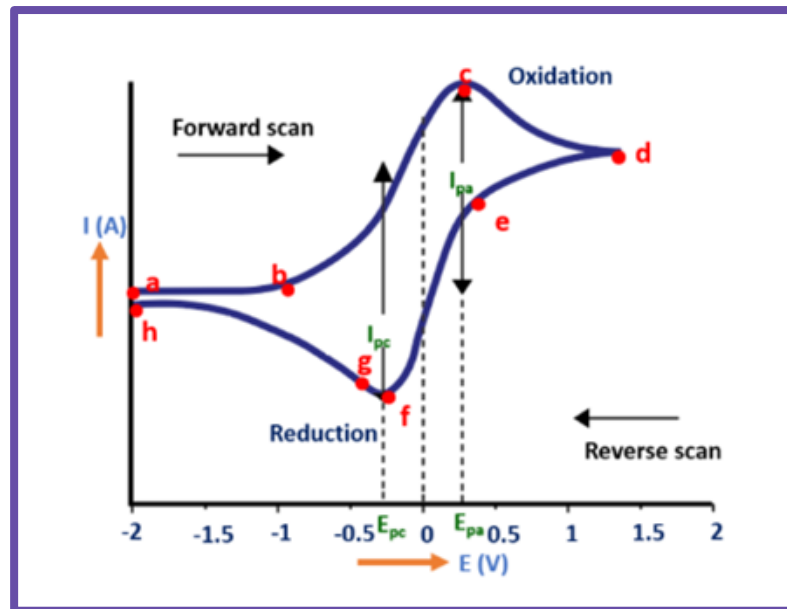
Cerium
Formate



How are we going to show this?

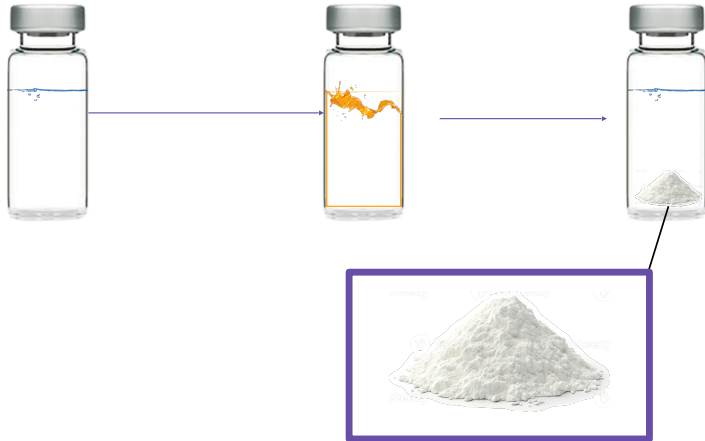
To measure the hydrogen atom binding strength...

- We put Cerium Formate onto electrodes and ran electrochemical experiments in buffers at different pH levels
- Using the way electric potential shifts with pH levels to calculate the BDFE directly.
- Cyclic voltammetry: we measured a passed current as a function of applied potential producing characteristic peaks that reveal the redox behavior and electron transfer rates of the cerium nodes within the structure



Methodology

Cerium Formate / $\text{Ce}(\text{HCOO})_3$



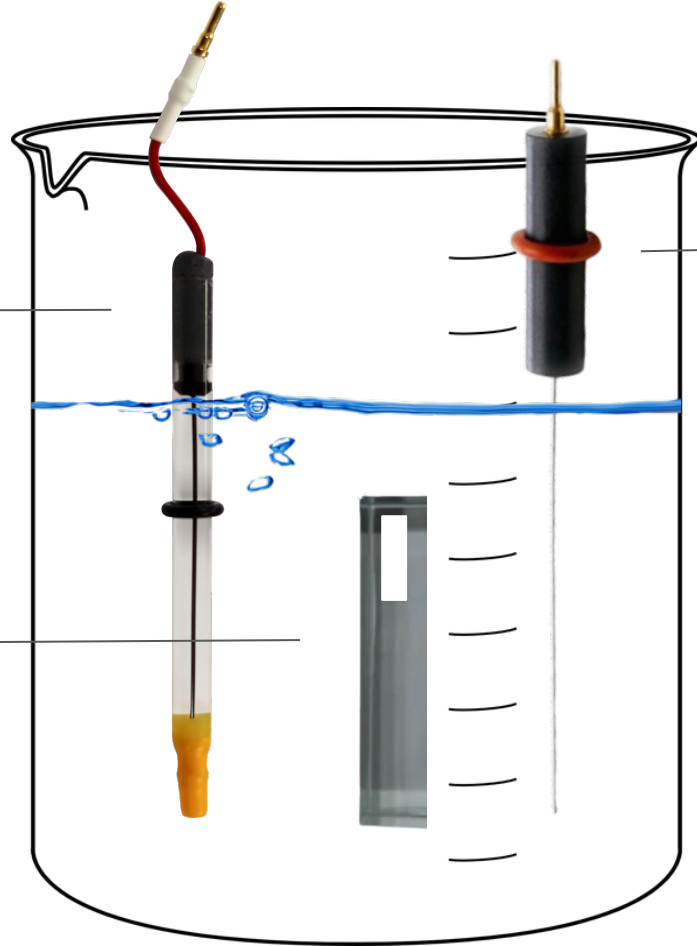
Buffer Solution	pH
MOPS - $\text{C}_7\text{H}_{15}\text{NO}_4\text{S}$	6-8
Tris - $\text{C}_4\text{H}_{11}\text{NO}_3$	7-9
Boric Acid - H_3BO_3	8-10

Methodology

Reference Electrode

Electrode with
Sample (Cerium
Formate)

Counter
Electrode



Questions? Concerns?