Portland State
Chemistry

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Towards a Molecular Understanding of Dynamic Fe-based Oxygen Evolution Catalysts

Heterogeneous electrocatalysts for the oxygen evolution reaction (OER) are complicated materials with dynamic structures. They exhibit potential-induced phase transitions, potential-dependent electronic properties, variable oxidation and protonation states, and disordered local/surface phases. These properties make understanding the OER, and ultimately designing higher-efficiency catalysts, challenging. Measurements of intrinsic activity show that, by far, the most-active phases for OER under alkaline conditions are Fe-containing mixed-metal oxyhydroxides, but exactly how the function remains controversial. I will discuss our work to understand the key properties of these catalysts, including morphology, composition, and molecular/electronic structure, and how they evolve and are dynamic under active catalytic conditions. These concepts inform design strategies for higher-performance catalyst architectures and for their incorporation into practical electrolyzer devices to make clean hydrogen fuel from inexpensive renewable electricity.