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Sustainable electrocatalysis: Importance of X-ray spectroscopy for understanding the active state of earth-abundant oxides in water-splitting catalysis

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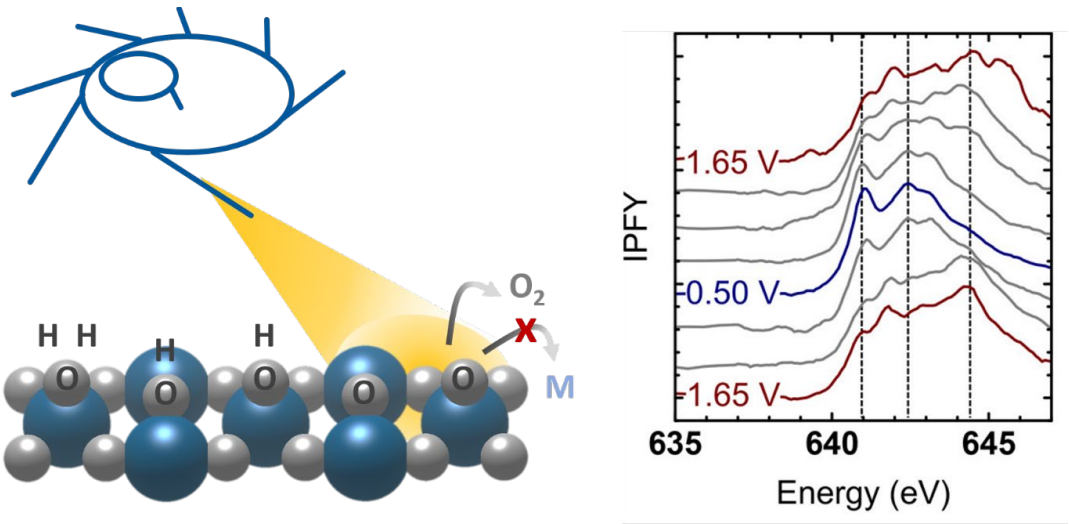
Electrocatalytic water oxidation is a highly desirable source of electrons and protons for the sustainable, CO_2-neutral production of green hydrogen, carbon-based liquid fuels, fertilizers and valuable chemical feedstocks. The performance of the required electrolyzer or artificial photosynthesis technology can be improved significantly by a fundamental understanding of the basic atomistic mechanism and properties that control energetic efficiency, reaction rates as well as stability. While there is no single universal material property that controls these processes, electronic properties usually have the largest impact. Oxides of non-noble metals like Mn, Fe, Co, Ni, etc. are commercially attractive catalysts due to their abundance. Yet, their surface during catalysis often differs significantly from the as-synthesized (or mined) material because they interact with the electrolyte (e.g., anions and/or pH) to form a voltage-dependent active state, whose nature often depends on the history of applied electric potentials, i.e., the used experimental protocol in an academic setting or the intermittence of renewable energy in a device. The evolution of the active state calls for *operando* X-ray spectroscopy to elucidate the local structure and electronic state of the active catalyst during electrocatalytic operation and their implications on reaction rate and catalyst stability. I will give a brief overview of the field and present selected recent highlights from our own work towards understanding water oxidation on various oxides.



Atomistic insight into water oxidation by synchrotron spectroscopy.

Selected references
[1] Antipin & Risch*, *J. Phys. Energy* 2, 032003 (2020).
[2] Baumung, Kollenbach, Xi, Risch*, *ChemPhysChem* 20, 2981 (2019).
[3] Villalobos, Golnak, Xi, Schuck, Risch*, *J. Phys. Energy* 2, 034009 (2020).
[4] Risch*, Stoerzinger, Han, Regier, Peak, Sayed, Shao-Horn*, *J. Phys. Chem. C* 121, 17682 (2017).