

Understanding and Harnessing Dynamic Materials for Sustainable Electrocatalytic Energy Conversion Technologies

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Abstract

We aim to exploit electrochemistry and revolutionize catalytic processes at the foundation of our energy and chemical industries that are currently major drivers of climate change. To achieve this vision, we must understand and harness catalyst material design, synthesis, and “resynthesis” under reaction conditions to enhance activity, selectivity, and stability of electrocatalytic materials and processes. Electrocatalysis provides unique opportunities to effectively utilize and store renewable electricity sources while tuning system performance via applied electric potentials and pH to develop technologies for sustainable production of fuels and chemicals. However, progress in these technologies is impeded by many factors, including knowledge gaps of complex catalyst material dynamics and degradation under reaction conditions.

We use controlled material syntheses and advanced *operando* x-ray spectroscopy techniques with custom reactors to monitor dynamic behavior of catalysts in response to electrocatalytic reaction conditions. Notably, we have developed several iridium-based perovskite and precious metal-free catalyst materials to establish electronic structure effects associated with systematic changes in composition, crystallinity, and strain. Insights from this work guide development of emergent technologies for green hydrogen production and sustainable chemicals manufacturing.

Short Biography

Linsey Seitz is an assistant professor in the Chemical and Biological Engineering Department at Northwestern University. She holds Chemical Engineering Degrees from Michigan State University (BS 2010) and Stanford University (MS 2013; PhD 2015); all her studies were supported by independent fellowships, including an NSF Graduate Research Fellowship and a Stanford DARE Fellowship. Linsey completed postdoctoral research at the Karlsruhe Institute for Technology with the Institute of Photon Science and Synchrotron Radiation, supported by a Helmholtz Postdoctoral Fellowship. Linsey was recently honored with the 2024 ACS Catalysis Early Career Award. She has received an NSF Career Award (2022), is a three-time Scialog Fellow, was recognized as a “Pioneer of the Catalysis and Reaction Engineering Division” of AIChE (2021), and has been named to the Northwestern University Associated Student Government Faculty Honor Roll (2022) for her outstanding mentoring.

