Controlled Materials Synthesis and Defect Engineering for Solar Thermochemical (STCH) Water Splitting for Sustainable Hydrogen Generation

DMREF/HydroGEN EMN Postdoctoral Position

National Renewable Energy Laboratory (NREL), Golden, CO

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The creation of new functional classes of thermochemical water splitting materials depends on integration of several core capabilities: enabling the design, evaluation, and qualification of new materials against known standard materials. Breakthroughs in (1) operating temperature, (2) efficiency, and (3) stability are needed to realize the real potential efficiencies of thermochemical water splitting. Furthermore, these breakthroughs require the ability to synthesize highly controlled new materials as well as the ability to demonstrate standard materials to establish critical comparisons between laboratories. NREL has demonstrated the ability to realize new materials, both through experiments as well as by high-throughput theory-driven accelerated design. The overall goal is to converge on new STCH redox systems worthy of pilot scale investigation. This node focuses on the growth of highly controlled crystalline and amorphous materials controlling critical properties of crystallinity, composition, defects, and topology at scale.

A key part of developing new STCH materials is creating a working understanding of the phase relationships and defect chemistry, both during the synthesis and during hydrogen production. To this end, we will partner with SLAC National Accelerator Laboratory specifically, using in-situ tools, to potentially monitor the materials chemistry virtually in real time. This can greatly accelerate the development of these materials while providing key science insights into materials design. The postdoctoral researcher will be involved in the experimental synthesis by ceramic (hydrothermal and PVD) approaches, and characterization of redox oxides for STCH water splitting, using the extensive set of tools at NREL and the collaboration with SLAC.