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Renewable Energy & Energy Efficiency

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Balancing Advanced Materials Design with Scalability for Efficient Water Treatment and Water Splitting Technologies

Part of the challenge in developing novel and advanced functional materials is the scalability of the material, both in terms of cost and feasibility. There is often a trade-off between creating a new material that has exceptional performance at the bench scale and creating a material that can be scalably integrated into a commercial technology. In our research, we focus on the development of non-precious metal-based nanoparticle catalysts and catalyst-immobilized composites for water treatment and electrochemical energy conversion applications. Our research spans from fundamental studies to scalable engineering projects, where we often are faced with sometimes conflicting challenges to develop a material that has unique functionality or structure, to understand the fundamental mechanisms of how our materials work, and to demonstrate cost-effective scalability. In this talk, I will discuss two examples from our on-going research where we are both working to understand fundamental mechanisms of materials performance as well as working to develop and optimize high-performance, scalable catalyst materials. I will give one example from our water treatment work and one example from our work in alkaline electrochemical water splitting. Both examples will focus on non-precious metal oxide/hydroxide nanoparticle materials, and I will discuss materials synthesis as well as characterization and performance efforts.