The Cutting-Edge in Clean Electrolysis

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Traditional applications for water electrolysis in the 20th century have been limited by high feedstock costs, and confined to high capital cost tolerant applications. With the growing availability of low-cost carbon-free electricity as a feedstock electrolyzers, a positive feedback loop is created: green hydrogen needs cheap renewables, and more renewables can be managed on the electrical grid by making green hydrogen. The net benefit is the potential of the green hydrogen to decarbonize various industrial sectors. At the same time, the electrolyzers of the 20th century need to be disrupted and re-engineered for the 21st century. Legacy commercial applications of polymer electrolyte membrane (PEM) electrolyzers, such as life support and industrial gas operated continuously on high cost electricity inputs with proprietary non-optimized components shrouded in trade secrets. Which has resulted in PEM electrolyzer cells that are overdesigned, underengineered and lacking basic chemical and physical understanding for the demands of 21st century applications. For water electrolysis to meet the Terawatt demand for green hydrogen in 2050, the capital cost must come down, we must manage intermittent electricity feedstocks and do more with less rare and expensive materials.

This talk will touch on the emerging scientific understanding of electrolyzers through the use of rational approaches and new characterization tools, the application of this understanding to engineering multiscale structures in the PEMWE* cell for optimizing kinetics and transport, and how that can translate into an elegantly designed 21st century PEMWE for efficient and durable green hydrogen production.

*PEM-based water electrolysis