



CHEMICAL ENGINEERING
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CHEMICAL ENGINEERING 290 SEMINAR SERIES PRESENTS

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National Renewable Energy Laboratory (NREL)

An Overview of Fuel Cell R&D at the National Renewable Energy Lab



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Both hydrogen and fuel cell related technologies have seen significant advancements in viability in the past few years. Fuel Cell vehicles are now reaching the point of limited commercialization with several automobile manufactures committing to manufacturing vehicles at 1000+ unit levels in the 2014-2017 timeframe. The National Renewable Energy Lab (NREL) has a broad portfolio of R&D focused on the advancement of fuel cell and hydrogen technologies. A broad overview of needs of the research community will be presented, as well as the work currently undertaken at NREL. Areas that will be specifically highlighted include the development of alkaline membrane fuel cells and advanced catalysts (based primarily on extended structures) including the development of novel electrodes.

Alkaline membranes have seen significantly increasing interest in the past several years and have made significant improvements in performance and durability. They still remain far behind proton exchange membrane (PEM) devices, particularly in the areas of fundamental understanding. The primary draw of alkaline systems has been the ability to potentially remove Pt as a precious metal from the fuel cell system. Presented work at NREL will focus on fundamental studies of cation durability and the need to develop standardized processes and baselines. Discussion and results will be presented which explore advanced cation concepts and polymer strategies that focus on perfluorinated backbone systems.

Extended structure electrocatalysts have also been developed and deployed at NREL and show significant promise for PEM fuel cell systems. Extended structure catalysts have long been known to result in improved specific activity and durability, but have been limited to relatively low surface areas. Advancements at NREL have resulted in materials which approach surface areas of nanoparticle catalysts, approximately an order of magnitude higher in surface area than typical extended structure catalysts. These materials have been synthesized using galvanic displacement and result in Pt/transition metal composites that have been successfully implemented in fuel cells. A discussion on the advancement and current state of these materials will also be included.

National Labs as a career path and overview information relevant to the National Renewable Energy Lab (NREL) and the presenter's background will also be presented.

Bryan Pivovar is Hydrogen and Fuel Cells Group Manager in the Chemical and Materials Sciences Center at the National Renewable Energy Laboratory (NREL) in Golden, CO, USA. He received his Ph.D. in Chemical Engineering from the University of Minnesota in 2000 and worked as part of the Los Alamos National Laboratory (LANL) Fuel Cell team (2000-2008). Since 2008, Bryan has led NREL's fuel cell R&D efforts which include programs in advanced catalysis, system contaminants, and anion exchange membranes. His current research focus has a heavy emphasis in the area of novel extended surface electrocatalysts and alkaline membrane fuel cells. He received the 2012 Tobias Young Investigator Award from the Electrochemical Society, he has chaired international workshops in the areas of Subfreezing Effects on Fuel Cells and Alkaline Membrane Fuel Cells, he was Chair of the 2005 Gordon Research Conference - Fuel Cells, and has co-authored over 80 papers in the general area of fuel cells.

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