

CHEMICAL ENGINEERING

SEMINAR SERIES



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Understanding Polymer Electrolyte Fuel Cells with X-ray Computed Tomography

ABSTRACT: Fuel cell electric vehicles are currently on the roads and compete with battery electric vehicles for clean and emission-free mobility sector. To enable more wide-spread deployment of the fuel cell electric vehicles, cost and durability challenges have to be addressed. Inherently, oxygen reduction reaction that takes place on the cathode side of polymer electrolyte fuel cell (PEFC) is sluggish and Pt or precious group metals (PGMs) have to be used as electrocatalysts. The current approach to reduce cost is to resort to low-loading Pt-based catalysts or to opt for PGM-free catalysts, such as Fe-N-C. For both cases, electrocatalyst has to be well-dispersed on the support, has accessibility to gas, ions and electrons, and has sufficient durability. Understanding the morphology and associated liquid and gas transport in these porous carbon-supported electrocatalysts is critical to optimizing the performance of PEFCs. Three-dimensional studies are necessary to fully resolve the complex and anisotropic structures. Synchrotron nano- and micro- X-ray computed tomography is used to characterize these materials under *in-situ* and *operando* conditions. We will discuss various experimental procedures for synchrotron imaging to further fundamental understanding of structure-property phenomena in these multi-scale materials and provide a roadmap for the design of next-generation materials. To complement the experimental effort, modeling studies will be presented, as well.

BIOGRAPHY: Professor Iryna Zenyuk holds a B.S. (2008) in mechanical engineering from the New York University Tandon School of Engineering. She continued her studies at Carnegie Mellon University, where she earned M.S. (2011) and Ph.D. (2013). After a postdoctoral fellowship at Lawrence Berkeley National Laboratory in Electrochemical Technologies Group Prof. Zenyuk joined the faculty of the Mechanical Engineering Department at Tufts University in 2015. In July 2018 she joined Department of Chemical Engineering and Material Science at University of California, Irvine, where she is also an Associate Director of the National Fuel Cell Research Center. At UC Irvine, Prof. Zenyuk's group works on enabling energy solutions by researching low-temperature hydrogen fuel-cells, Li-metal batteries and electrolyzers. She is a recipient of the NSF CAREER award (2017), Interpore society Fraunhofer Award for Young Researchers (2017), Research Corporation for Science Advancement, Scialog Fellow in Advanced Energy Storage (2017, 2018) and Electrochemical Society (ECS) Toyota Award (2018).

RECEPTION 3:30 • LECTURE 4:00 - 5:00
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