



Friday, March 22 • 2:30 PM

PWEB 175

Two-Phase Transport in Proton Exchange Membrane Fuel Cells

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Abstract: Water management is one of the most critical issues in proton exchange membrane fuel cells (PEMFCs). The water generated in catalyst layer as a product of the electrochemical reaction is mainly transported through porous media by diffusion if it's vapor, or by capillarity in case of liquid. In flow channels, the liquid water is removed primarily by inertial force of the gas flows. In my research group (Multiscale Transport Process Laboratory) at Michigan Technological University, one of our focused research areas is the gas-liquid two-phase transport processes in PEMFCs.

In various aspects of the two-phase transport phenomena, this presentation is focused on the impact of land-channel geometry. If we look at the cross-section of PEMFC, land-channel geometry causes the difference in transport distance between the flow channel to the catalyst layer, and results in the uneven distribution of various factors, such as transport resistance, species concentration, and current generation. In order to investigate the distributions of various parameters in the land-channel direction, we developed a small-scale segmented cell with about 350-micron resolution, and successfully measured the current and high-frequency resistance distribution in the land-channel direction for two different flow fields.

Biographical Sketch: Dr. Kazuya Tajiri is an associate professor of Department of Mechanical Engineering-Engineering Mechanics at Michigan Technological University. He has obtained his Bachelor degree in Aeronautics and Astronautics from University of Tokyo, Master degree in Aerospace Engineering from Georgia Institute of Technology, and Ph. D in Mechanical Engineering from The Pennsylvania State University. After obtaining a Ph.D degree, he worked at Argonne National Laboratory as a postdoctoral researcher, and then in 2010 he joined Michigan Technological University as an assistant professor. He also has work experience at Nissan Research Center in Yokosuka, Japan. In 2013, he was selected as one of the finalists for the Distinguished Teaching Award at Michigan Technological University.

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