UNIVERSITY OF MARYLAND

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THE FLUID DYNAMICS REVIEWS SEMINAR SERIES

FLUID DYNAMICAL ASPECTS OF REDOX FLOW BATTERIES

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DeWalt Seminar Room
2164 Glenn L. Martin Hall

Speaker

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ABSTRACT

All-liquid flow batteries, such as the vanadium redox flow battery (VRFB), have the unique property of independent scalability of power and energy. It is possible to design a flow battery system for slow charging and high power discharging (as in a peak shaving application) or for rapid charging and slow discharging (such as in islanded operation of a microgrid-supported by solar PV power). Among other advantages of relevance to large installations are long life (15 to 20 years), tolerance to deep discharge and absence of fire hazard.

In flow batteries, the liquid electrolytes are circulated through the battery stack whenever the battery needs to be charged and discharged. Understandably, the performance—both electrochemical and hydrodynamic—of a flow battery depends on the fluid dynamics of flow though the stacks. Although the flow is laminar and single-phase, the media involved, the possible flow paths and the consequent influence on the electrochemical behaviour, are quite complicated. We have been studying these for the past decade through a mixture of experimentation and CFD simulations. The talk will describe major highlights of the understanding that has thereby been generated and how this has led to the development of novel flow fields for large flow battery stacks.

BIO

Dr. Sreenivas Jayanti is a Professor in the Department of Chemical Engineering at IIT Madras, Chennai. He studied mechanical engineering at IIT-BHU, Varanasi, India; nuclear engineering at Ohio State University, Columbus, USA; fluid mechanics at INPG, Grenoble, France; and obtained his PhD from Imperial College, London, UK. He has been with IIT Madras, India since 1995. His research interests include computational fluid dynamics, clean coal technologies, carbon dioxide capture and sequestration, fuel cells and redox flow batteries. He has published well over 100 journal articles in these areas and is also the author of a book entitled "Computational fluid dynamics for engineers and scientists" which was published by Springer in 2018.

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