**Towards Deterministic Electrode Design: Elucidating the Role of Surface Chemistry and Microstructure on Redox Flow Battery Performance**

Redox flow batteries (RFBs) are promising for energy-intensive grid storage applications, but further improvements are needed for universal adoption [1,2]. While research efforts have primarily focused on the discovery and development of potentially inexpensive redox couples, significant cost reductions may also be achieved through advances in other system components. Of particular importance are the porous electrodes which are responsible for multiple critical functions in the flow cell related to thermodynamics, kinetics, and transport including providing surfaces for electrochemical reactions, distributing liquid electrolytes, as well as conducting electrons and heat. However, there is limited knowledge on how to systematically design and implement these materials in emerging RFB applications, forcing the repurposing of available materials that are not tailored for this electrochemical system. Moreover, current generation materials, which are typically developed via empirical approaches, lack control of surface chemistry (e.g., compositional heterogeneity) and microstructure (e.g., broad pore size distribution). This fundamentally limits the performance, durability, and, consequently, the cost of resultant systems. In this talk, I will discuss methods for disaggregating and quantifying resistive losses in various porous electrodes using model redox couples, diagnostic flow cells, and electrochemical modeling [3,4]. When applied in combination with suitable spectroscopy and microscopy techniques, structure-performance relations can be elucidated [5,6] which may eventually lead to design rules that enable the fabrication of chemistry-specific electrodes based solely on the knowledge of the physical and electrochemical properties of the redox active electrolyte.

**References**

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**Biography**

Fikile Brushett is an Associate Professor in the Department of Chemical Engineering at the Massachusetts Institute of Technology (MIT) where he holds the Cecil and Ida Green Career Development Chair. He received his B.S.E. in Chemical & Biomolecular Engineering from the University of Pennsylvania in 2006 and his Ph.D. in Chemical Engineering from the University of Illinois at Urbana-Champaign in 2010 under the supervision of Professor Paul J. A. Kenis. From 2010-2012, he was a Director’s Postdoctoral Fellow in the Electrochemical Energy Storage Group at Argonne National Laboratory under the supervision of Dr. John T. Vaughey. In 2013, he started his independent career at MIT where his research group seeks to advance the science and engineering of electrochemical technologies that enable a sustainable energy economy. He is especially interested in the fundamental processes that define the performance, cost, and lifetime of present day and future electrochemical systems. His group currently works on redox flow batteries for grid storage and electrochemical processing of carbon dioxide and biomass. He also serves as the Research Integration co-Lead for the Joint Center for Energy Storage Research, a DOE-funded Energy Innovation Hub.