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ARMS 1010

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Mechanistic Interactions at Scale in Electrochemical Energy Storage

Abstract: Advances in electrochemical energy storage systems are crucial for vehicle electrification, integrating renewable energy into the power grid, and enabling electric aviation. There is an urgent need to accelerate innovation toward improved and safer utilization of high energy and power densities in rechargeable batteries, spanning the range from lithium-ion to advanced “post-lithium-ion” battery chemistries. These complex and dynamic electrochemical systems are underpinned by coupled physical processes, including charge, heat, and mass transport, as well as their interplay with mechanical stresses across electrochemically reactive interfaces and porous electrode architectures. The dynamically evolving nature of electrochemistry-coupled reactive transport processes, further compounded by heterogeneities spanning the hierarchy of temporal, spatial, and energy scales, gives rise to complex phenomenology, including bottlenecked transport, chemo-mechanical instability, and local gradients. I will discuss the underpinnings of mechanistic interactions at electrochemically active interfaces and in electrode architectures for energy storage.

Biography: Partha P. Mukherjee is a Professor of Mechanical Engineering and a University Faculty Scholar at Purdue University. His prior appointments include Assistant Professor and Morris E. Foster Faculty Fellow of Mechanical Engineering at Texas A&M University (2012-2017), Staff Scientist at Oak Ridge National Laboratory (2009-2011), Director’s Research Fellow at Los Alamos National Laboratory (2008-2009), and Engineer at Fluent India (currently Ansys Inc., 1999-2003). He received his Ph.D. in Mechanical Engineering from the Pennsylvania State University in 2007. His awards include Scialog Fellows’ recognition for advanced energy storage, University Faculty Scholar and Faculty Excellence for Early Career Research awards from Purdue University, the Minerals, Metals & Materials Society Young Leaders Award, and invited presentations at the U.S. National Academy of Engineering Frontiers of Engineering symposium and Gordon Research Conference – Batteries, to name a few. He is a Fellow of the American Society of Mechanical Engineers. His research interests focus on transport, electrochemistry, and materials interactions, including an emphasis on the broad spectrum of energy storage and conversion.

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