University of Pavia

Ph.D. School of Electrical and Electronics Engineering and Computer Science
Ph.D. School in Microelectronics

Battery Workshop

July 2, 2019, Aula Volta
Università degli Studi di Pavia – Corso Strada Nuova 65 – Pavia

9:30 – 9:45 Welcome

9:45 – 10: 45 Martin Z. Bazant – "Stability and Kinetics of Li-ion Battery Interfaces"

Abstract: Reactive interfaces hold the key to improving the battery performance, in ways that cannot be predicted by traditional models. This talk will explain how driven intercalation reactions control the phase stability, degradation and rate capability of the most common Li-ion battery electrodes (LFP, LCO, NCM, graphite,…). A modeling framework is introduced, based on nonequilibrium thermodynamics, which fits the free energy rather than open circuit voltage and a generalization of Marcus theory for coupled ion-electron transfer is proposed to replace the empirical Butler-Volmer equation. Such models can be tested and calibrated by PDE-based inversion of experimental image data and other forms of machine learning, opening the possibility of physics-based, data-driven design of improved batteries.

11:00 – 12: 00 Richard D. Braatz – "Perspectives on Modeling, Prediction, and Control of Lithium-ion Batteries"

Abstract: Lithium-ion batteries have become widely used in applications due to their high energy and power densities and operating voltage. This presentation provides perspectives on the modeling, prediction, and control of lithium-ion batteries, including a vision of a next-generation advanced battery management systems and the steps being taken to implement that vision.

Martin Z. Bazant is the E. G. Roos (1944) Professor of Chemical Engineering and Mathematics and Executive Officer of the Department of Chemical Engineering at the Massachusetts Institute of Technology. After a PhD in Physics at Harvard University (1997), he joined the MIT faculty in Mathematics (1998) and then Chemical Engineering (2008). He is a Fellow of the APS, ISE and RSC and winner of the Kuznetsov Prize in Theoretical Electrochemistry (ISE), the Andreas Acrivos Award for Professional Progress in Chemical Engineering (AIChE), and the MITx Prize for Teaching and Learning in MOOCs. He also serves as the Chief Scientific Advisor for Saint Gobain Research North America.

Richard D. Braatz is the Edwin R. Gilliland Professor at the Massachusetts Institute of Technology (MIT) where he does research in applied mathematics and control theory and their application to advanced manufacturing systems. He has collaborated and/or consulted with more than 20 companies including United Technologies Corporation, IBM, and Novartis. Recognitions include the AACC Donald P. Eckman Award, the Antonio Ruberti Young Researcher Prize, IEEE Fellow, and IFAC Fellow. He is a member of the U.S. National Academy of Engineering.

Organizer

Prof. Davide M. Raimondo

Ph.D. Coordinators

Prof. Paolo Di Barba
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