

Emerging Investigators in Electrochemical Energy Conversion and Storage 2022

This special issue features the 2022 *Emerging Investigators in Electrochemical Energy Conversion and Storage*. Eleven emerging investigators were invited to this special issue to showcase up-and-coming scientists and engineers in the field of electrochemical energy conversion and storage. Emerging investigators are typically in the early stages of their independent careers (within about 12 years following graduation with a doctorate degree) and have demonstrated potential for high impact in the field. The purpose of this special issue will be to highlight emerging engineers and scientists who are internationally recognized for making outstanding contributions to the electrochemical energy conversion and storage field. The JEECS associate editors and guest editors have contributed to the suggestion of invitees and to the review of invited manuscripts for this special issue. We also thank the reviewers for their careful and diligent review of the invited work.



Ertan Agar is an Assistant Professor in the Department of Mechanical Engineering and the Director of the Electrochemical Energy Systems and Transport Laboratory (E²STL) at the University of Massachusetts Lowell. He earned his Ph.D. degree in Mechanical Engineering from Drexel University. Following his doctoral studies, Dr. Agar worked as a Postdoctoral Researcher in the Department of Chemical Engineering at Case Western Reserve University. His research group aims to advance knowledge in the design and diagnostics of flow-assisted electrochemical systems for addressing global challenges in energy and water applications. Dr. Agar is an active member of the Electrochemical Society. He also serves as the Faculty Lead for the UMass Lowell I-Corps Site Program and the Regional Northeast I-Corps Hub.



Ananya Renuka Balakrishna is a WiSE Gabilan Assistant Professor in the Department of Aerospace and Mechanical Engineering at the University of Southern California. She received her Ph.D. in Solid Mechanics and Materials Engineering from the University of Oxford and then pursued postdoctoral research as a Lindemann Fellow at the Massachusetts Institute of Technology (Department of Materials Science) and the University of Minnesota (Aerospace Engineering and Mechanics). Broadly, her research focuses on the mechanics of phase transformation materials—intercalation electrodes, multiferroics, and shape-memory alloys. Specifically, her group develops mathematical models (e.g., phase field methods, molecular dynamics) to investigate the interplay between material instabilities, microstructural patterns, and material properties. Her theoretical studies provide fundamental insights into material behavior that could guide the development of next-generation energy storage and energy-conversion materials.



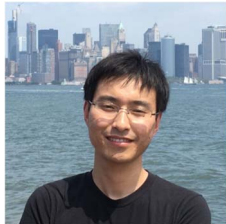
Pallab Barai works at the Applied Materials Division in the Argonne National Laboratory (ANL) as a computational scientist while attempting to develop theoretical frameworks for analyzing processes relevant to the synthesis and performance of lithium-ion batteries. He received his M.S. in Mechanical Engineering in 2008 from Rutgers University and Ph.D. in the same discipline in 2015 from Texas A&M University. He worked at Lawrence Berkeley National Laboratory and ANL as Postdoctoral Research Associate before starting his appointment as a Computational Scientist. His research activities are oriented around the development of computational methodologies for understanding the effective properties of composite materials with application in energy transfer and energy storage devices. He has also developed mathematical frameworks at the mesoscale level for elucidating the challenges at the electrode–electrolyte interface associated with the adoption of solid electrolytes in next-generation lithium-ion batteries. Computationally modeling the synthesis of battery-relevant materials is another research direction pioneered by him that is of significant interest to the energy storage research community.



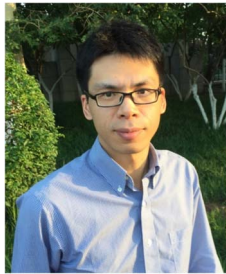
Dibakar Datta is an Assistant Professor of Mechanical Engineering at the New Jersey Institute of Technology (NJIT). He received his Ph.D. from Brown University in 2015 and had postdoctoral training at Stanford University. Dr. Datta's primary research interest is computational electrochemomechanics, the coupling of mechanics and electrochemistry, for next-generation energy storage and multifunctional devices. The question driving his research concentrates on how the structure and chemistry of materials at the atomic/molecular level control their performance in practical applications. To address this, he employs various modeling and simulation methods ranging from quantum mechanical methods (e.g., density functional theory), molecular dynamics, Monte Carlo, and machine learning, using massively parallel computing facilities.



Akhil Garg is currently an Associate Professor in the State Key Laboratory of Digital Manufacturing Equipment and Technology at Huazhong University of Science and Technology, China. He received his Ph.D. degree in Mechanical and Aerospace Engineering from Nanyang Technological University, Singapore, in 2015. During his Ph.D., he worked jointly with Aerospace Industry, Rolls-Royce, Singapore, on design optimization from 2010 to 2012. He was awarded Guangdong High Level Provincial Talent (Yangfan) in 2016 and Huazhong Scholar Award in 2019. He published over 70 peer-reviewed articles in this field. His main research interests include battery pack designs for electric vehicles, digital twins for batteries, and thermal management of batteries. His current research focuses on life cycle management of batteries by studying its design, manufacturing operations, and reusability aspects. The framework includes the integration of these phases and their industrial impacts in near future.



Mingyuan Ge is an associate physicist in National Synchrotron Light Source II at Brookhaven National Laboratory (BNL), with a joint appointment at the Department of Material Science and Chemical Engineering at Stony Brook University. He is also working as a beamline scientist in charging the transmission X-ray microscopy at FXI (18-ID) beamline. He received his Ph.D. in Material Science from the University of Southern California in 2015, before serving a postdoctoral fellowship at BNL. His research interest is centered on instrument and algorithm development using classical and machine learning methods to achieve high spatial/temporal resolution of X-ray imaging for energy material characterization.



Feng Hao is a Full Professor and Qilu Young Scholar of Engineering Mechanics at Shandong University. He received his B.S. from Wuhan University (2009) and Ph.D. from Tsinghua University (2014). He was a postdoctoral fellow at Columbia University (2014–2017), Texas A&M University (2017), and Purdue University (2017–2019). His current interests include the chemomechanical interactions in lithium metal batteries and the mechanical performance of advanced composite materials. His research group explores the interface structure and multi-field coupling in energy storage systems through multi-scale modeling approaches and non-destructive techniques.



Yijin Liu is a lead scientist at the SLAC National Accelerator Laboratory, where he leads the transmission X-ray microscopy program of the Stanford Synchrotron Radiation Lightsource. Dr. Liu has over 10 years of experience in developing state-of-the-art X-ray characterization techniques including multi-modal and multi-scale microscopy using both synchrotrons and compact laboratory X-ray sources. In addition to his expertise in X-ray techniques, Liu has broadly applied these methods for scientific research in renewable energy science, industry catalysis, oil production, and material under extreme conditions. In more recent years, Liu's research group focused on studying energy storage materials using synchrotron experimental tools as well as the associated machine learning and data mining approaches.



Elham Sahraei is an Associate Professor and Director of Electric Vehicle Safety Lab at Temple University. She was the Co-director of the Massachusetts Institute of Technology (MIT) Battery Modeling Consortium, a multi-sponsor industrial program supported by major automotive and battery manufacturers from 2011 to 2019. Dr. Sahraei earned her Ph.D. from the George Washington University in 2011 and completed two years of postdoctoral training at MIT in 2013, where she became a research scientist afterward. Her ongoing research is on the safety of lithium-ion batteries under combined mechanical–electrical loading. She develops experimental and computational methods to characterize and enhance the safety of lithium-ion batteries for electric vehicles. Her most recent work has been sponsored by the Office of Naval Research, PA Manufacturing and Innovation program, as well as Fiat-Chrysler Corporation. She has also been an investigator on several Ford-MIT alliance projects, and she is the inventor of “Collision Safety Structure,” a structure for controlled buckling of driver seats that reduces the perils of frontal crashes.



Jun Xu is an Associate Professor in the Department of Mechanical Engineering and Engineering Science and an Adjunct Professor in the School of Data Science at The University of North Carolina at Charlotte (UNC Charlotte). Dr. Jun Xu now serves as the inaugural Director of Battery Complexity, Autonomous Vehicle and Electrification (BATT CAVE) Research Center at UNC Charlotte. He received his Ph.D. in Environmental Engineering/Engineering Mechanics from Columbia University in 2014. From 2014 to 2018, he served as a Professor in the Department of Automotive Engineering at Beihang University. In 2018, he joined UNC Charlotte as an Assistant Professor and was promoted to Associate Professor with tenure in 2022. His research interest mainly focuses on multiphysics modeling and characterization of battery safety issues and cycling behavior. Dr. Xu is a recipient of the James H. Woodward Faculty Research Award at UNC Charlotte and “40 under 40” Award by the Charlotte Business Journal.



Ying Zhao is currently a principal researcher in the School of Aerospace Engineering and Applied Mechanics at Tongji University, Shanghai, China. She received her B.S. (2010) and M.S. (2013) in Mechanics at Tongji University. She obtained her Ph.D. (2017) in Materials Science at Technische Universität Darmstadt in Germany. Prior to joining Tongji, she worked as a postdoctoral research associate in Engineering at the University of Cambridge, where she participated in the SOLBAT Project of Faraday Institution. Her research interests include electrochemomechanical modeling of lithium-ion batteries, modeling of hyperelastic and viscoelastic materials, phase-field approach for fracture and phase separation, and novel numerical methods such as IsoGeometric Analysis (IGA) and the Finite Cell Method (FCM).