UCI Samueli School of Engineering

Department of Materials Science and Engineering UCI

UNIVERSITY OF CALIFORNIA, IRVINE

DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING

SPECIAL SEMINAR

"REVOLUTIONIZING BATTERY TECHNOLOGY: ENGINEERING QUANTUM MATERIALS FOR ENHANCED SAFETY AND PERFORMANCE IN SOLID ELECTROLYTES"

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Tuesday, April 29, 2024

1:30 - 3:00 PM

Engineering Tower, Conference Room 652

Abstract: In the face of escalating smartphone usage, with a 2024 consumer report citing that 97% of U.S. individuals own at least one, the challenge of battery overheating has become prevalent. My doctoral studies present a groundbreaking approach to this issue by engineering a quantum material as a solid electrolyte with superior ionic mobility at optimal operational temperatures. Utilizing wet chemistry, I synthesized quantum dots to create Cu chalcogenides with superionic conductivity, enhancing battery safety and performance. My postdoctoral work extended these findings, exploring reduced-dimensional quantum wells and transitioning from cadmium-based to copper chalcogenides, leveraging copper's recyclability. My current research also delves into high-pressure x-ray studies performed at synchrotrons, uncovering new material phases, and enhancing electrolyte stability. In a parallel avenue, I investigated perovskite-based solar batteries, aiming for efficiency improvements through innovative synthesis and material assembly. In this talk. I will discuss how to effectively utilize atomically precise material engineering towards the discovery of energy materials meant for high-priority energy storage applications. My vision includes developing non-flammable, high-conductivity solid electrolytes from abundant elements, optimizing synthesis via machine learning, and advancing understanding of ionic transport in solid electrolytes. Collaborations and advanced imaging techniques, like time-resolved electron energy loss spectroscopy, are integral to this endeavor, aiming to revolutionize electrolyte design for safer, high-performance batteries.

Bio: Progna Banerjee is currently a NST Core-funded postdoctoral scholar at Argonne National Laboratory, working on advancing experimental efforts central to Nanoscale Science & Technology (NST) division's research thrusts in “Quantum”, “Interfaces” and “Energy”. Holding a Ph.D. from the University of Illinois at Urbana-Champaign, her interdisciplinary thesis work was conducted across the Physics, Chemistry departments, and the Materials Research Laboratory. Her current research focus is on the development and application of innovative synthetic methodologies to create and analyze ultra-fast ionic solid electrolyte materials, aiming to revolutionize battery energy storage technologies. She is deeply committed to pushing the boundaries of materials science and engineering in the context of battery technology, employing artificial intelligence-assisted synthetic tools. Her expertise is grounded in extensive experience and knowledge in materials and physical chemistry, as well as condensed matter physics, acquired through her education at premier R1 institutions and her contributions to leading US-DOE national laboratories. She is eager to share her vision for integrating her research with educational endeavors, aiming to cultivate an interdisciplinary approach that merges materials science, chemistry, and physics to foster innovative solutions in energy storage and beyond.