# MECHANICAL & MATERIAL COLLOQUIUM

## Catalyzing the Next Era of High-Energy Batteries: Strategies Beyond Lithium-Io

*by Dr. Bilal El-Zahab (Florida International University)*

*This seminar will explore strategies to move beyond the intrinsic energy-density limitations of conventional lithium-ion batteries. With rapidly growing demand for electrified transportation and grid storage, we will first frame the current battery landscape, including global manufacturing trends, supply-chain concentration, and evolving consumer expectations for performance, safety, and cost. We will then discuss lithium-sulfur batteries as a representative "beyond lithium-ion" platform, highlighting how their fundamental chemistry offers step-change improvements in theoretical energy density while introducing new challenges such as polysulfide shuttling, sluggish redox kinetics, and electrode instability. The talk will emphasize how materials design, interfacial engineering, and catalytic approaches can be integrated to address these issues in a holistic manner. Drawing on recent advances in catalysis, electrode architectures, and diagnostic techniques, the seminar will illustrate how combining molecular-level insight with cell-level engineering can accelerate the translation of next-generation chemistries toward practical devices. Throughout, the focus will be on conceptual frameworks and design principles to promote broad thinking about how to engineer high-energy, safe, and sustainable battery systems for the next decades.*

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.Dr. Bilal El-Zahab is an Associate Professor in the Department of Mechanical and Materials Engineering at Florida International University. He earned his Ph.D. in Chemical Engineering from the University of Akron in 2009 and previously held postdoctoral research positions at MIT and Louisiana State University. Dr. El-Zahab's research focuses on advanced materials and energy technologies, including electrochemical energy storage, battery materials, and microfluidic systems. He has published extensively in leading journals and has received several recognitions, including FIU's Excellence in Teaching Award and Excellence in Mentorship Award. In addition to his academic work, he serves on the Board of Directors of the FIU Research Foundation and Lion Battery Technologies.

**Place:**
**EC 1110**

**Time:**
**2:00-3:15PM**

**Mar. 17, 2026**

***For questions, comments and suggestions, contact Colloquium Organizers***
***Dr. Saja AL Rifai (salrifai@fiu.edu) or Dr. Jiuhua Chen (chenj@fiu.edu)***