JEFFREY I. ZINK INORGANIC CHEMISTRY SEMINAR SERIES

Sophia Uemura

The Kaner Group

"A Holistic Approach to Develop the Next Generation of Aqueous Zinc-Ion Energy Storage Systems"

Abstract: Lithium-ion batteries (LIBs) have become the dominant energy storage technology for portable electronics and electric vehicles, thanks to their high energy density and long cycle life, but growing global demand for sustainable, large-scale storage has revealed their limitations. Key challenges include lithium scarcity, rising costs, safety risks from flammable organic electrolytes, and environmental concerns. Aqueous zinc-based batteries (ZIBs) have emerged as promising candidates for safe and cost-effective energy storage, benefiting from the intrinsic nonflammability of water-based electrolytes, and their natural abundance in the Earth's crust. Despite their great potential, this technology remains underdeveloped for practical use due to serious limitations in several aspects. In order for industrial applications, ZIB cathodes will need to achieve a mass loading higher than 10 mg cm-2. However current methods result in a thick electrode with hindered ion transport, resulting in limited electrochemical performance. Second, the glass fiber separator's physical structure allows dendrite growth that causes early short circuiting and parasitic corrosion reactions. Lastly, the Zn anode's uneven surface leads to uncontrollable dendrite formation resulting in limited battery lifetime and the onset of the hydrogen evolution reaction (HER). Therefore, my strategies in this talk will address solutions in all three main components of a ZIB. First, I have developed a 3D printed cathode to incorporate industrial level mass loading of 38 mg cm-2 to offset the usual sluggish ion kinetics and achieve excellent charge-storage performance. Second, I will present a robust amine functionalized polymer separator with high mechanical strength to suppress dendrite formation and corrosion reactions. Third, I will introduce a method of using a laser-scribed silver nanoparticle embedded in reduced graphene oxide interface to regulate Zn nucleation and suppress HER for an ultra-stable zinc anode. By addressing all three problems, this work demonstrates that a holistic approach is essential to moving zinc-ion energy storage meaningfully closer to real-world viability.

Tuesday, May 12th, 2026
2:00 p.m. | YH4222 - Collaboratory Dongwon Yoo Seminar & Conference Hall

UCLA College | Physical Sciences Chemistry & Biochemistry

More information: isaluo196@ucla.edu

This event is made possible by generous donations from our supporters and also through the gifts of the Bhaumik Centennial Collaboratory, Yoo Seminar & Conference Hall, Tsay Study Lab, and Centennial Collaboratory Donor Wall & Space Funds.