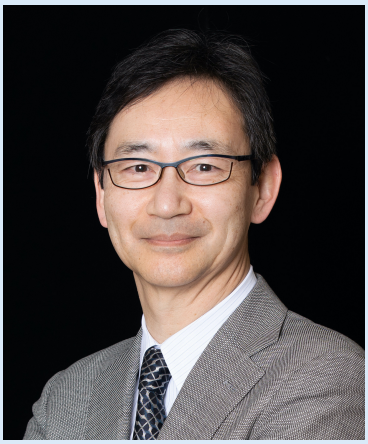
JEFFREY I. ZINK INORGANIC CHEMISTRY SEMINAR SERIES



Prof. Ping Liu

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“Long-life Battery Materials: Intercalation and Beyond”

Abstract: The history of rechargeable batteries teaches us that replacing phase conversion reactions with alloy or intercalation reactions is highly effective in enhancing cycle life. The reduced chemo-mechanical changes and the avoidance of the nucleation of new phases are basis for such enhanced stability. However, to realize energy densities higher than intercalation-based lithium-ion batteries, recent research has moved again into complex conversion reactions. For example, significant effort has been devoted to realizing long cycle life for metal anodes and sulfur cathodes.

In the past decade, we have explored opportunities on both types of reactions. For intercalation reactions, we discovered that lithium vanadium oxide with a disordered rocksalt structure can work as a reversible host for lithium ions at electrochemical potentials approaching Li metal itself. Moreover, given its cubic structure and the small volume change, the material has shown exceptional rate capability and > 10k cycles of life. The Na analog was also found to be as stable despite significant short-range structural distortion due to the larger size of Na+. These examples show that finding new intercalation hosts is still possible, some of which have more desirable crystal structures than the common layered oxides and carbonaceous materials.

Among conversion cathodes, sulfur and metal fluorides have been extensively studied. However, their cycling stability remains challenging. On the other hand, the sulfurized polyacrylonitrile, or SPAN, has shown stable cycling for thousands of cycles. Understanding the structural and chemical mechanisms may point to directions that uncover more high-capacity stable materials. Our work shows that the conjugated pyridine structure promotes pi-pi stacking, which is essential for the structural resilience during cycling. These findings point to new possibilities of materials beyond traditional metal oxides with cycle life rivaling that of intercalation compounds.

Meet the Speaker
11:45 a.m. | YH 3096

Wednesday, September 30th, 2026
4:00 p.m. | YH4222 - Collaboratory Dongwon Yoo Seminar & Conference Hall

UCLA College | Physical Sciences Chemistry & Biochemistry

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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.