

Seeing the Unseeable: A Neutron and X-Ray Vision into Energy Storage Materials



26 November 2025

Prof. Kun QIAN

Great Bay University

Venue: N23-4018

Time: 16:00 - 17:00

Hosted by: Prof. Qing LI

Abstract

The electrochemical performance of batteries is intrinsically governed by the structural dynamics of their constituent materials. Establishing a precise correlation between structure and function is therefore paramount for advancing battery technology. This endeavor, however, is significantly challenged by the difficulty in characterizing lithium-containing materials, as the light Li element is weak in scattering X-rays. To overcome this limitation, combined neutron-based and X-ray-based techniques emerge as powerful, complementary probes. This talk showcases a suite of such advanced characterization methods: Neutron Depth Profiling (NDP) for mapping the spatial distribution and diffusion of lithium in materials; Neutron Powder Diffraction (NPD) for precise analysis of bulk crystal structure evolution in cathode materials; and Small-Angle Neutron Scattering (SANS) combined with Small-/Wide-Angle X-ray Scattering (SAXS/WAXS) to probe solvation structures of liquid electrolytes. The synergistic application of these techniques provides a comprehensive, multi-scale perspective, bridging the critical knowledge gap between material degradation and performance fade in lithium batteries.

Biography

Prof. Kun QIAN is an Assistant Professor and Doctoral Supervisor at Great Bay University. His research focuses on the application of advanced characterization techniques, particularly those based on synchrotron and neutron sources, to study material structures, interfaces, and degradation mechanisms. With over seven years of hands-on experience at large-scale facilities, he has conducted numerous experiments at beamlines 11-ID-C, 12-ID-B, 12-ID-C, 11-BM, and 20-BM of the Advanced Photon Source (APS) at Argonne National Laboratory (USA), as well as at the Shanghai Synchrotron Radiation Facility (SSRF) and the China Spallation Neutron Source (CSNS). Prof. Qian has authored 37 publications in leading journals such as *Nature Energy*, *Energy & Environmental Science*, *Advanced Materials*, and *Advanced Energy Materials*. His research has been supported by multiple competitive grants, such as the Young Scientists Fund (Category C) from the National Natural Science Foundation of China (NSFC), Guangdong Provincial Fund, and industrial partnerships.