

Probing Batteries with X-rays and Neutrons from Cradle to Grave

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Lithium-ion batteries (LIBs) have transformed modern technology, powering everything from portable electronics to electric vehicles and renewable energy storage systems. As the world shifts toward post-Lithium solutions, Sodium-based cells are gradually making their debut in the mass market. In this evolving landscape, large-scale facilities drive the advancement of battery systems by providing crucial insights. Due to their unique capabilities, synchrotron and neutron radiation reveal essential details that are key to optimizing performance.

One of the main goals of ongoing studies is to transfer the knowledge gained from LIBs to emerging post-Lithium technologies, with X-ray diffraction and X-ray absorption spectroscopy offering in-operando data to enhance battery performance. At the same time, growing concerns over resource limitations have sparked the interest in reuse, recycling, and upcycling of batteries

Access to large-scale facilities is limited, making it increasingly important to pre-characterize materials in-situ and in home-labs. This step is often done before utilizing synchrotron or neutron sources. In this presentation, typical experiments using synchrotron and neutron radiation to study battery systems will be showcased, with a comparison to what can be achieved in-house. Key strategies for successful experimental design will be shared, along with common pitfalls to avoid.