

Batteries play a crucial role in modern society and are essential to meeting net-zero ambitions. However, rising demand combined with limited EU-based supply of critical raw materials is leading to concerns over a potential shortage of battery commodities. Furthermore, there is a pressing need to improve the environmental sustainability of batteries and battery production. New chemistries and processing strategies are emerging to address these issues, but these introduce further complexity and are poorly understood. New metrology is critical to accelerate the development of the next generation sustainable battery materials systems.

A battery materials metrology framework exists based on benchmark Li-ion batteries (LIBs) but its extension to new chemistries is non-trivial owing to the wider diversity of elemental combinations, structures, and interactions. It is necessary to ensure that existing best practice can be reliably extended to emerging, more sustainable materials systems such as sodium-ion batteries (SIBs), while broadening the range of techniques to include properties such as thermal characteristics. Recycling of battery materials offers a route to de-risking the supply chain, but the process introduces impurities, so there is a need for traceable analytical techniques and calibration materials to reliably quantify and understand the impact of elements in recycled electrodes. The complexity of battery electrode composites makes them highly challenging to characterize reliably, particularly during charge-discharge cycling. Operando methods offer a solution to this, but improved confidence in these measurements requires their hybrid combination; there is a need to develop instrumentation to enable multiple independent and simultaneous measurements of singular and related quantities to minimize uncertainty.

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