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The European Battery Hub at ESRF - History, concept and operation

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Following an upgrade programme, the ESRF performance has been increased a hundredfold, enabling more experiments in less time. New access modes were designed to optimise the use of beamtime and to facilitate collaborations between researchers on topics with strong societal impact. From 2021 to 2024, CEA and the ESRF tested multi-beamline access through the creation of a first pilot hub dedicated to battery characterisation. Since 2024, the Battery Hub has brought together ESRF scientists and European research groups (Chalmers Univ., HIU-KIT, Bayreuth Univ., CNRS, CEA-Liten, CEA-Irig). These experts in battery characterisation are sharing around 80 shifts each semester across six beamlines (BM32, ID13, ID31, ID16B, ID26, ID20), enabling multiscale studies of battery materials (crystallographic structure, morphology, chemical and electronic environment) and related reaction mechanisms from atomic scale to real battery cell level. The objective of the Battery Hub is to accelerate the development of more sustainable and higher-performance batteries, thanks to the complementary expertise of each partner and to the state-of-the-art characterisation capabilities of the ESRF. The work is currently focused on all-solid-state and Na-ion batteries until 2027. Several findings from the last year are already published or about to be. An extract of some of them will be presented after a description of the Battery Hub history and concept.

The European Battery Hub develops a comprehensive large-scale synchrotron-based correlative characterisation of battery materials and devices, integrating scattering, spectroscopic and imaging techniques into standardised workflows.

It enables the holistic understanding of reaction and degradation mechanisms in batteries.

It tackles key scientific questions for two highly relevant technologies, specifically Na-ion batteries (NIBs)

It brings together 6 interdisciplinary academic groups from France, Germany and Sweden with ESRF experts, to ac

It pushes the frontiers of operando characterisation techniques thanks to the exceptional coherence and brilli

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