From OpMetBat to HyMetBat
A Metrology Study on Operando Cycling of Li-ion batteries

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Abstract

The development of new battery materials and the understanding of their ageing processes are key to improve the performance, lifetime, safety and cost of energy storage technologies, such as Li-ion and Na-ion batteries for electric vehicles and grid storage. However, innovation by industry relies on accurate characterization techniques under operando conditions. It is well known that small changes in the battery design, assembling and sample conditions will impact the battery performance and measured properties. To overcome some of these issues, the **OpMetbat [**1] project build on a metrological framework, supporting traceable operando characterisation of state-of-the-art battery materials under dynamic charge / discharge conditions. This includes advancement and validation of ex situ methods, establishing new protocols, cells and a best practice guide for operando approaches and developing new instrumentation enabling hybrid, multiparameter measurement to inform new materials development. The **HyMetBat** project expand on the work initiated in the **OpMetBat** project, extending the hybrid metrology operando measurements by compiling the data in a database, accessible to the battery community. The data collected from several characterization techniques measured under equivalent conditions, using the same battery materials, operando cell and cycling protocols, are stored in an open access database hosted by the project. For statistical verification, atomistic simulations are applied to calculate properties measured experimentally under controlled conditions. The results collected in the database are used to create training sets developed to study battery degradation by statistically validated machine learning tools.

References

[1] **OpMetBat**: https://opmetbat.inrim.it/ Partners: Physikalisch-Technische Bundesanstalt (PTB, Germany); Commissariat à l'énergie atomique et aux énergies alternatives (CEA, France); Czech metrology institute (CMI, Czech Republic); Istituto Nazionale di Ricerca Metrologica (INRIM, Italy); National Physical Laboratory (NPL, UK); Helmholtz-Zentrum Berlin für Materialien und Energie GmbH (HZB, Germany); Institut Jožef Stefan (JSI, Slovenia); Mersin Üniversitesi (MEU, Turkey); Technische Universität Berlin (TUB, Germany); The University of Liverpool (Uliv, United Kingdom); Univerza v Novi Gorici (UNG, Slovenia); Università degli Studi di Roma La Sapienza (UNIROMA1, Italy); Westfälische Wilhelms Universitaet Muenster (WWU, Germany); Eidgenössische Materialprüfungs- und Forschungsanstalt (EMPA, Switzerland); Centro Ricerche FIAT (CRF, Italy)