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Forschungszentrum Energiespeichertechnologien

BATTERY CONFERENCE
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Identifying battery storage systems to ensure stable grid operation

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Motivation

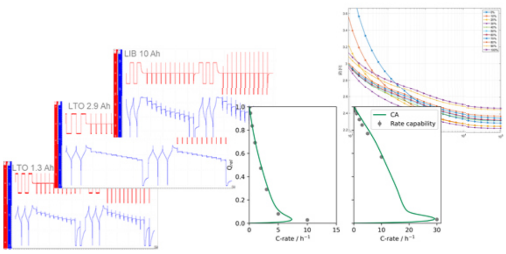
- The design of a correctly dimensioned battery storage system to ensure stable grid operation requires a holistic view of the entire system with regard to the storage unit, the inverter and the feedback of dynamic grid requirements.
- A comparison of the particular requirements, which typically demand high power rate with low energy throughput and high fluctuation, with storage technologies currently in use shows that there is a lack of technical solutions.
- The approaches of the aluminium-ion battery (AIB) with aluminium and graphite as electrode material are promising, for which energy densities in the range of 50-60 Wh/kg are shown. Furthermore, a cycle stability of 500,000 cycles was achieved at a charge rate of 100C.

Objectives

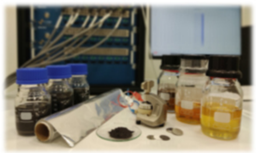
- Determining the requirements for a battery storage system in different dynamic grid application scenarios
- Development of a transfer function from the electrical grid via the inverter to the battery and vice versa
- Standardised test specification for the suitability of storage technologies for grid support
- Electrochemical characterisation and modelling of storage technologies for high dynamic requirements (LIB, AIB, supercaps)
- Gap analysis for grid applications with high dynamics
- Optimisation of the alternative Al-ion cell chemistry, especially with regard to cost structure, life cycle assessment and resource availability
- Pouch cell concept for AIB and development of a module prototype for stationary use

Methods

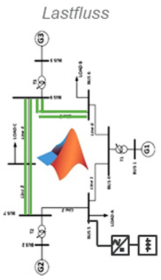
- Dynamic characterisation of storage technologies by Chrono-Potentiometry, Chrono-Amperometry and impedance spectroscopy



- Evaluation of materials and morphology for AIB

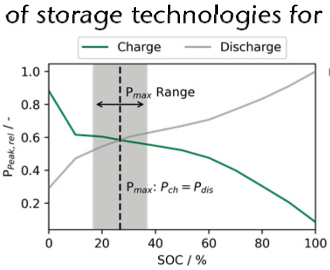


- Matching between grid service requirements and battery cell properties through gap analysis
- Coupled Matlab model grid - inverter – battery

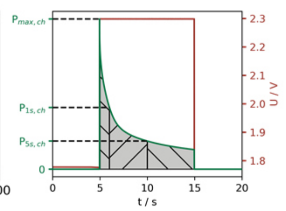


Results

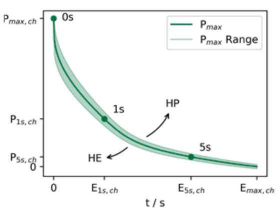
- Standardized test specification for the suitability of storage technologies for grid support



Step 1: Maximum power range (Chrono-Potentiometry)

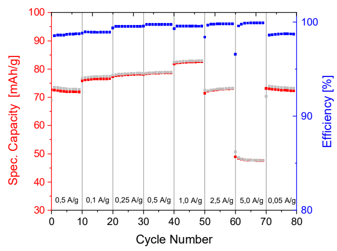


Step 2: Chrono-Amperometry → transient power capability



Step 3: transient energy content

- Evaluated (Pouch) cell concept for AIB



[Courtesy of Fraunhofer IISB, THM Freiberg]

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