

Fraunhofer Battery Alliance

Testing and evaluation

*Test infrastructure for
HV battery systems
(© Fraunhofer LBF)*

The 26 member institutes of the Fraunhofer Battery Alliance develop technical and conceptual solutions along the entire value chain of electrochemical energy storage systems up to the application level on behalf of customers or in publicly funded projects together with industry. Our expertise and many years of experience range from materials development to system integration of mobile and stationary storage systems.

Competences and field of work

The testing and evaluation of energy storage systems is an important part in the development chain for automotive applications. Due to the complex issues involved, a significant number of attributes has to be investigated. In addition to standard tests, the facilities available within the Fraunhofer Battery Alliance enable specialized and highly scientific tests on specific topics, on cell, module, and system level.

Testing on cell level (including equipment)

Individual cells are the basis of each battery system – their properties and key data must be determined by comprehensive characterization and testing. The facilities of the Battery Alliance offer the possibility of electrochemical and physical characterization of both material and cell. Material-relevant

data such as specific capacity, power density, lithiation and delithiation potentials as well as the gas formation rate and other parameters relevant for a comprehensive understanding of the electrochemical processes such as cycle stability, internal resistance, calendar aging behavior and degradation processes, can be determined in a wide temperature range (-40 to +180 °C).

Furthermore, electrical, thermal, and mechanical tests as well as safety tests with time-resolved analysis of the released substances are carried out at cell and module level. In the event of incidents or an accident, batteries must not pose a hazard to humans or to the environment. Therefore, it is essential to know the battery behavior under different conditions in order to assess the hazard potential and to provide suitable protective measures. Post-mortem analysis can be used to determine damage to lithium-ion batteries or caused by lithium-ion batteries.

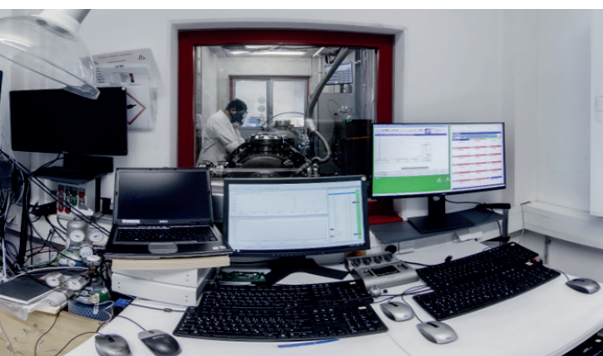
Testing on module and system level (including equipment)

The behavior and hazard potential of a battery module or system depends on the number and size of the individual cells. The member institutes of the Fraunhofer Battery Alliance also have the expertise and equipment to test battery modules and systems, to determine their operational durability and system reliability, and to investigate their behavior under accidental conditions. Test devices are available for conventional coin cells up to large battery systems, such as power test equipment up to 1000 V, 600 A, 250 kW with CAN bus emulation and heat and climate chambers as well as various water baths. In addition, battery management and energy management systems can also be tested specifically.

The evaluation of structural durability and system reliability is an important step before new products are introduced into the market. The activities of the Fraunhofer Battery Alliance range from data analysis to suitable testing methods resulting in a reduced experimental time duration for energy storage systems. The institutes are equipped with electrodynamic shakers up to 27 kN (RKV) including climate chamber, multi-axial vibration tables for batteries up to 600 kg in mass including climate chamber and energy source/ sink, scanning vibrometry (one- and three-dimensional) and customer-specific test setups with servo-hydraulic excitation. Furthermore, reliability methods (FMEA, ASIL, functional safety) are used to evaluate energy storage systems.

In addition to standard safety tests, the member institutes perform quasi-static and dynamic impact loads to test battery behavior under accidental conditions. Crash facilities for testing lithium-ion systems down to module level are available, coupled with extensive analytical technology such as high-speed camera, X-ray video and computer tomography (CT). Furthermore, the institutes are equipped with fire containers with extinguishing and flooding functions to burn down batteries. The expertise and equipment available within the Fraunhofer Battery Alliance make it a leading institution in the field of safety, impact and crash research for battery technologies.

*Control room including analysis equipment
for battery safety tests (©Fraunhofer ICT)*



Our offer

- Tests according to common standards and customer-specific battery testing
- Safety tests on cell, module, and system level
- Time-resolved gas analysis during abuse and safety tests
- Evaluation of operational stability, structural durability, system reliability of battery systems, including set-up and connection methods
- Destructive, quasi-static and dynamic test methods on systems
- Crash facilities for investigating the crash safety of battery systems down to the module level
- X-ray video for the observation of cell-internal processes, e.g., during a thermal runaway
- Load and stress tests, determination of state of charge and state of health
- Performance / aging tests and storage under defined conditions
- Housing, electronics and thermal management (cooling systems)
- Analysis with different methods, e.g., CT
- Material characterization

Please feel free to contact us – with many years of experience and expertise, we will collaborate with you to develop customized solutions tailored to your needs.



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