Fraunhofer Battery Alliance

Testing and Evaluation

The Fraunhofer Battery Alliance, consisting of 19 Fraunhofer institutes, carries out research in the field of electrochemical energy storage devices (batteries and supercapacitors) in order to develop technical and conceptual solutions for commercial applications. Particular consideration is given to the social, economic and ecological implications of the technology.

Beside materials, systems and simulation, a further competence of the Alliance is in the field of testing.

Competences and fields of work

The testing and evaluation of energy storage devices is an important stage in the development chain for automotive applications. Due to the range of challenges involved, a significant number of attributes must be investigated. Beside standard tests, the facilities available within the Fraunhofer Battery Alliance enable specialized and highly scientific tests on specific topics, on a cell, module and system level.

Testing on cell level

Cells are the basis of every battery system. The Fraunhofer Battery Alliance evaluates battery systems and their cell design. Abuse tests are carried out on a cell and module level, and damage and post-mortem analyses complete the service portfolio.

Electrical testing on module and system level

The Fraunhofer Battery Alliance has long-standing experience in the field of battery system technology (construction of battery modules and systems, development of battery management systems) and battery tests (performance and aging tests), as well as the modeling and simulation of battery and energy systems.
**Durability and system reliability during operation**
Evaluation of operational stability and system reliability is an important step before new products are introduced onto the market. Activities of the Fraunhofer Battery Alliance include loading data analysis, testing methods and the accelerated testing of energy storage systems. Reliability tests (FMEA, ASIL, functional safety) are also used to evaluate energy storage systems.

**Behavior and accident scenarios**
In accident scenarios it is important that batteries do not pose a hazard to humans or to the environment. The expertise and equipment available within the Fraunhofer Battery Alliance make it a leading institution in the field of impact and crash research.

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**Facilities and equipment**

**Testing on cell level**
- Chemical analysis of substances emitted in abuse scenarios
- Abuse tests in pressure containers
- Analysis of cell materials and components (e.g. REM, XRD, Raman, DSC, ICP-AES)
- Protective gas box to open and evaluate cells

**Electrical testing on module and system level**
- Over 140 test circles for batteries ranging from small button cells to large battery systems for traction and stationary applications

**Behavior and accident scenarios**
- Battery testing stand for quasi-static and dynamic impact loads
- Component crash unit
- Tests in a protected environment
- Facilities for whole-vehicle crash testing (from 2012)
- Comprehensive measurement technology including a high-speed camera, gas analysis and CT

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**Our offer**
Our service portfolio covers all standardized tests, and also offers possibilities for customer-specific testing. Activities within the Fraunhofer Battery Alliance include the definition or development of relevant testing and evaluation programs. The Alliance also offers consultancy and additional research and development competences in this field.

The following tests can be carried out:
- ISO 12405
- IEC 62660
- UN transport tests
- FreedomCAR tests
- Tests according to other common standards (SAE, UL, GB/SOC...)
- Safety tests on cells, modules and battery packs
- Analyses using different processes, e.g. CT
- Freely programmable testing cycles
- Material characterization
- Load and stress tests
- Aging tests
- Evaluation of operational stability and system reliability of battery systems, including set-up and connection methods
- Casing and storage
- Electronics
- Cooling systems and elements
- Consultancy, studies

1. Nail penetration test on Li-ion cells. Photograph: Fraunhofer ICT.
2. Electrodynamic shaker including climate chamber for environmental simulation. Photograph: Fraunhofer LBF.