



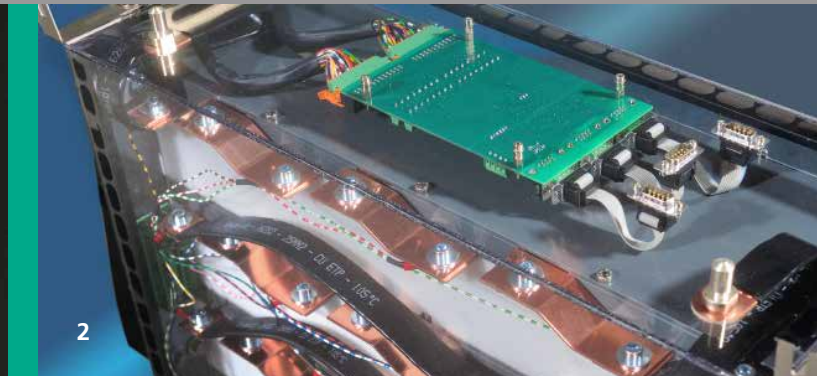
Fraunhofer

BATTERIEN

FRAUNHOFER BATTERY ALLIANCE



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1 Battery management system.

Photo: Fraunhofer IISB.

2 Battery module made from

18650-cells (project FSEM II).

Photo: Fraunhofer ILT.

Fraunhofer Battery Alliance

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FRAUNHOFER BATTERY ALLIANCE SYSTEMS

The Fraunhofer Battery Alliance, consisting of 19 Fraunhofer institutes, carries out research in the field of electrochemical energy storage devices (batteries and super-capacitors) 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, cell production, simulation and testing, a further competence of the Alliance is in the field of systems.

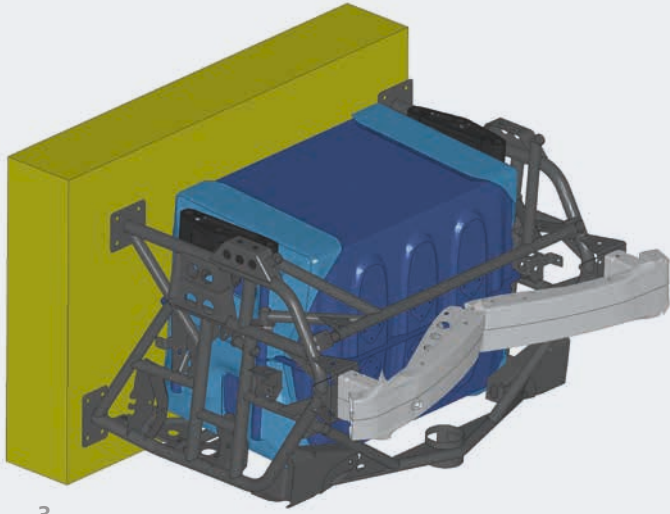
Competences and fields of work

In the Fraunhofer Battery Alliance, individual cells with a different technological basis can be developed into battery modules and complete battery systems for various applications, including electromobility, stationary energy storage devices and specialized applications, according to our customers' needs.

Work includes:

- the simulation-based design of the mechanical construction
- thermal management (cooling system)
- assembly
- safety concepts
- application and fulfillment of (safety) requirements
- safety and risk analysis, for example using fault tree analysis (FTA) and failure mode and effect analysis FME(D/C)A
- development of battery management systems
- algorithms for measurement of state of charge and aging
- optimized charge and operation management strategies

The interfaces of the modular battery systems are configured to facilitate system integration in terms of both performance and communication.



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Our offer

Products

- Prototypes of battery modules and systems for portable, electromobile and stationary applications
- Battery management systems on chip, module and cell level
- Broad spectrum of battery technologies (e.g. lithium, lead or high-temperature batteries and redox-flow systems)
- Hybrid battery systems

Development

- Modeling and simulation
- Design supported by cutting-edge simulation tools
- Measurement of state of charge and aging
- Optimized charge and operation management strategies, and cell-balancing processes
- Electronic components on chip and module level (current sensors, safety circuits, capacity monitors)
- Services accompanying development, such as verification and validation
- Connection to energy systems
- Development of adapted contacting technologies such as laser welding processes for cell contacting

Safety

- Safety analysis and concepts
- Consultancy and support in the safety-relevant design of battery systems
- Proof of fulfillment of technical requirements in terms of reliability and safety

- Laboratory testing
- Compilation of hazard lists, and hazard analysis of entire systems as well as critical sub-systems

Consultancy

- Performance and evaluation of design studies
- Market analyses
- Feasibility studies

Examples of applications

Electromobility: Safe integration of traction batteries

The Fraunhofer Battery Alliance is working on safe and reliable integration solutions for vehicle batteries. On the one hand, traction batteries represent a potential hazard to vehicle occupants and the environment, and therefore require special protection. On the other hand, extra weight reduces the range of electric vehicles. It is therefore important to optimize the battery holders and protective casings with regard to durability, reliability and crash resistance, while at the same time reducing weight. The construction and design is enhanced through the use of computer-assisted methods.

Expertise in material characterization and modeling, and in component optimization and evaluation, together with the possibility of experimental verification, complete the service portfolio of the Fraunhofer Battery Alliance.

Stationary storage for renewable energies and network stabilization

The rapid increase in the use of renewable energies means that stationary storage devices are needed in a variety of applications. These include the intermediate storage of photovoltaic energy (to increase individual consumption and the solar fraction) and the stabilization of the electricity grid. Storage devices are also used in solar and wind parks to balance energy supply to the network and adjust supply to consumer requirements.

The Fraunhofer Battery Alliance develops optimized battery systems from a few kWh to MWh output. Particularly important developments are long lifetime, a large number of operating cycles with maximum depth of discharge, and reliability and safety. Another important factor is cost reduction, for example through optimized module and system design, efficient cooling systems, the use of model-based battery management systems or new production solutions from the cell to the system. In addition, battery systems are designed for easy integration into the system environment. Important factors in this respect are the connection to power electronics (for example battery inverters) and the possibility of data exchange between the battery management systems and overarching energy management systems.

3 *Crash simulation of a collision test on the rear frame of the Fraunhofer demonstration vehicle Artega. Photo: Fraunhofer IWM.*

4 *Lithium battery module for a hybrid light-weight vehicle. Photo: Fraunhofer ISE.*