Battery Technology Center of KIT

Sustainable and low-cost generation, storage, and use of electrical energy for stationary and mobile applications are among the biggest global challenges facing society in the next decades. At KIT, research into and development of innovative electrical energy storage systems are pursued by several institutes, thus covering the complete added value chain in a holistic and interdisciplinary approach.

At KIT's Battery Technology Center, battery research activities are pooled across institutes. Here, an open technology platform is established for future electrical energy storage systems. Work focuses on the development and production of new materials and cells, on the development of battery systems, and on system integration. In parallel, new processes for the low-cost production of these batteries are developed and tested on a prototype scale. The primary goal is to develop solutions for storage systems of future generations.

Research areas at the Battery Technology Center are carried out by the following institutes of KIT:

- Cell development and tests: Institute for Applied Materials – Energy Storage Systems (IAM-ESS)
- Production research: Institute of Production Science (wbk)
- Energy storage systems: Institute of Electrical Engineering (ETI)

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Karlsruhe Institute of Technology

Focus on the Storage of Electrical Energy

BATTERY TECHNOLOGY CENTER

INSTITUTE FOR APPLIED MATERIALS – ENERGY STORAGE SYSTEMS (IAM-ESS) WORKING GROUP CELL DEVELOPMENT AND TESTING

In the field of cell development, the construction of high-quality lithium-ion pouch cells are in focus in the laboratory and industry-related large format.

Cell Assembly

Semi-automatic line for manual manufacture of pouch cells in the dry room:

- Analysis of failure mechanisms with forced cell failures
- Performance analysis of cell components, such as separator, electrodes, conductor foils
- Tests of new electrolytes and additives
- Tests of new active materials
- Tests of new cell formats

Cell Tests

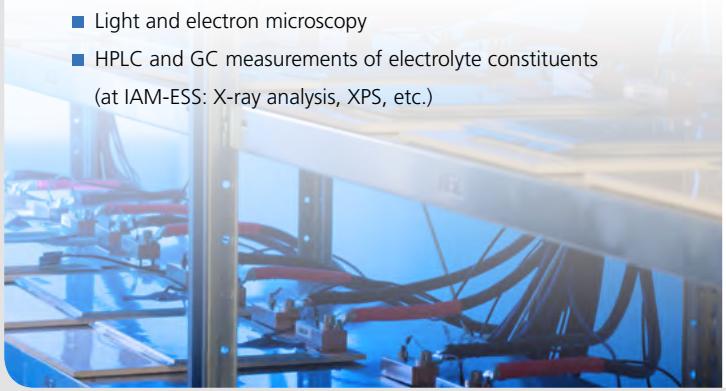
Electrochemical characterization of cells of any format (hard case, pouch and round cells):

- Rate capability and internal resistance
- Endurance tests and application of load profiles
- Calendar aging tests
- Electrochemical impedance spectroscopy

Post-mortem Analysis

Investigation of aging phenomena or cause and effect relationships:

- Light and electron microscopy
- HPLC and GC measurements of electrolyte constituents (at IAM-ESS: X-ray analysis, XPS, etc.)



INSTITUTE OF PRODUCTION SCIENCE (WBK) – WORKING GROUP ELECTROMOBILTY (MACHINES, EQUIPMENT AND PROCESS AUTOMATION)

Most of the cost of lithium ion cells and batteries is attributable to their production. The objective is the development and prototypical representation of economical production processes.

Process Development and Optimization

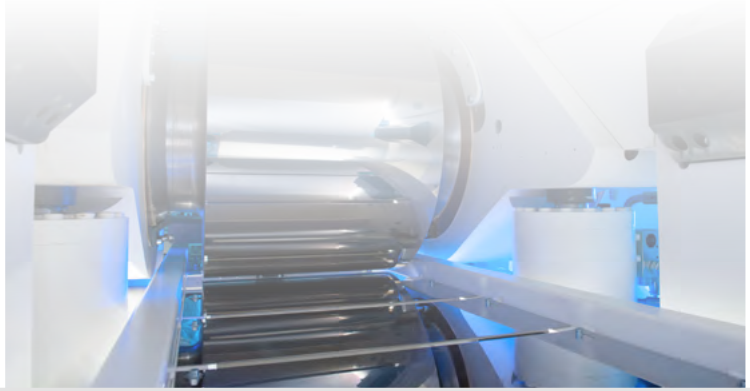
- Development of novel stacking processes
- Optimization of the calendaring process
- Development of format-flexible production processes
- Development of a system for the disassembly of battery modules
- Development of handling solutions for the manufacture of battery modules

Process Studies

- Investigation of the behavior of pouch cell foils in deep drawing
- Calendaring tests
- Studies of the mechanical behavior of electrodes.

Development of Production Systems

- Development of robot-supported agile production technologies for format-flexible battery manufacture
- Establishment of quality assurance systems



INSTITUTE OF ELECTRICAL ENGINEERING (ETI) – WORKING GROUP ELECTRICAL ENERGY STORAGE SYSTEMS IN APPLICATION

The Institute of Electrical Engineering with the division of Energy Storage Systems carries out Research and Development work from battery development to overall system integration.

Battery Systems Development

- Battery modeling for battery development and design taking into account thermal loading, bonding technology, and aging
- Construction of prototypes for verification and validation purposes
- Optimized BMS algorithms
- Innovative and application-oriented power electronics down to the cell level
- Safety and performance assessment

Overall System Integration

- System design and dimensioning
- Storage system integration for stationary and mobile applications and sector coupling
- Smart, prognosis-based control for PV integration and load peak shaving taking into consideration battery aging
- Power electronics for the integration of storage systems in the grid

Test Infrastructure

- Latest hardware-in-the-loop test benches
- Storage systems of 5 – 1500 kWh and more than 100 PV test facilities to verify hardware and software
- Plant cluster of a future energy system as validation platform within Energy Lab 2.0