AUSTRIAN INSTITUTE OF TECHNOLOGY

BATTERY TECHNOLOGIES

BATTERY RESEARCH AT AIT

The battery is the heart of modern electric drive concepts. Globally, great effort is invested into making electrical energy storage systems as efficient, powerful, cost-effective, and safe as possible. This is the basis of our research motivation at AIT Austrian Institute of Technology, the largest non-university research institution in Austria. Together with our partners, we are researching the battery of the future.

HIGHLIGHTS

// Battery material development and optimisation

// Industry-relevant electrode engineering and cell prototyping

// Accredited electrical environmental and safety tests on cell, module, and system level

// SoX determination

// Bridging the gap between academic and industrial research

FROM LAB TO PROTOTYPE

Our scientists pursue a holistic research and development approach which covers the entire process from material optimisation via battery testing up to system design.

MATERIAL DEVELOPMENT

FOCUS

In material development, our research focus is on novel, high-performing anode and cathode materials of the future, and on optimising commercial cell chemistries. Our main emphasis is on 3rd generation cathode materials, such as nickel-rich NMC and LNMO, Si-C-composites and Sn-based anode materials, and post-lithium cathode and anode materials as used in all-solid-state and magnesium ion batteries.

HIGHLIGHTS

// Wet chemical and solid state synthesis of cathode and anode materials

// High energy cathode materials such as LNMO ($LiNi_{0.5}Mn_{1.5}O_2$) and nickel-rich NMC ($LiNi_xMn_yCo_{1-x-y}O_2$)

// Si-C composites and Sn-based anode materials

// Cathode and anode materials for Mg-ion batteries

// Processing of all-solid-state materials for scalable production

MATERIAL CHARACTERISATION

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Whether it's new material development or quality control of industrially produced substances – material characterisation is a core part of our research activities. The targeted use and appropriate combination of analytical methods and customer-specific sample preparation techniques guarantee solutions that meet the highest quality standards of material characterisation.

HIGHLIGHTS

// Wavelength-dispersive X-ray fluorescence analysis (WD-XRF)

// X-ray diffractometry (XRD, ambient/non-ambient)

// Particle size and size distribution analysis

// Gas chromatography mass-spectrometry (GC/MS)

// Electron microscopy (SEM) and EDX

ACCREDITED ACCORDING TO EN ISO/IEC 17025

ELECTRODE PREPARATION AND CELL DEVELOPMENT

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Our Dry Room, together with a modern research pilot line for the production of stacked pouch cells, enables us to perform industrially relevant protoyping. Special attention is paid to the optimisation of each individual production step.

Industrially relevant research and development can be performed at lowered investment risk.

HIGHLIGHTS

// Electrode design, coating, calendering, and slurry development

// Industrially relevant prototype manufacture in the Dry Room

// Pouch cell manufacture up to 10 Ah capacity per cell

// Optimisation of cell components

// Sensor integration for Next Generation Smart Cells

BATTERY TESTING

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In the battery testing laboratory, batteries are investigated in detail on the cell, the module, and the system levels. That includes electrical testing as well as safety evaluation through abuse testing.

We offer support from selecting cell technologies and functionality testing via battery characterisation, driving cycle simulation up to lifetime testing and the investigation of the influence of different ambient conditions.

HIGHLIGHTS

// Electrical tests:
functionality, characterisation, lifetime, calendar ageing, cyclical ageing (up to 1200V and 750 A)

// Thermal safety tests:
thermal stability, elevated storage temperatures

// Mechanical safety tests:
internal short circuit in cells, crushing, drop tests

// Electric safety tests:
overcharge, external short circuit (Rs ≤ 137 µΩ, 20 kA), deep discharge/voltage reversal

ACCREDITED METHODS

- IEC 62660-1
- ISO 12405-4
- IEC 62281
- IEC 62133-2
- IEC 62660-2
- UN38.3

FACTSHEETS

BATTERY DIAGNOSTICS

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Battery diagnostics include electrical testing of cells under normal and abuse conditions, measuring of structural changes in electrode materials, in operando gas analysis of electrolytes, and contactless expansion measurement of cells. The combination of electrochemical and morphological characterisation results in a comprehensive diagnostics portfolio.

HIGHLIGHTS

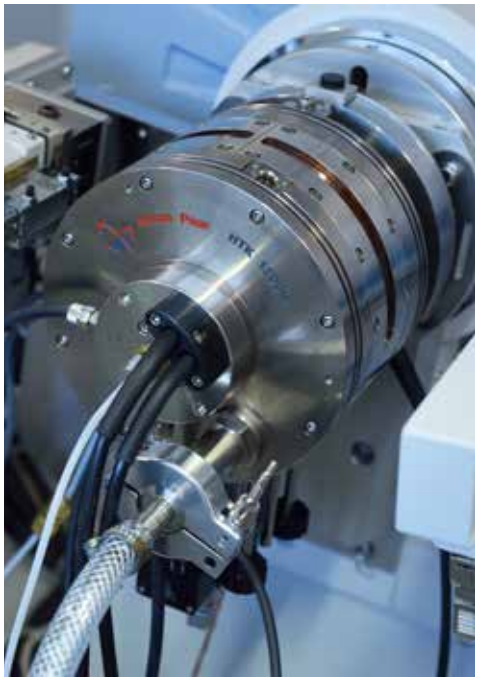
// Electrochemical investigation, impedance spectroscopy, GCPL for coin and pouch cells

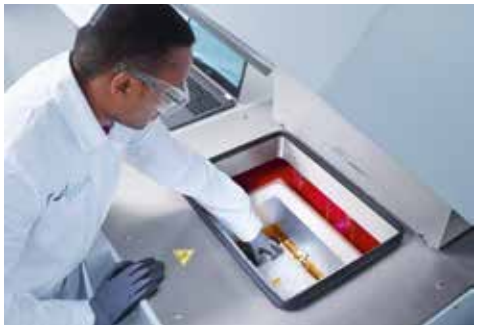
// In-Situ ultrasound diagnostics (amplitude and duration)

// In-Situ PXRD, high temperature XRD

// Calorimetry (up to industrial pouch cell format)

// Operando GC/MS, including fast sampling





POST MORTEM ANALYSIS

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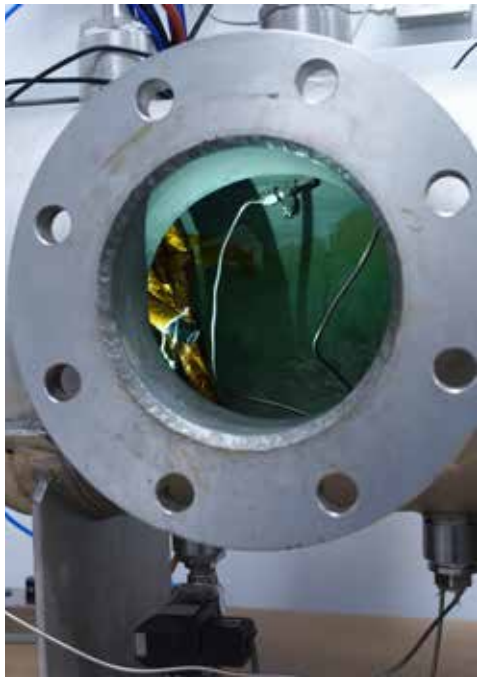
For investigating and understanding electrode degradation, commercial or self-produced cells are opened and disassembled in a glove box under inert gas conditions (Argon). In-house analytics enable elemental and structural analyses and investigation of the morphology of cell components and the condition of components (electrodes and separator) can be evaluated. The results flow directly into ageing simulations.

HIGHLIGHTS

// Determination of physico-chemical parameters of active materials
// Cell impedance spectroscopy
// Scanning electron microscope with energy dispersive X-ray fluorescence analysis (SEM/EDAX)
// Powder X-ray diffractometry (PXRD)
// Quantification of specific surface area (nitrogen adsorption)



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