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FRAUNHOFER BATTERY ALLIANCE



1 *Mixing tests in the technology center for battery production.*

Photo: Fraunhofer IKTS.

2 *Electrode production.*

Photo: Fraunhofer IFAM.

3 *Small-scale production of anodes and cathodes.*

Photo: Fraunhofer ISC.

FRAUNHOFER BATTERY ALLIANCE CELL PRODUCTION

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 attention is paid to the social, economic and ecological implications of the technology.

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

Competences and fields of work

The Fraunhofer Battery Alliance develops innovative electrode materials and provides the opportunity to further develop these materials for use in industrial products, through a close collaboration with partner institutes.

Cell development

The advancement of existing cell systems and research into future technologies (lithium-air, lithium-sulfur, etc.) are a key area of work within the Battery Alliance. The main focus is on new materials and material formulations for electrodes, new electrolyte systems and separators. The Alliance also works on enhanced manufacturing processes, which lead to an increase in cell performance, decreased costs and/or the reduction of harmful emissions.

In addition, lithium cells can be tailored to suit the requirements of specific applications. A focus on pouch cells enables a flexible component design. Cells and cell modules constructed in this way can be fitted precisely into the available space.

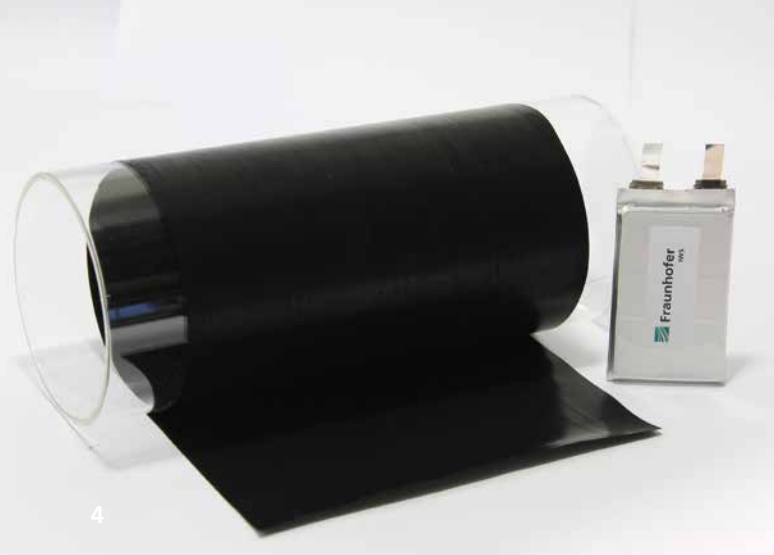
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Cell construction

The members of the Battery Alliance have flexible production platforms for the manufacture of lithium secondary batteries and lithium-sulfur batteries. The cell manufacture can be divided into two main stages:

- Manufacture of electrodes and separators
- Cell assembly

By changing the materials in the lithium secondary battery, its performance can be controlled over a wide range. In addition, the foil casing makes it possible to adapt the cell geometry significantly according to the pre-defined construction space. Over time the addition of new materials has led to a comprehensive “electrochemical system construction kit”, which is constantly adapted to meet increasing requirements.

Cell testing

The measurement technology available to the Battery Alliance allows the extensive electrochemical and physical characterization of materials and cells. Material-related data such as specific capacity, power density, lithiation and delithiation potentials as well as the rate of gas formation can be examined against lithium in half-cells with 2 or 3 electrode positions.

Other parameters that are important for a comprehensive understanding of the electrochemical processes such as, for example, cycle stability, internal resistance and aging behavior, can be determined within a wide temperature range (-40 to +180 °C) for both full- and half-cells. For this process, numerous testing circuits are available with maximum currents between 100 mA and 100 A.

Pilot plant and small-scale production

Our institutes operate special pilot plants for transferring results obtained in the laboratory to industrial scale. In these plants, all stages of the production of electrochemical cells can be carried out. Within the process chain for the manufacture of lithium-ion batteries, the steps of slurry mixing and coating are especially critical as even small variations in the parameters have a direct impact on the battery cell quality. The processes systematically developed in R&D are therefore up-scaled and optimized using several mixers, coating units and subsequent assembly units. The production capacities are shared with industrial partners and ensure the rapid implementation of research findings into small-scale production, while industrial customers also profit from this process know-how.

Our offer

- Development of electrode foils and tailored formulations
- Energy-efficient drying processes
- New testing and characterization methods
- Prototype production of customer-specific lithium cells (including an automated demo unit)
- Optimization of the microwave welding of different metals (Cu-Al and Cu-steel) for connecting cells to form modules
- Evaluation of new materials and components in lithium cells
- Holistic development of lithium-sulfur batteries
- Modeling of cell behavior and failure
- Post-mortem analysis to determine the impact of manufacturing parameters

4 Cathode material for application in lithium sulfur cells. Photo: Fraunhofer IWS

5 LiPo-cells for automotive applications. Photo: Fraunhofer ISIT