

# TESTING of ELECTROCHEMICAL ENERGY STORAGE

A Service of Fraunhofer IZM



Li-Polymer-Batteries on Si-Wafer



Test cells with reference electrode in climate chamber

## Micro Batteries

Fraunhofer IZM works for more than 10 years on the development of rechargeable micro batteries. The main focus is on miniaturization and systems integration in silicon and glass substrates on wafer level. In this context Fraunhofer IZM offers comprehensive development and testing services. One of the most common tasks is to choose the best battery system for a specific application and make sure that the power supply meets all specifications. Effective intermediate energy storage is required for all energy harvesting concepts, due to the varying availability of ambient energy and varying

energy requirements of the device. Secondary micro batteries are high-energy storage and are attractive for a wide variety of miniaturized applications like small sensor nodes, active smart labels or MEMS.

The battery test labor features more than 400 free programmable battery test channels (MACCOR, BASYTEC), programmable climate chambers and impedance spectrometers. Glove boxes and sophisticated material analytic is available for post-mortem analysis. Additional test equipment is used for super capacitors and metal air batteries.

In addition we offer thermal analysis and simulation of battery packs as well as electrochemical numerical simulation of single cells based on a mesoscopic model. An extensive material data basis can be used for the simulations.

## Battery development service

- Development of electrode formulas and deposition of test electrodes
- Characterization of electrode materials
- Half cell measurements
- Electrolyte characterization
- Testing of capacity, self-discharge and cycle behavior
- Long term tests under defined ambient conditions
- Pulse and high current behavior
- Impedance measurement
- Test of charge procedures and chargers
- Test of safety circuits

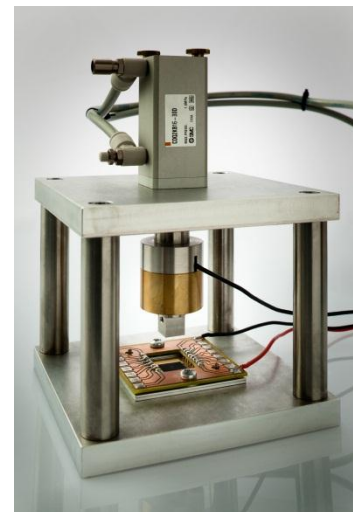
Tests can be performed according to battery standards like IEC 509, IEC 21A 227, 228,230. 239,256, IEC35 1025,

IEC 86-4, DIN, EN 60285, 60622, 60623, 61434, 60086, DIN IEC 61960

The most suited battery can be identified according to benchmarking tests.

## References

- VARTA: thin film batteries
- VARTA: hydrogen generation cells
- Weinmann: NiMH packs
- Automotive cells of various suppliers
- Saliwell: implantable micro batteries
- TexSys: Li-Polymer batteries for outdoor equipment
- Revolt: Zn-Air batteries



Measurement of battery electrode conductivity



Test of PEM fuel cells in a climate chamber

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## Micro Fuel Cells

The micro energy systems group of Fraunhofer IZM is developing fuel cells for more than 10 years. Fraunhofer IZM offers independent and system-oriented service and support for the efficient development of power supplies.

We offer competent support for the development and conceptual design of fuel cell systems for your application.

Characterizing the energy supply system under different load and ambient conditions is a common problem in the development of energy supplies. Fraunhofer IZM offers assistance in all development stages to make sure that your system meets the required specification.

- Multi-channel test bed for PEM fuel cell systems with single cell monitoring, voltage, impedance and temperature measurement in a climatic chamber
- Special test stand for the development of PEM fuel cells control algorithms
- 56 test channels for PEM FCs, long term tests
- Mapping of current density distribution and temperature distribution for single cell optimization.
- Hydrogen leakage tests
- Free programmable load / GSM pulses for fuel cell test
- Fluid flow characterization of vents and pumps
- Characterization of fuel cell components
- MEA and GDL characterization at various ambient conditions
- Determination of the electrical conductivity and the contact resistances of current collector and electrode materials

- Electro chemical corrosion measurement
- Cell an component characterization by impedance spectroscopy
- 8 channel test bed for galvanic hydrogen generators and metal-air batteries with sophisticated air management.