Contact

Electrical Energy Storage
Dr. Matthias Vetter
Phone +49 761 4588-5600
Dr. Daniel Biro
Phone +49 761 4588-5246
batteries.cell@ise.fraunhofer.de

Battery Cell Technology
Dr. Daniel Biro
Phone +49 761 4588-5246
batteries.cell@ise.fraunhofer.de

Battery Engineering
Stephan Lux
Phone +49 761 4588-5419
batteries.system@ise.fraunhofer.de

Applied Storage Systems
Johannes Wüllner
Phone +49 761 4588-2129
batteries.application@ise.fraunhofer.de

Battery Testing
Adrian Heuer
Phone +49 761 4588-5220
adrian.heuer@ise.fraunhofer.de

Fraunhofer Institute for
Solar Energy Systems ISE
Heidenhofstr. 2
79110 Freiburg, Germany

www.ise.fraunhofer.de

Further information

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R&D Across the Whole Value Chain

Electrical Energy Storage

ise.link/electrical-energy-storage

Electrical Energy Storage

Powerful electrical energy storage systems are the backbone for the efficient and reliable use of fluctuating, renewable energy sources as well as for electromobility and portable devices.

Fraunhofer ISE has made the optimization of battery systems across the whole value chain a priority, starting from the material and cell through the complete system and up to the integration. We offer extensive R&D services for battery materials, cells, modules and systems.

With our comprehensive and long-term experience, innovative ideas and state-of-the-art laboratory facilities, we support clients and partners, such as suppliers of materials and battery cells, production and characterization equipment industries, battery system suppliers, system integrators, OEMs, system operators and utilities as well as project developers, banks and insurance companies.

Battery Cell Technology

We conduct research on new materials, innovative cell architectures and new production processes, which we supplement with techno-economic analyses and cell simulations in order to evaluate the economic efficiency and technological effectiveness of our approaches.

Our services comprise:
- development and characterization of materials and battery cells
- development of process technologies
- aqueous systems for stationary energy storage
- lithium-ion battery cells
- solid state battery cells
- technical and economic analyses (TCO)
- life cycle analysis (LCA)

Battery Engineering

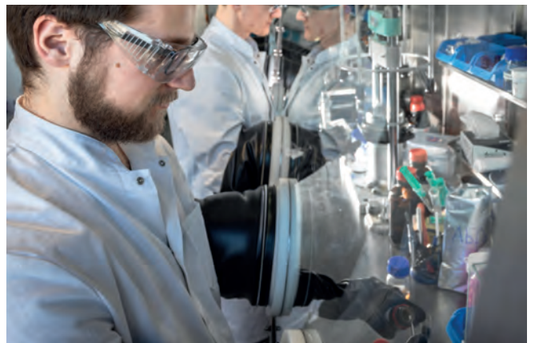
Along the whole value chain we provide highly professional R&D services for battery system solutions in which we optimize various stationary, electromobile and portable applications with respect to specific boundary conditions and requirements. We develop holistic approaches, which include advanced measures for increased safety and reliability as well as prolonged lifetimes.

Our services comprise:
- cell formation
- cell and system characterization
- performance analyses, aging scrutiny and modeling
- system design and engineering
- thermal management
- battery management
- algorithms for state estimation and lifetime prediction
- optimized charging and operating control strategies
- thermal runaway investigation, including gas analysis
- strategies for mitigating propagation risks

Applied Storage Systems

We optimize the integration and operation of energy storage for various applications, focusing on the entire system in a holistic and interdisciplinary approach. Based on simulation and modeling and our long-term experience, we advise our customers and partners along the wholee value chain. We help to ensure the safe, reliable and high performance operation of the electrical energy supply, which is the basis for bankable and insurable projects.

Glovebox for preparation of sufide-based solid-state batteries. © Fraunhofer ISE/Photo: Dirk Mahler



Press for the controlled compression of pouch cells. © Fraunhofer ISE/Photo: Dirk Mahler

Electrical testing of high-voltage systems in our battery test laboratory. © Fraunhofer ISE/Photo: Dirk Mahler

Commissioning of a cross-sectoral (electrical power, heat, cold) off-grid container. © Fraunhofer ISE/Photo: Dirk Mahler

Our services comprise:
- realization of lighthouse projects
- business case development and evaluation
- consulting during complete life cycle of storage projects
- system modeling, analysis and optimized system design
- simulation based storage sizing
- energy management systems
- technical due diligence: site inspection, testing, monitoring

Battery Testing

Comprehensive testing and verification have become more and more important, due to the increasing deployment and growing complexity of battery storage. Without testing, system errors, incorrect installations or inadequate system operation may lead to performance failures, which result in financial losses or even damage and accidents. Our testing and verification services range from battery cells up to complete systems. We carry out both customer-specific tests and tests according to established standards (e. g., UN38.3, IEC 62133, IEC 62619, IEC 62841).

Our services comprise:
- aging: calendric and cyclic
- safety: components and systems incl. functional safety as well as electrical, thermal, and mechanical misuse
- reliability: consideration of operating conditions and system behavior with aged components
- performance: efficiency and effectiveness
- end-of-line quality control for cell production
- system design validation by destructive testing
- validation of thermal runaway mitigation

Technical Infrastructure

- various R&D labs with processing chains for the production and processing of advanced materials and battery cells for advanced lithium-ion and all-solid-state battery cells, and aqueous battery cells for stationary storage.
- extensive materials' and battery cell characterization instruments, including materials, microstructure analysis and post-mortem analysis.
- 100 m² dry room (dewpoint down to -55 °C) and labs with tunable dry air conditions
- various destructive battery testing facilities like crush, shock, and vibration for all kinds of battery sizes
- laboratory equipment for electrical and thermal misuse testing
- test circuits for cycling and advanced characterization of battery cells and measurement systems for electrochemical characterization of new battery chemistries
- battery test circuits for single battery cells up to the system level with 500 kW (1000 V, 600 A)
- climatic chambers up to walk-in chambers with safety equipment
- isothermal battery calorimeter
- high-accuracy coulometric test stand
- Hardware-in-the-Loop (HIL) test stand for battery management systems
- testing and measurement equipment for characterization and certification of PICO PV systems and Solar Home System kits
- test rigs for complete residential PV storage systems up to 15 kW (HIL)
- measurement equipment for testing and characterization of commercial PV storage systems as well as PV diesel hybrid systems with and without battery support

Our Expertise

Fraunhofer ISE combines extensive technical knowledge and expertise, more than 25 years of field experience, innovative thinking and state-of-the art technical equipment in order to provide our partners and customers with

- profound expertise along the whole value chain from materials, battery cells, battery systems up to electrical storage applications
- a one-stop shop for research, development, quality assurance and certification in cooperation with reknowned certification bodies
- optimized cost-effectiveness, performance, durability, reliability and safety of electrical storage solutions
- reduced time-to-market, since integration and certification issues are already considered during the development process