HIU HELMHOLTZ INSTITUTE ULM
Electrochemical Energy Storage

www.hiu-batteries.de/en

PIONEERING
ELECTROCHEMICAL ENERGY STORAGE.

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EFFICIENT BATTERIES AS KEY TO ENERGY TRANSITION & ELECTROMOBILITY

NUMBERS & FACTS

NAME

Helmholtz Institute Ulm (HIU)

FOUNDED

2011

EXECUTIVE DIRECTOR

Prof. Dr. Maximilian Fichtner

BOARD OF DIRECTORS

Prof. Dr. Stefano Passerini (Deputy Director),
Prof. Dr. Joachim Ankerhold, Prof. Oliver Kraft,
Prof. Dr. Arnulf Latz, Dr. Margret Wohlfahrt- Mehrens

MANAGING DIRECTOR

Dr. Heribert Wilhelm

ADDRESS

Helmholtzstraße 11, 89081 Ulm, Germany

EMPLOYEES

- Total: 144 (2022)
- Research group leader: 19
- Scientific staff: 47
- PhD students: 81
- Administration: 13
- Professorships: 3
- Employees in Karlsruhe: 21
- Employees in Ulm: 123

FOUNDING PARTNERS

- Karlsruhe Institute of Technology (KIT)
- Ulm University
- German Aerospace Center (DLR)
- Center for Solar Energy and Hydrogen Research Baden-Württemberg (ZSW)

GERMANY'S BATTERY BASE - THE HELMHOLTZ INSTITUTE ULM

The Helmholtz Institute Ulm (HIU) is engaged in the research of innovative and sustainable cell chemistries and the development of electrochemical battery concepts of the next generation. Efficient batteries are the most important key to success of the energy transition and electromobility. The international team of around 150 scientists researches on the further development of the basics of sustainable energy storage systems for stationary and mobile use.

The HIU was founded in January 2011 by the Karlsruhe Institute of Technology (KIT). As a member of the Helmholtz Association, it set up the facility in cooperation with the Ulm University and further strengthened battery research at the Ulm Campus site. With the German Aerospace Center (DLR) and the Center for Solar Energy and Hydrogen Research Baden-Württemberg (ZSW), two other strong, associated partners are involved ever since.

The HIU efficiently bundles the different competencies of the four partners and enables profound progress in research on energy storage in the medium to long term. Basic and application-oriented research are brought together under one roof. This makes a significant contribution to securing the future of energy supply from renewable sources.

Energy from intermittent renewable resources has to be stored as it cannot always be used immediately.

Similarily, electric vehicles have to have an onboard storage of the electrical energy required for driving. The most efficient solution for these requirements are batteries that can effectively store and release electrical energy with very little losses.

HIU addresses the basic issues of electrochemical storage and, on the basis of new knowledge, develops fundamentally new materials and cell concepts.

The aim of HIU is to develop sustainable electrochemical energy storage with higher capacity and greater efficiency while also being lighter, longer lasting, safer and cheaper.

To reach these aims, HIU combines the knowledge of four leading research organizations under one roof. Unlike any other research institute in Germany, it – together with the expertise of its partners – covers virtually every aspect of battery research.

Perspectively, the HIU strives to combine excellent basic research with the real-world needs. At the same time, it expands its Young-Researcher Fellowship program to integrate highly qualified young scientists in this strategical important field for research and industry.

MORE STORAGE CAPACITY, LIGHTER, MORE DURABLE, SAFER, CHEAPER AND MORE ENVIRONMENTALLY FRIENDLY

FUTURE BATTERIES DO NOT REQUIRE LITHIUM

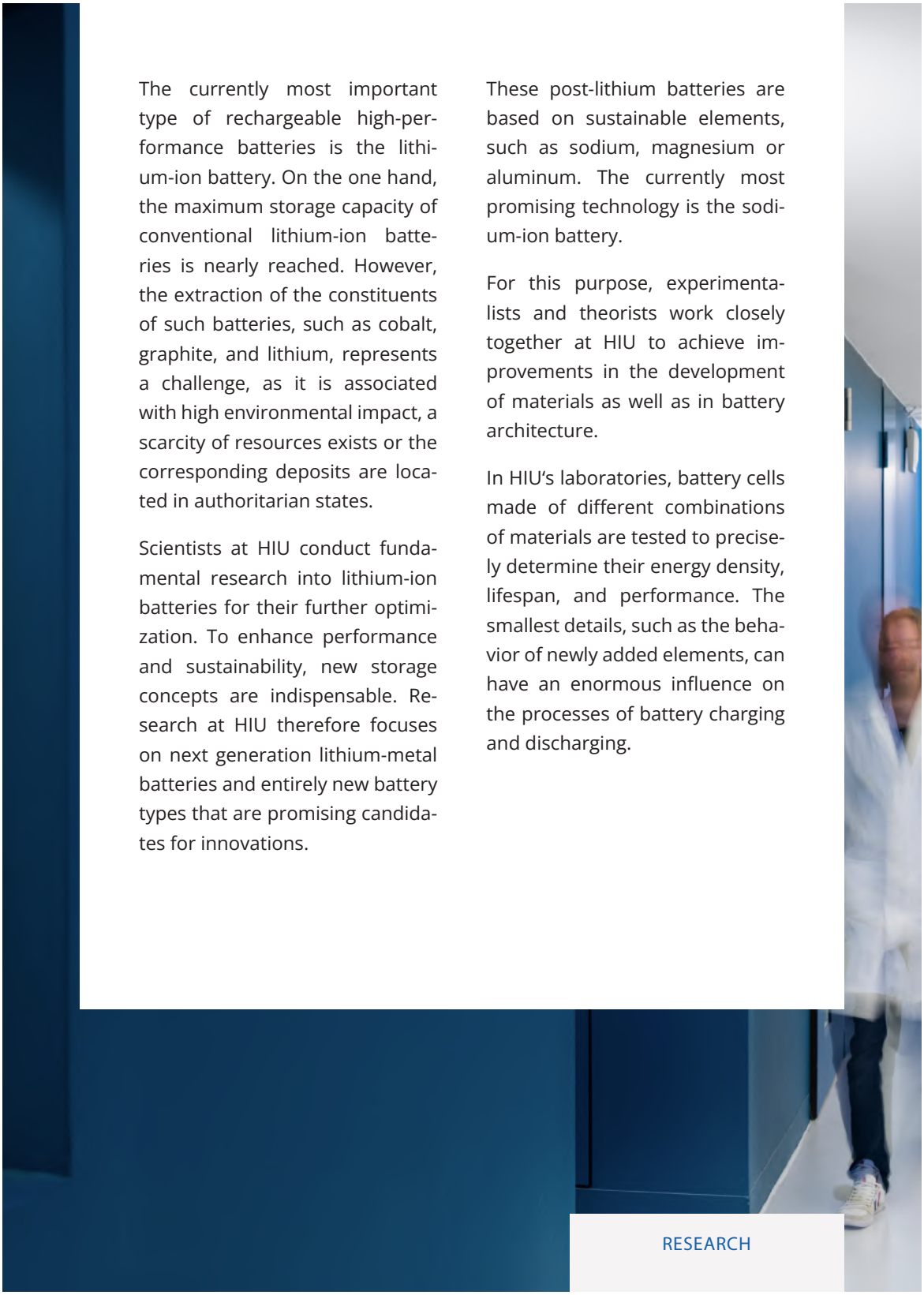
The currently most important type of rechargeable high-performance batteries is the lithium-ion battery. On the one hand, the maximum storage capacity of conventional lithium-ion batteries is nearly reached. However, the extraction of the constituents of such batteries, such as cobalt, graphite, and lithium, represents a challenge, as it is associated with high environmental impact, a scarcity of resources exists or the corresponding deposits are located in authoritarian states.

Scientists at HIU conduct fundamental research into lithium-ion batteries for their further optimization. To enhance performance and sustainability, new storage concepts are indispensable. Research at HIU therefore focuses on next generation lithium-metal batteries and entirely new battery types that are promising candidates for innovations.

These post-lithium batteries are based on sustainable elements, such as sodium, magnesium or aluminum. The currently most promising technology is the sodium-ion battery.

For this purpose, experimentalists and theorists work closely together at HIU to achieve improvements in the development of materials as well as in battery architecture.

In HIU's laboratories, battery cells made of different combinations of materials are tested to precisely determine their energy density, lifespan, and performance. The smallest details, such as the behavior of newly added elements, can have an enormous influence on the processes of battery charging and discharging.



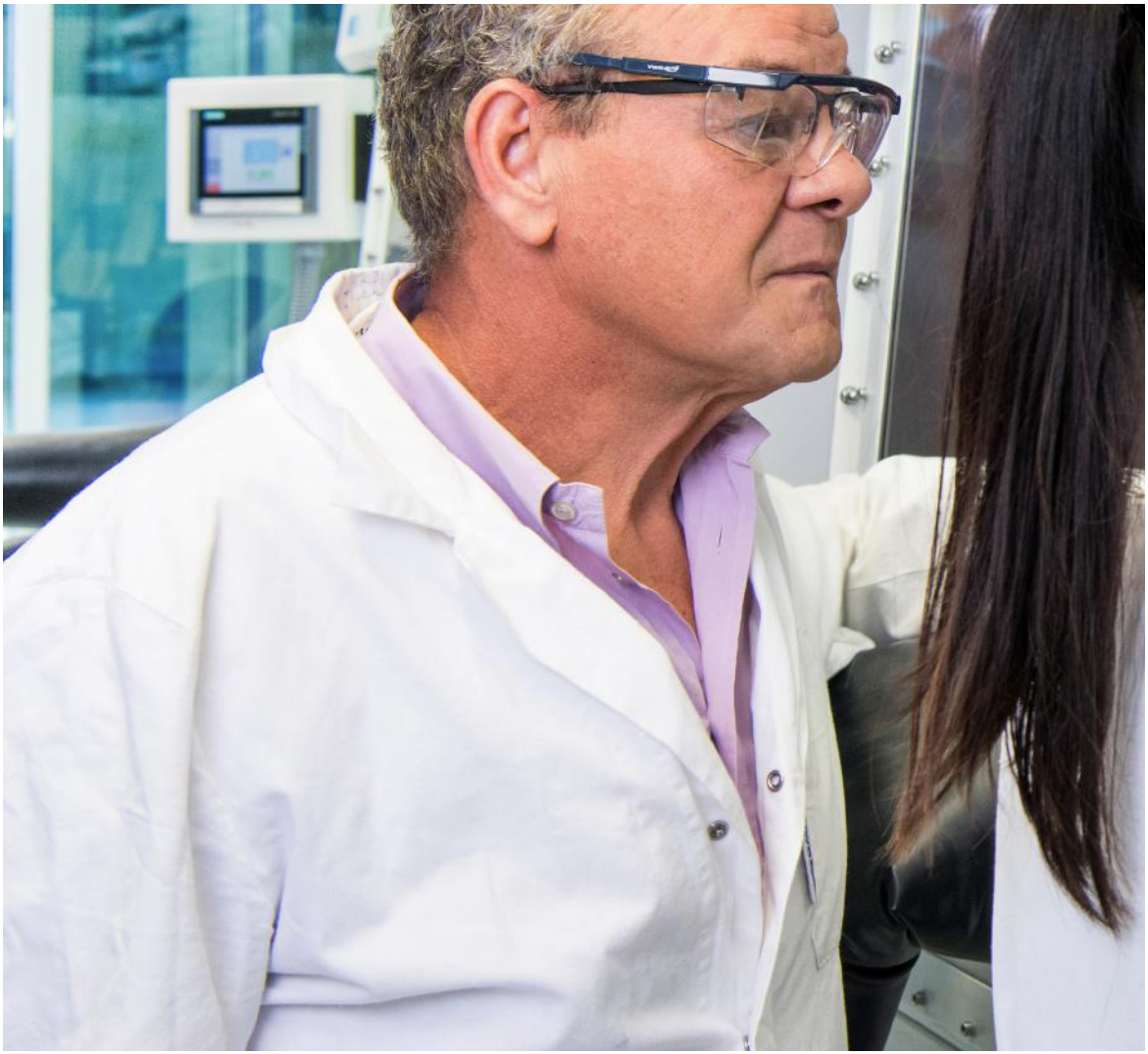
HIU's unique structure is also reflected in its Board of Directors: it includes a representative from each partner. As the governing body of HIU, it meets regularly, takes important strategic decisions, and is responsible for external relations and the assessment of the institute's performance.

Research at HIU is organized into the five areas electrochemistry, materials, theory, systems, and methods, which in turn are divided into various research groups.

These are led by renowned scientists who are also head of institutes or research groups at one of the four partner institutions. Furthermore, HIU has also defined four interdisciplinary topics – metal deposition, insertion materials and electrode structure, lithium-based conversion materials, and batteries beyond lithium – which enable and foster collaborative research.

In addition, a Young Investigator Group work on topics related to electrochemistry.

RESEARCH



Within the framework of the „Excellence Strategy“ launched by the federal government and the states, KIT, Ulm University, ZSW, and Gießen University successfully acquired the Cluster of Excellence “Post Lithium Storage – New Concepts for a Sustainable Future (POLiS).”

HIU played a major role in the proposal phase and during the seven-year funding period, HIU will receive annually a part of the allocated funding of up to seven million Euros.

In addition, HIU is partner of the Center for Electrochemical Energy Storage Ulm-Karlsruhe (CELEST), established January 1st, 2018, that facilitates new joint efforts in research, academic education, development, and technology transfer. CELEST is a platform to enhance communication and to coordinate and further develop

LARGEST RESEARCH PLATFORM FOR ELECTROCHEMICAL ENERGY STORAGE IN GERMANY

joint activities with other universities, research institutions, and industry in Germany and abroad. With its 29 partner institutes working in the area of electrochemical energy storage, CELEST represents the biggest research platform of this kind in Germany.

HIU has also been a major contributor to the outstanding KIT activities in the topic of „Electrochemical Energy Storage" within the Helmholtz Association. This top rating was awarded only to three out of 15 research units.


LI-ION BATTERY

Research at the HIU is structured into five research areas, which in turn are divided into 16 research groups.

Electrochemistry

Electrochemistry for Batteries
Prof. Dr. Stefano Passerini

Applied Electrochemistry
T.T.-Prof. Dr.-Ing. Helge Stein

Electrochemical Energy Storage Materials
Dr. Dominic Bresser

Basics of Electrochemistry
Prof. Dr. Timo Jacob

Electrochemical Energy Conversion
Dr. Roswitha Zeis

Materials

Solid-State Chemistry
Prof. Dr. Maximilian Fichtner

Nanoscale Hybrid Materials
Prof. Dr. Helmut Ehrenberg

Solid State Electrolytes
Prof. Dr.-Ing. Horst Hahn

Molecular Metal Oxide Composites
Prof. Dr. Carsten Streb

Composites & Hybrid Materials
Dr. Margret Wohlfahrt-Mehrens

Interaction-Electrode-Electrolyte
Prof. Dr. Jürgen Behm

Theory

Multiphysics Modelling
Prof. Dr. Arnulf Latz

Elementary Processes
Prof. Dr. Axel Groß

Systems

System Architecture
Prof. Dr. Jens Tübke

Resources, Recycling, Environment & Sustainability
Dr. Marcel Weil

Battery Management & Monitoring
Dr. Olaf Böse

Methods

Dr. Holger Geßwein
Prof. Dr. Christian Kübel
Dr. Reiner Mönig
Dr. Michael Knapp

Associated

Prof. Dr. Ute Kaiser
Prof. Dr. Jürgen Behm

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Karlsruher Institut für Technologie

ulm university universität ulm

ZSW

DLR

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