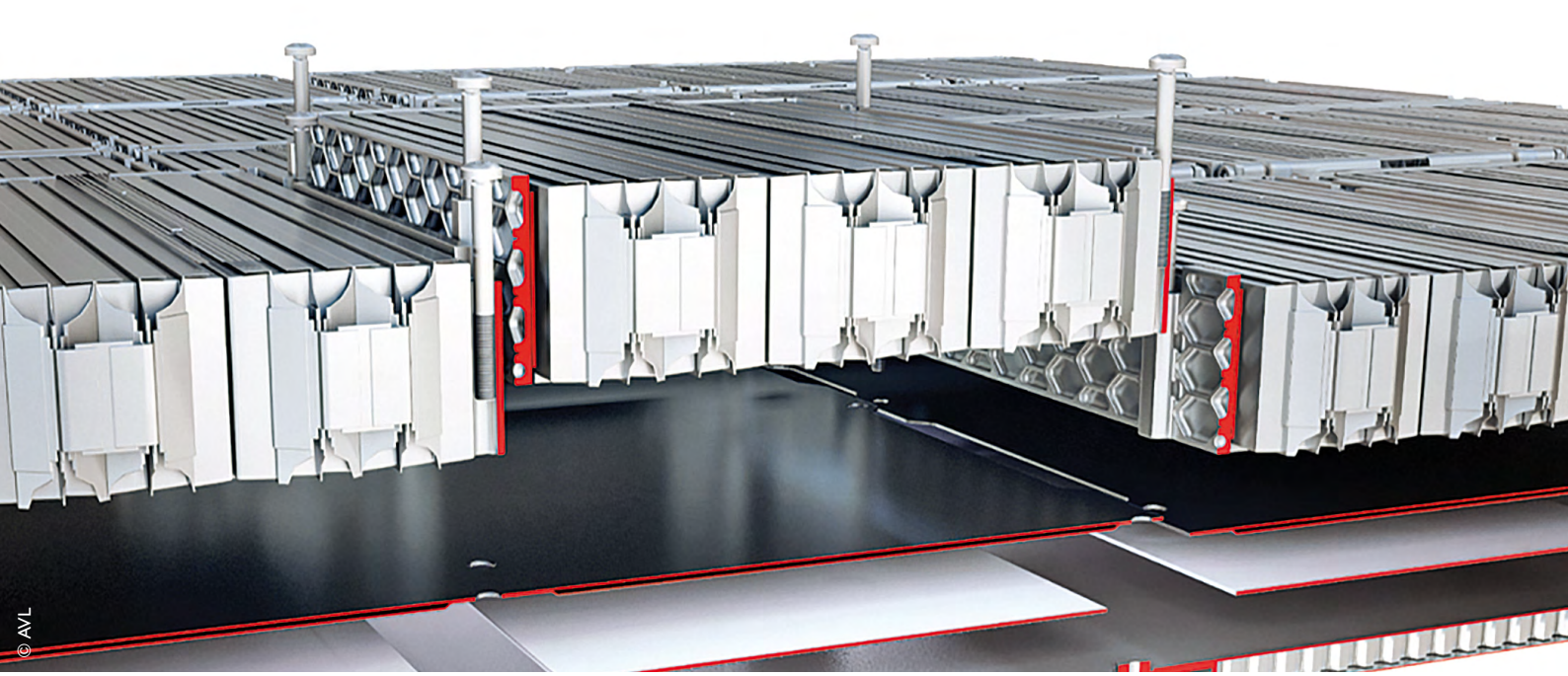

Federal Ministry
Republic of Austria
Education, Science
and Research

Christian Doppler
Forschungsgesellschaft

Keeping the future on the radar

The lifespan of a battery depends on its cell chemistry – but what are the influencing factors and what will the future bring? The CD Laboratory acts as a quality seal and radar system for the future.

What is at issue?

AVL List GmbH focuses, among other things, on developing and testing lithium-ion batteries, as used in electric cars, for example. This requires an in-depth knowledge of how various components and in particular individual cells have to be integrated and interconnected in order to achieve the required level of performance, safety and durability in the end. AVL's customers such as car manufacturers are interested in obtaining information about battery life and the latest developments in the battery sector.

The research question: Mechanical stress and its impact on battery life

Factors such as temperature, structural changes during charging and discharging and the time of recharge all have an impact on the ageing process of the battery and are taken into account in battery design. Until now, it was not known whether mechanical stress on a vehicle (such as vibration or shock) contributes to the battery's cell ageing process and this aspect had been neglected when estimating battery life. It does indeed seem plausible that strong mechanical forces could have a negative influence on the cells and their chemical processes by triggering particle cracking, i. e. a break-up of the active material particles.

CD Laboratory for Lithium Batteries – Ageing Effects, Technology and New Materials

Head
Univ.Prof. Dr. Martin Wilkening; Graz University of Technology

Duration
01.09.2012 – 31.08.2019

Company partners
AVL List GmbH, EPCOS OHG, Infineon Technologies Austria AG

Three questions for ...

Dr. Peter Prenninger
Research Coordinator at AVL List GmbH

Why is basic research so important for innovation?
Many everyday technologies, such as electric drives and digital computers, are based on the results of basic research. These research results are an essential prerequisite for overcoming technical hurdles and creating new innovative products.

What are the major challenges in collaborating with universities?
The industry needs to understand that research results cannot simply be 'ordered' – research is characterised by an open approach to results. And universities should understand that steering academic research questions towards economically relevant innovations will benefit society and therefore university research.

What do you value most about the CD Laboratory funding model?
A direct and straightforward exchange of ideas, questions and approaches between industry and research institutions allows industrially and academically relevant issues to be identified and specifically addressed using a bottom-up approach. And these questions should be answered after seven years so that new topics can be worked on.

AVL therefore investigated whether mechanical stress has an impact on the lifespan of a battery cell and thus should be taken into account when calculating the expected battery life.

Cooperation in the CD Laboratory

A battery consists of cells which are interconnected to form modules and large battery packs with the aim to deliver the desired levels of energy and power as well as to provide optimal safety and robustness. AVL has the expertise it takes to properly integrate cells into modules and battery packs and also has in-depth knowledge of cell chemistry. The basic scientific research into electrochemistry, which is just as important to development, is however carried out in collaboration with external partners. The CD Laboratory headed by Univ.Prof. Dr. Martin Wilkening offers the required depth of university-based research and broad-based technical expertise, including numerous analytical methods and large-scale equipment.

Results: More knowledge avoids detours

Numerous experimental setups were developed and implemented at the CD Laboratory. The result of the application-oriented basic research was clear after four to five years: for certain material classes and components, mechanical stress does not influence the durability of a lithium-ion battery cell to the extent originally anticipated. This knowledge saves time and money in battery development and validation.

Results: The future radar

Once it had been clarified whether mechanical stress influences the lifespan of a battery cell, the CD Laboratory turned its attention to a new topic which is also of crucial significance to the company: the solid-state battery cell as the technology of the future. AVL needs to understand this cell technology in detail in order to be able to develop innovative batteries for the markets of the future. The CD Laboratory certainly lived up to its radar role: through this research cooperation, the company has a good insight into the key topics addressed by international top research and gains specific expertise in the technologies of the future, thereby securing a critical head start in battery development. When the latest cells are launched onto the market, AVL will be excellently positioned from the outset and will have a competitive advantage. The result is therefore a solid knowledge base for future work.

Scientific challenge

How do electrically-charged particles move within a solid? This question is the subject of fundamental research in physics and chemistry. Ever-improving spectroscopy methods and newer, better materials enable a very detailed description and analysis of the key properties: ionic conductivity and chemical and electrochemical stability. This new knowledge is applicable wherever highly conductive solid materials are used. This includes numerous fields in the materials sciences and the development of batteries and sensors.

Added value for the company

The research provided scientific proof that mechanical stress does not have any notable influence on the lifespan of a lithium-ion battery cell and can therefore be neglected in the development and validation of batteries and battery cells.

The research cooperation has opened up a new perspective on the batteries of the future and therefore represents a key competitive edge for the company.

Christian Doppler Forschungsgesellschaft (CDG)
Boltzmanngasse 20/1/3, 1090 Vienna, Austria, tel.: +43 1 5042205, e-mail: office@cdg.ac.at
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