Press release

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AIT INTENSIFIES BATTERY RESEARCH

The founding of a separate "Battery Technologies" Competence Unit along with the establishment of a solid-state battery lab consolidates AIT's leading role in the development of the battery of the future. Sustainability is a strong focus here.

Vienna (AIT): With the transport sector emitting about 30% of all CO2, there is a great need for action in this area. Electric vehicles use energy much more efficiently than conventional vehicles with internal combustion engines and will play a decisive role in achieving climate targets in the future; according to the climate strategy of the Federal Ministry for Climate Protection, Environment, Energy, Mobility, Innovation and Technology (BMK), Austria should become climate-neutral by 2040 at the latest.

The development of electric vehicles has seen great progress in recent years. AIT researchers are significantly involved in this: in cooperation with many partners from science and industry, the AIT Center for Low-Emission Transport takes a holistic approach to developing components and technologies that render electromobility more efficient, more powerful, safer, more sustainable, and more affordable. An important strategic thrust here is the development of high-performance and environmentally friendly batteries. "Our systemic understanding of low-emission transport allows us to make an important contribution to achieving the climate goals while supporting our corporate partners," explains Christian Chimani, Head of Center for Low-Emission Transport at the AIT Austrian Institute of Technology.

Cutting-edge research at AIT

The activities at AIT regarding electric vehicles have expanded considerably in recent years. "Fueled by our successful internationalisation, large EU projects, and cooperation with international partners, our activities have doubled in recent years – both in terms of the number of projects and researchers an budget," reports Helmut Oberguggenberger, Head of the Competence Unit "Electric Vehicle Technologies".

As a result of this strong growth, and in order to sharpen the strategic focus, a separate "Battery Technologies" Competence Unit has now been created from this Competence Unit. On the one hand, existing research activities will be bundled in this, while on the other hand, further investments will be made in strategic thematic fields. The new Competence Unit with around 30 highly specialised experts is headed by Marcus Jahn and is going to work on the following promising research fields:

- Battery Materials Development and Characterisation

- Sustainable and Smart Battery Manufacturing
- Solid State Batteries

Although these research areas differ in terms of orientation, content, and time line, they are united by a common goal: the search for the "ideal battery". "The ideal battery has a high energy or power density; it is environmentally friendly, safe, and cost-effective," Jahn summarises. “With the current lithium-ion batteries, we are still a long way from reaching this goal. They pose a number of challenges, for example in terms of durability, safety, use of resources, and/or recyclability.”

Which specific battery types will prevail in the future is not yet foreseeable, says Jahn. "The ideal battery is unlikely to be a single cellular chemistry or shape since many application areas have a wide range of different requirements." In the stationary sector, the cost factor is most important, whereas energy density is not crucial. The requirements for a mobile phone or a vehicle are completely different. "So the answer is not likely to be one and the same technology for everything." However, there are certain parameters – especially in terms of performance, safety, and sustainability – that play a key role in all battery types and applications.

Three strategic directions

In the area of **"Battery Materials Development and Characterisation"**, new materials that could replace lithium in the future ("Post- Lithium") are being developed under the direction of Damian Cupid. Lithium poses a number of technical problems, such as its aging and its safety, and is also considered a critical raw material that is extracted on a large scale in only a few countries. Magnesium-ion batteries or sodium-ion batteries, among others, are regarded as future alternatives. It is already known that these principles work and can be attractively priced. But there is still a lot of room for improvement. The same applies to new cobalt-free batteries, in which alternative materials are used as the main electrode components.

The research field **"Sustainable and Smart Battery Manufacturing"** headed by Katja Fröhlich primarily deals with manufacturing methods for modern batteries, i.e. with taking the step from the lab to industrial production. The past few years have seen the establishment of a high-quality research infrastructure complete with industry-relevant prototype production , in which all processes can be intensively investigated and further developed. A central focus here is on sustainable production – one of the aims being how to replace environmentally harmful solvents with benign substances

The third research area, **"Solid State Batteries"**, which is headed by Marcus Jahn, deals with an extremely promising technology. Solid state batteries do not contain liquid electrolytes (which are flammable) and are thus safer and more durable. A number of suitable materials are already known – such as polymers, ceramics and glasses, or sulfide-based substances – each of which has specific advantages and disadvantages. Corresponding manufacturing methods for solid-state batteries are now being developed in a new solid-state battery lab at AIT.

Unique selling point for AIT

With this investment, AIT is consolidating its leading position in battery research. In recent years, AIT researchers have already taken on the management of major EU projects in which technologies are being further developed, together with partners from science and industry. AIT is also a founding member of the Europe-wide association "LiPLANET", in which operators of battery pilot plants exchange information.

"AIT is one of very few European research institutes to enter the field of process research for solid-state batteries at a very early stage," explains Marcus Jahn. The focus here is on the entire process chain. "This is a unique selling point for AIT: in Europe, there are no more than a handful of other groups trying to do anything similar," the researcher says.
Building on the knowledge of the materials, completely new manufacturing processes must be developed to make solid-state batteries ready for practical use within a few years. "To better understand these systems, fundamental questions still need to be answered," Jahn explains.

Strong focus on sustainability

The portfolio of research topics and objectives pursued at AIT has varying time lines: While battery manufacturing is addressing today's industrial challenges, solid-state batteries and especially new battery materials still require years of research – both basic and applied.
A key issue in all areas of research is sustainability – a factor that is also currently being strongly promoted by the EU. This applies not only to the efficiency of electric vehicles and the minimization of CO2 emissions, but also to manufacturing components and their assembly into a complete system. Marcus Jahn specifically cites the following areas: "The ideal battery contains no toxic components. It is easy to recycle, and ideally one already uses a high proportion of recycled materials in its manufacturing process. Furthermore, no critical raw materials are used. And the manufacturing process itself doesn't involve any toxic substances, either." Life cycle analyses are carried out for all areas, covering the entire process chain from raw materials via manufacturing and usage all the way to end-of-life and recycling.

Smart batteries for new fields of application

An increasingly important chapter is the construction of so-called "smart cells". These are battery cells and modules equipped with sensors that monitor their "health". In this way, important information on battery management can be obtained to increase performance, service life, and safety.

Moreover, AIT researchers are breaking new ground in a completely new field of application for batteries: They are working on electric drives for aircraft so as to make them more climate-friendly. "In this area, we still have quite a way to go until we reach the goals in terms of energy and power density," Jahn says. Since weight plays a key role in flying, research is being conducted into load-bearing batteries that can be integrated e.g. into the wings.

Holistic view of the mobility of the future

The further development of batteries is part of a whole range of research activities at the Center for Low-Emission Transport: Besides technologies for electric vehicles in the strict sense, these

include in particular weight reduction through lightweight construction (aluminium and magnesium alloys, design, etc.), the development of resource-efficient production processes for materials and vehicle components, and research for a resilient and safe transportation infrastructure, in order to contribute to reducing negative environmental impacts in this area as well.

Further Informations
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