Press Release

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AIT INTENSIFIES BATTERY RESEARCH

Establishment of a dedicated competence unit "Battery Technologies" and setting up of a solid-state battery laboratory consolidate AIT's leading role - strict focus on sustainability

Vienna (AIT): With a share of 30 percent, the transport sector is one of the largest CO2 emitters, and there is a great need for action in this area in order to achieve the climate targets. Electric vehicles are much more efficient in their use of energy than conventional vehicles with combustion engines and will therefore play a decisive role in achieving climate targets in the future - after all, 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 further development of electric vehicles has made great strides in recent years. Researchers at the AIT have played a key role in this development: Together with many partners from science and industry, the AIT Center for Low-Emission Transport is taking a holistic approach to developing components and technologies that will make electromobility more efficient, more powerful, safer, more sustainable and more affordable. An important thrust here is the development of high-performance and environmentally friendly batteries. "Through our systems understanding of low-emission transport systems, we can make an important contribution to achieving climate targets and supporting our corporate partners," explains Christian Chimani, Head of Center for Low-Emission Transport at AIT Austrian Institute of Technology.

Top-class research at the AIT

Activities at AIT related to electrified mobility drives have been greatly expanded in recent years. "Driven by our successful internationalization, major EU projects and cooperation with international partners, our activities have doubled in recent years - both in terms of the number of projects and researchers as well as the 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. This unit will combine existing research activities in this area and make further investments in strategic areas. The new Competence Unit, with around 30 highly specialized experts, is headed by Marcus Jahn and is working on the following promising research fields:

- Battery Materials Development and Characterisation
- Sustainable and Smart Battery Manufacturing
- Solid State Batteries

These research areas differ in terms of orientation, content and time horizon - but 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," summarizes Jahn in one sentence. Current lithium-ion batteries are still some way from achieving this goal. This is because they pose a number of challenges, for example in terms of aging, safety, use of resources and recyclability.

At present, it is impossible to predict which specific battery types will prevail in the future, says Jahn. "The ideal battery will probably not be a single cell chemistry or form. That's because there are a lot of different requirements arising from many application areas." In stationary applications, for example, the cost factor is most important, he said, while energy density is not as critical. There are completely different requirements for a cell phone or a vehicle, for example, he said. "So the answer will tend not to be the same technology." However, he said, there are certain parameters - particularly performance, safety and sustainability - that play a major role in all battery types and applications.

Three strategic thrusts

In the area of "Battery Materials Development and Characterization," new materials are being developed under the leadership of Damian Cupid that could replace lithium in the future ("Beyond Lithium"). Lithium poses a number of technical problems (such as aging or safety) and is also considered a critical raw material that is only extracted on a large scale in a few countries. Possible alternatives for the future include magnesium-ion batteries and sodium-ion batteries. It is already known that these principles work and can be attractively priced. However, there is still a lot of development potential. The same applies to new cobalt-free batteries, in which alternative materials are used as the main component of the electrodes.

The "Sustainable and Smart Battery Manufacturing" research field headed by Katja Fröhlich is primarily concerned with manufacturing methods for modern batteries - in other words, with the step from the laboratory to industrial production. In recent years, a high-quality research infrastructure has been established for this purpose, including prototype production close to industry, in which all processes can be intensively investigated and further developed. A central focus here is sustainable production - for example, the aim is to replace environmentally harmful solvents with harmless substances.

The third research area, "Solid State Batteries," is concerned with an extremely promising technology.
"Solid State Batteries," which is headed by Marcus Jahn. Solid-state batteries are batteries that do not contain liquid electrolytes (which are flammable) and are therefore safer and more durable. more durable. A number of suitable materials are already known - such as polymers, ceramics and glasses, or sulfide-based substances - each of which has advantages and

disadvantages. In a new solid-state battery laboratory at AIT, appropriate manufacturing methods for solid-state batteries are now being developed.

Unique selling point of the AIT

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

"AIT is now one of very few research institutes to enter the field of process research for solid-state batteries at a very early stage," explains Marcus Jahn. The focus is on the entire process chain. "This is a unique selling point of AIT: In Europe, there are at most a handful of other groups trying something similar," says the researcher.
Building on the knowledge of the materials, completely new manufacturing processes need to be developed to make solid-state batteries ready for practical use in a few years. "Fundamental questions still need to be answered to better understand these systems," Jahn explains.

Strong focus on sustainability

Very central to all areas of research is the issue of sustainability - a factor that is also currently being pushed strongly by the EU. This applies not only to the efficiency of electric vehicles and the minimization of CO2 emissions, but also to the manufacture of components and their assembly into an overall system. Marcus Jahn specifically mentions the following areas:
"The ideal battery contains no toxic components. It is easy to recycle, and ideally a high proportion of recycled materials is used in its manufacture. Furthermore, no critical raw materials are used. And the manufacturing process is also free of toxic substances." Life cycle analyses are carried out for all areas, covering the entire process chain from raw materials, through production and use, to end-of-life and recycling.

Intelligent batteries for new fields of application

An increasingly important chapter is the design of so-called "smart cells." These are battery cells and modules equipped with sensors that monitor their health. This makes it possible to obtain important information on battery management in order to increase performance, service life and safety.

The AIT researchers are also breaking new ground in a completely new field of application for batteries: they are working on electric drives for aircraft to make them more climate-friendly. "In this area, we are still a long way from our goal in terms of energy and power density," says Jahn. target in terms of energy and power density," says Jahn. Since weight plays a key role in flying, research is being conducted, for example, on batteries that can be integrated into wings.

Holistic view of the mobility of the future

The further development of batteries is embedded in a whole bundle of research activities at the Center for Low-Emission Transport: In addition to technologies for electric vehicles in the narrower sense, these include in particular weight reduction through lightweight construction (aluminum and magnesium alloys, design, etc.), the development of resource-efficient production processes for materials and vehicle components, and research into a resilient and safe transportation

infrastructure, in order to contribute to a reduction in negative environmental impacts in this area as well.

Further information
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