FRAUNHOFER INSTITUTE FOR SILICATE RESEARCH ISC
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PRESS RELEASE

Smart Recycling of Waste Traction Batteries from Electric Vehicles – EU Funding for New Resource-Efficient Solution

Today's electromobility consumes large amounts of traction batteries, preferably high-performance lithium-ion batteries. These batteries contain valuable raw materials and should not be discarded as waste at the end of their life. Efficient recycling requires closed materials loops and a logistic solution capable of growing along with the increasing number of waste batteries from more and more electric vehicles. The research project "Automotive Battery Recycling 2020" which was launched earlier this year with EU-funding from EIT RawMaterials sets out to identify efficient recycling routines that are ecologically sound, economically viable and readily transferable to industrial scale. The overall aim is to improve the EU-wide recycling chain and add to a secure supply of raw materials through the recovery of valuable materials from waste streams.

We are used to a mobile life but it runs on power, and energy storage relies on a number of valuable raw materials which are not easily available in Europe. They need to be imported, and more so every day with progressing electromobility. Traction batteries which power electric vehicles consume large amounts of rare and even critical raw materials. A working recycling of traction batteries is a must if we wish to retain these valuable material flows inside Europe for the recovery and reuse of these limited resources.

The Fraunhofer Project Group for Materials Recycling and Resource Strategies IWKS, part of the Fraunhofer Institute for Silicate Research ISC, is a partner in the collaborative project AutoBatRec2020 (Automotive Battery Recycling 2020) which was launched in January 2018 and sets out to re-assess the entire battery recycling chain. Every aspect will be under investigation, from the collection of waste batteries to all available materials separation and recovery methods up to the re-use of recycled materials in new batteries. The goal is to get a thorough insight into the efficiency, economic feasibility and overall sustainability of existing processes and then recompose them to design a truly smart and economically attractive value chain adding to the general appeal of battery end-of-life management and recycling.

The challenges in recycling start out at the very beginning by having to collect the growing amounts of waste traction batteries that come along with the increase in electric vehicles, and electromobility has only just begun. Logistic solutions must

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accomodate for steadily rising amounts. Hence, novel collection and transportation concepts are a major item in the work program of the AutoBatRec 2020 project.

A key element of special importance for the recycling chain is the automated dismantling of the large traction battery systems. Today's mostly manual labour needs to be replaced by much faster automated processes. The actual materials recovery also leaves room for improvement. In view of this, the researchers will evaluate all state-of-the-art mechanical crushing and shredding methods as well as new electrohydraulic solutions which can be combined with sophisticated sorting technology for the targeted recovery of the individual material fractions contained in a battery. Advantages and disadvantages of the different methods will be analyzed and combination possibilities with well-established metallurgical processes, which are suitable to the large-scale extraction of elementry high-tech metals from waste batteries, will be evaluated.

"What's more, we will develop concepts for the re-use of battery components as a whole instead of individual material fractions in order to augment the efficiency and profitability of materials cycles", adds Dr. Andreas Bittner, Head of New Business Development at Fraunhofer ISC.

One of the most challenging problems for the researchers to overcome is the diversity of the many battery systems on the market today which all end up in the same waste flow and complicate automated processes. The differences between the individual battery systems may be quite significant in terms of design, state and raw materials content. The mere task of obtaining all relevant information on the many systems is a challenge in itself. Also, the disassembly may be hazardous as batteries may contain corrosive, harmful substances or flammable and even explosive components. New concepts must account for all this to eliminate risks and ensure a sustainable and eco-friendly recycling of all battery types.

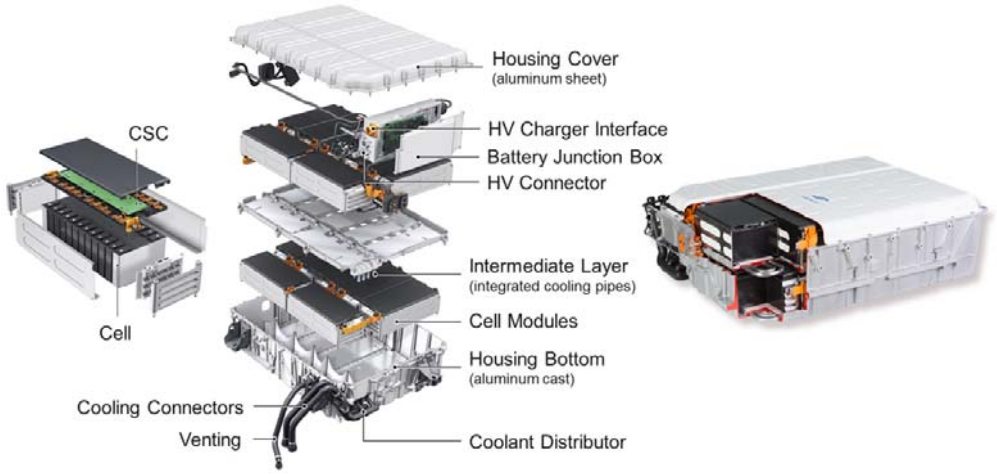
Last but not least, the researchers will address a smarter design for recycling to facilitate recycling in the future and render it even more efficient.

Project details:
"Automotive Battery Recycling 2020 – AutoBatRec2020"
Project launch: 1 January 2018
Term: 3 years
Funded by EIT RawMaterials – a Knowledge and Innovation Community of the European Union.

Project consortium:
Fraunhofer Institute for Silicate Research ISC – Project Group for Materials Recycling and Resource Strategy IWKS, Germany (coordinator)
Fraunhofer Institute for Manufacturing Engineering and Automation IPA, Germany
UMICORE NV, Belgium
Commissariat à l'énergie atomique et aux énergies alternatives CEA, France
Technical University Bergakadmie Freiberg, Germany
SAMSUNG SDI Battery Systems GmbH, Austria
ImpulsTec GmbH, Germany
Daimler AG, Germany

Footage:

Opened traction battery. © Daimler AG



Schematic build-up of an automotive battery system © Samsung SDI

The **Fraunhofer-Gesellschaft** is the leading organization for applied research in Europe. Its research activities are conducted by 72 institutes and research units at locations throughout Germany. The Fraunhofer-Gesellschaft employs a staff of more than 25,000, who work with an annual research budget totaling 2.3 billion euros. Of this sum, almost 2 billion euros is generated through contract research. Around 70 percent of the Fraunhofer-Gesellschaft's contract research revenue is derived from contracts with industry and from publicly financed research projects. International collaborations with excellent research partners and innovative companies around the world ensure direct access to regions of the greatest importance to present and future scientific progress and economic development.

The **Fraunhofer Institute for Silicate Research ISC** (director Prof. Dr. Gerhard Sextl) is one of the leading Bavarian R&D centers for material-based research and development in the fields of energy, environment and health. With a permanent staff of about 480 scientists and technicians the Institute works to develop innovative materials and technologies for sustainable products and make essential contributions to solving the major global issues and challenges of the future. With its parent Institute and the Translational Center in Wuerzburg, its Project Group for Materials Recycling and Resource Strategies at Alzenau and Hanau, and its Center for High-Temperature Materials and Design HTL at Bayreuth Fraunhofer ISC combines first-rate expertise in materials science with long-standing experience in materials processing, industrial application and the upscaling of production and process technologies to pilot scale as well as in materials analysis and characterization. With a clear focus on sustainability, the Institute with its project groups is a strong R&D partner for industrial partners.

The **Fraunhofer Project Group for Materials Recycling and Resource Strategies IWKS** with its sites at Alzenau and Hanau was founded in 2011 by the Fraunhofer Gesellschaft as part of the Fraunhofer ISC. The business units Resource Strategy, Recycling and Materials Cycles, and Substitution work to secure the longterm raw materials supply for our industry and their leading position in high technology research. Innovative separation, sorting, reprocessing and substitution options are in the focus of the research work.

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