

FRAUNHOFER INSTITUTE FOR SILICATE RESEARCH ISC
WÜRZBURG, GERMANY

PRESS RELEASE

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ECO COM'BAT opens up new approach to enhance sustainability of high-voltage batteries

Electromobility sets challenging requirements for new high-performance batteries – cruising range, life span, safety, or charging times, to mention only a few. An intrinsic challenge is the resource need for a growing number of big car batteries. Ten partners from industry and research organizations successfully joined forces in the EU funded project ECO COM'BAT to develop a sustainable next generation of high-voltage lithium-ion batteries.

The objective of the EIT RawMaterials project ECO COM'BAT was to combine green and high-performance materials and to upscale their production for the next generation of high-voltage lithium-ion batteries. ECO COM'BAT was coordinated by the Fraunhofer Institute for Silicate Research ISC and carried out in the period from April 2016 to December 2018. With the materials producers Arkema and Umicore, the cell manufacturers SAFT and Customcells, the research and technology organizations Fraunhofer, CEA, CSIC, ENEA, VITO, and the Technical University Darmstadt, the project participants covered all edges of the knowledge triangle along the battery value chain.

Reduction of critical materials

Compared to conventional batteries the new type should be more powerful and with regard to the materials used even more sustainable. "The main task of the ECO COM'BAT project was to substitute conventional, often expensive, rare or even critical materials as cobalt in the electrodes and of fluorine in the electrolyte", explains project coordinator Dr. Andreas Bittner from Fraunhofer ISC. For this purpose the project team adapted and optimized ORMOCER® coated, low-cobalt NMC 622 and a special high-voltage electrolyte based on the conductive salt lithium-bis(fluorosulfonyl)imide (LiFSI), which can be operated stably even at high voltages, to the battery requirements. This leads to approximately 20 percent reduction of cobalt content and a reduction of electrolyte fluorine content by two thirds. In addition, the structured carbon additives Porocarb® and Graphistrength® were applied to further increase the energy and power density. The sustainable materials were integrated in pouch cells on a pilot level, which showed an improved performance (up to 50 % better cycle stability at 4.3 V) in comparison to cells with industrial reference samples.

Upscaling to pilot production level

To come from experimental laboratory level to producibility, usually several upscaling steps are necessary. Within the ECO COM'BAT project the partners combined innovative materials with well-known production properties in order to come up with only a few upscaling steps to a relevant pilot level of batch sizes with up to 20

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kilograms. For the optimization of the ECO COM'BAT materials and cells, a comprehensive simulation of the battery performance and aging was performed. Moreover, an efficient recycling concept was developed and tested to recover precious materials like nickel, cobalt, graphite and lithium and to achieve a high degree of sustainability. The commercial impact of the project results for a new generation of sustainable high-voltage batteries, is promising, as the different battery materials shows excellent performance and processing properties. The materials are ready for the near-to-production upscaling once enough market demand is obtained.

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Information about ECO COM'BAT: www.eco-combat.com

Funding

EIT RawMaterials, initiated and funded by the EIT (European Institute of Innovation and Technology), a body of the European Union, is the largest consortium in the raw materials sector worldwide. Its vision is to develop raw materials into a major strength for Europe. Its mission is to enable sustainable competitiveness of the European minerals, metals and materials sector along the value chain by driving innovation, education and entrepreneurship.



This activity has received funding from the European Institute of Innovation and Technology (EIT), a body of the European Union, under the Horizon 2020, the EU Framework Programme for Research and Innovation

Images

Pilot manufacturing of new battery electrodes. © P.Avavian/CEA

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The **Fraunhofer-Gesellschaft e. V.** 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 26,600, who work with an annual research budget of 2.6 billion euros. Of this sum, 2.2 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 380 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 for Regenerative Therapies in Würzburg, 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.

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