To the Media

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Zentrum für Sonnenenergie- und Wasserstoff-Forschung Baden-Württemberg (ZSW)

Location: Helmholtzstr. 8,
89081 Ulm
Germany

Recycling Critical Raw Materials in Lithium-ion Batteries

ZSW investigates cobalt, lithium and natural graphite recovery and reuse in new cells

Demand for raw materials is rising fast as the transportation and energy sectors' appetite for large lithium-ion batteries continues to grow. The European Union has designated some of these raw materials as being critical. Cobalt, lithium and natural graphite fall into that category, but today's recycling processes can only recover some of the metals, and lithium not at all. Seeking to prevent bottlenecks in raw material supply lines and to mitigate price risks, the Centre for Solar Energy and Hydrogen Research Baden-Württemberg (ZSW) is investigating how to best reclaim battery electrodes in a new project called RecycleMat. Its goal is to recover as much material as possible – preferably all of it – for direct reuse to produce new electrodes. The Ministry of Economic Affairs, Labor and Housing Baden-Wuerttemberg is funding the study for two years. Baden-Württemberg's Minister of Economic Affairs Dr. Nicole Hoffmeister-Kraut today presented the ZSW with the notice of award for a 870,000 euro grant.

"High-quality recycling is a key skill for the industrial hub of Baden-Württemberg. In future, sustainable and competitive value chains will have to include the optimum recycling of products at the end of their useful life. When it comes to recycling batteries, we are taking an important step in the right direction with the RecycleMat project."

"Future demand for lithium-ion batteries for electric vehicles and for short-term storage of green electricity will surely be enormous," says Dr. Margret Wohlfahrt-Mehrens, who heads up Accumulators Materials Research at ZSW in Ulm. "The development of a recycling concept to recover as much raw material from spent batteries as possible can be decisive to the sustainable supply of these resources and could considerably reduce the amount of material and energy required for new cells."

Recycling battery materials reduces dependencies

The cathode material used today for batteries are layered transition metal oxides containing more than ten percent cobalt. Working conditions and environmental practices in cobalt mines are often less than ideal. This is the case in the Democratic Republic of Congo, which holds around half of the world's reserves. The majority of lithium deposits, around 75 percent, is in South America. Germany has designated these as critical raw materials that are vulnerable to high supply

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and price risks. The same goes for the natural graphite used for cells' anodes. Local capabilities to recover electrode materials from spent batteries, called end-of-life cells, can help reduce domestic cell manufacturers' dependencies on the offshore supply lines that furnish these raw materials.

There are various processes and types of plants to reclaim recyclables in lithium batteries. The prevailing method for large volumes of material is to melt down entire batteries or cells and then treat the melted residue and slag with complex processes. Recycling companies have adopted these processes for commercial purposes, but valuable metals such as cobalt, nickel and copper are still lost to the high temperatures that produce slag. These process are also unable to recover components such as lithium, manganese and aluminum. Alternative methods involving several high-temperature processes or combinations of hydrometallurgical and thermal processes can recover but a relatively small amount of recyclable resources.

A way of recycling even lithium

Researchers are now setting out to conduct a feasibility study called "Cathode and Anode Materials from Recycled Lithium Ion Batteries," or RecycleMat for short, to describe a more efficient recycling process to recover the likes of lithium, nickel, cobalt and natural graphite from discarded battery electrodes. ZSW scientists at Ulm are engaging in this project to investigate how to best extract components from spent batteries and recondition the electrode material for direct reuse in new lithium-ion batteries or as an intermediate product for battery material synthesis. To this end, they aim to mechanically separate components from end-of-life batteries or from waste produced when manufacturing cells, and then purify these components before subjecting the active materials to thermochemical aftertreatment. All this is to be done in an energy-sparing way.

The researchers expect the material and process data obtained with this method to provide a robust foundation for resynthesizing materials. Industry partners will help assess the resulting products. Having developed battery materials and manufactured lithium-ion cells in pilot plants and on a near-industrial scale, ZSW has a deep well of expertise to draw on. Its researchers are well aware of the specification profiles and requirements for materials and processes.

About ZSW

The Zentrum für Sonnenenergie- und Wasserstoff-Forschung Baden-Württemberg (Centre for Solar Energy and Hydrogen Research Baden-Württemberg, ZSW) is one of the leading institutes for applied research in the areas of photovoltaics, renewable

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fuels, battery technology, fuel cells and energy system analysis. There are currently around 280 scientists, engineers and technicians employed at ZSW's three locations in Stuttgart, Ulm and Widderstall. In addition, there are 100 research and student assistants.

Media contacts ZSW

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Pictures of the grant presentation ceremony with Minister Dr. Nicole Hoffmeister-Kraut will be available as of 2 pm via this link:
https://www.zsw-bw.de/nc/presse/presseinformationen.html

Images are available from Solar Consulting or at
https://energie.themendesk.net/zsw/.