Securing critical raw materials for e-mobility. The METALLICO project

Dr. Sandra Pavón, Prof. Martin Bertau,
Dr. Burkardt Faßauer, Dr. Mareike Partsch

Securing the raw material base for tomorrow's solutions

To drive the defossilization of the transport sector, it is important to secure the availability of the required raw materials. Almost all of these resources are classified as critical. The battery industry has been experiencing a growing demand for raw materials for years and it is vulnerable to supply risks, even though viable value chains have been established and waste recovery and recycling play a central role.

Moreover, electromobility has given a further boost to battery technology, a key strategic sector for the European Union (EU). The majority of electric vehicles use Li-ion batteries, which contain metals such as nickel, cobalt, copper, manganese and, of course, lithium. Globally, these battery metals come mainly from Australia, Chile, China, the Democratic Republic of Congo and South Africa. In light of this, the METALLICO project (ID grant agreement: 101091682), with a budget of almost 12 million euros, will develop a strategy for the EU on how to ensure security of supply on the basis of domestic raw materials. Half of the consortium of 20 partners from nine European countries is made up of companies, which is crucial for the technical implementation of the processes. The project brings together representatives from the entire value chain (including mining and production) to test new processes to produce battery materials using raw materials from primary and secondary sources. The development of modern, cost-effective processes with domestic raw materials not only secures Europe's supply. As a novelty, METALLICO pursues a zero waste approach. Five new processes aim to reduce product waste in the production of battery materials and ensure the complete recycling of unavoidable residues. The processes will be evaluated in terms of their sustainability. The aim of the project is to demonstrate in four different case studies that the critical metals lithium, cobalt, copper, manganese and nickel can be produced and recovered sustainably. To achieve this, the five METALLICO processes will be scaled up from laboratory scale to an industrially relevant scope at different industrial sites. The residues recycled into new products in the case studies will be evaluated and validated in the battery, cement, paint and ceramics industries. This is an important step towards establishing a circular economy because the products must meet the requirements of the markets and be able to be returned to the value chain.

The focus of Fraunhofer IKTS in the project is on the pilot-plant validation of the process for lithium extraction and geopolymer production. The cooperation with the Institute of Technical Chemistry at the TU Bergakademie Freiberg enables the selective extraction of lithium with the patented COOL process. The starting materials are lithium ores, such as spodumene. An initial heat treatment is followed by leaching with supercritical CO_2 and subsequent electrodialysis and crystallization, which enables the selective extraction of lithium carbonate in battery quality. The lithium-free residue produced in the filtration stage is used to make geopolymers, i.e., CO_2-free binders that can replace cement. Cement production is responsible for 8 % of CO_2 emissions worldwide. The project will evaluate the use of these siliceous residues as construction materials. This is the key step towards establishing a circular economy based on the zero waste principle. The process is being scaled up to TRL 7 and tested in Spain with the participation of *G.E.O.S. Ingenieurgesellschaft mbH, IDENER* and *CETAQUA water technology center.*

Figure 1: Autoclave system at Fraunhofer Technology Center High Performance Materials THM.

Funded by the European Union

METALLICO