

## COMET MODULE

### FULIBATTER – FUTURE LITHIUM-ION-BATTERY RECYCLING FOR RECOVERY OF CRITICAL RAW MATERIALS

**Main location:** Linz (Upper Austria)

**Other locations:** Leoben (Styria)

**Thematic area:** Material & Production

(according to [www.ffg.at/comet/netzwerk](http://www.ffg.at/comet/netzwerk))



#### Thematic focuses

- Waste management and waste technological approaches for lithium-ion-battery (LIB) recycling
- Pyrometallurgical processing of LIBs and black matter
- Bio-hydrometallurgical treatment of LIB residues

#### Planned realisation and outcomes

The focus of FuLIBatter is to recover critical raw materials from the active material (also called black mass) of lithium-ion batteries (LIB) of different application areas (automotive, stationary and portable storage media) to closed-loop material cycles.

Current recycling processes mainly focus on mechanical processing to separate cases, cables, and other coarse components. The largest mass fraction of LIB after reprocessing, the fine-grained active material (making up to 70% by weight of the battery mass), contains critical elements, like lithium, phosphorus, cobalt, silicon and graphite. Additionally, economically important metals such as copper, nickel, and manganese are present in varying concentrations, depending on the battery type. Currently, many of these elements are not selectively recovered and end up in waste gas or the slag fraction after pyrometallurgical treatment, or they may be dissolved in wastewater after hydrometallurgical processes.

The amendment to the EU Battery Regulation will mandate higher recycling efficiencies (65% in 2025 and 70% in 2030) and recovery rates for lithium (50% by December 31, 2027, and 80% by 2031), as well as for cobalt, nickel, and copper (90% by December 31, 2027, and 95% by 2031).

In the first subproject, froth flotation will be used to separate the graphite in high quality and at the same time improve the recyclability of the metal oxides. Characterization of the separated graphite will provide information on its quality and usability in battery cell production or in other applications (carburiizing agent in the steel sector or secondary raw material in refractories production).

In a second subproject, on the one hand the thermal deactivation of LIB cells will be investigated through CFD simulations. On the other hand, a reducing pyrometallurgical process will be developed to separate a metal alloy containing cobalt, nickel and copper, and to recover the valuable materials lithium and phosphor via the gas phase. The resulting metal alloy will be assessed for its potential use as an alloying additive for special steel production.

In the third development line (3<sup>rd</sup> subproject), the concept of biohydrometallurgy will be applied. Microorganisms will be used to extract metals from the matrix (bioleaching) coupled with selective element recovery. Bioelectrochemical systems (BES) offer a sustainable method for recovering metals from leachates with lower energy requirements compared to conventional electrolysis cells.

## COMET FACTSHEET

### Selected company partners (max. 10):

1. AUDI AG
2. BRAIN Biotech AG
3. EBNER Industrieofenbau GmbH
4. RHI Magnesita GmbH
5. Saubermacher Dienstleistungs AG
6. TUEV SUED Landesgesellschaft Oesterreich GmbH
7. voestalpine High Performance Metals GmbH
8. VTU Group GmbH

### Selected scientific partners (max. 5):

1. acib GmbH (Austrian Centre of Industrial Biotechnology)
2. Universitaet fuer Bodenkultur (Department fuer Agrarbiotechnologie IFA Tulln)
3. Coventry University
4. Montanuniversitaet Leoben
5. UVR-FIA GmbH

### Selected international<sup>1</sup> partners (max. 5):

1. AUDI AG
2. Coventry University
3. UVR-FIA GmbH

**Duration:** 01.07.2022 - 30.06.2026 (4 years)  
**Staff employment:** 8 FTE, thereof 7 scientists  
**Management:** Dr. Elizaveta Cheremisina, Senior Project Manager

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[www.ffg.at/comet](http://www.ffg.at/comet)

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<sup>1</sup> Partners with headquarters outside Austria