The race to meet a surge in demand for lithium and cobalt by 2030

How far have we advanced battery recycling?

Anticipating an exponential surge in demand – 18 times more lithium and 5 times more cobalt by 2030 – poses a crucial question: How advanced is battery recycling to meet our growing needs for lithium and cobalt?

The recent amendment to the EU Battery Regulation mandates higher recycling efficiencies (65 % in 2025 and 70 % in 2030) and sets ambitious targets for recovery rates for lithium (50 % by the end of December 2027, and 80 % by 2031), as well as for cobalt, nickel, and copper (90 % by the end of December 2027, and 95 % by 2031).

Alongside the escalating recycling requirements, the demand for Li and other critical raw materials increases by 27 % annually, reaching its peak in 2030. During this period, we may need up to 18 times more Li, 5 times more Co, and up to 60 times more Li in 2050, considering current supply rates. How can we meet this demand, and are there more sustainable methods for producing lithium than seawater extraction or traditional mining and leaching of ores?

The COMET Module FuLIBatteR (Future Lithium-Ion Battery Recycling for Recovery of Critical Raw Materials) transforms waste generated by our society into secondary raw materials through innovative cross-sectorial recycling approaches spread across three projects. These are Project 1, “Waste Management and Technological Approaches for LIB Recycling”, Project 2, “Pyrometallurgical Processing of LIBs and Black Matter”, and Project 3, “Bio-hydrometallurgical treatment of LIB residues”.

The module’s team has started flotation tests and is actively working on enhancing the recovery of anode material in Project 1. Simultaneously, high-temperature InduMelt trials have commenced in Project 2, yielding promising results for lithium recovery detected in the gas phase. Concurrently, bio-leaching tests are underway in Project 3, demonstrating leaching efficiencies of up to 100 % for selected metals in initial trials.

While promising results have been achieved in projects 1 – 3, challenges persist. To be more precise, in Project 1, the flotation process's sensitivity, as well as that of the floating agents, to varying compositions in the black mass necessitates the careful selection of flotation reagents to enhance graphite recovery. Furthermore, the quality of upstream pyrolysis during the battery recycling process, aimed at obtaining the black mass, significantly influences graphite recovery through flotation. Therefore, high impurity contents in the black mass are undesirable. In Project 2, further investigation steps are required to determine the optimum concentration and effects of impurities such as Al, Cu, and elevated amounts of C to prevent reactions with Li or negative effects on its recovery and subsequent losses. In Project 3, efforts are underway to expand the leaching test to increase leaching efficiencies for all target metals from the LIBs and reduce the leaching duration to below five days. The FuLIBatteR team is actively addressing these challenges, pushing the boundaries of research in the field.

Moreover, FuLIBatteR has presented its advancements nationally and internationally by actively participating in various events. These include the ESTEP Conference – A Circular Economy driven by the European Steel, held from 3 to 5 October 2023, in Barcelona, Spain, and the IPCEI EuBatIn: "Vienna Networking Days", which took place on 29 September 2023, at BMK in Vienna. A contribution from FuLIBatteR Project 3 was presented at the Symposium "Bioprocess and Sustainability" on 27 September 2023, at IMC in Krems, Austria. In the meantime, FuLIBatteR became an associated partner of the IPCEI EuBatIn project.

In addition, a successful workshop was organized in Leoben, Austria, facilitating collaboration among module partners and partners, who supported the module with a letter of interest, to exchange ideas, knowledge, and know-how in battery recycling, thus strengthening cooperation in the field.

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