

Materials recovery from end-of-life lithium-ion batteries: results and perspectives

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End-of-life lithium-ion batteries can be considered as a strategic source of secondary raw materials which can be potentially recovered and re-introduced into new production cycles, in accordance with the circular economy principles.

Due to the high cost of cobalt, its availability and the criticalities related to the extraction conditions from primary sources, the scientific community is currently moving towards a decreasing content of cobalt in Lithium-Nickel-Manganese-Cobalt-Oxide batteries (LiNiMnCoO_2 , NMC) as well as to the use of cobalt-free batteries, such as Lithium-Iron-Phosphate batteries (LiFePO_4 , LFP).

In this presentation, the main results obtained within the framework of IEMAP project are shown and discussed. They refer to a recovery process applied on lithium-iron phosphate cathodes which is mainly based on hydrometallurgical techniques.

This hydrometallurgical process is being developed according to a "product-centric" approach, aimed at recovering the greatest number of materials through innovative, efficient and circular technological solutions. The process consists of a leaching step carried by a $\text{FeCl}_3 + \text{H}_2\text{O}_2$ solution which allowed Li and Fe dissolution; Fe was then recovered by precipitation; finally, Li was precipitated as a salt. The leaching residue was then treated in order to recover Fe as FePO_4 .

The quality of the obtained products, potentially usable to synthesize new active materials, will be demonstrated by chemical characterization.