

ABSTRACT - POSTER

Regeneration of spent LFP: Direct relithiation toward battery-ready cathode material

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Abstract

The Lithium-ion batteries (LIBs) technology market is shifting from nickel- and cobalt-based chemistries to lithium iron phosphate (LiFePO₄), driven mainly by automotive sectors, seeking lower cost, safety, durability and reduced exposure to nickel and cobalt supply chains. The low economic value of LFP has historically limited the attractiveness of its recycling. However, its growing adoption is creating a need for efficient recycling strategies that valorize this intrinsically low-value cathode active material (CAM) while improving the environmental impact of the battery value chain. Direct regeneration offers a promising approach by restoring the electrochemical properties of the spent CAM while preserving its original crystal structure, thereby avoiding the energy- and resource-intensive steps required for conventional pyro- or hydro-metallurgical recycling routes.

In this study, spent LFP is recovered from end-of-life LIBs, which are first discharged, and then disassembled. The cathode electrode is processed to recover the CAM powder. The cathode material is then washed to obtain clean active material. Subsequently, the degraded LFP is recycled through a direct relithiation process, using a combination of a reducing agent, which reduces Fe³⁺ to Fe²⁺ and a lithium source to compensate for Li loss. The ultimate objective is to reuse the regenerated LFP as CAM in a new LIB.