LIB cathode production processes designed for "direct recycling"

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Lithium-ion batteries (LIB) continue to dominate the energy storage landscape and as the demand and use continues to arise, the need for effective recycling methods becomes increasingly important. Recycling of spent LIBs closes the loop of electrodes materials due to the direct use of spent active material as secondary raw materials to produce fresh electrodes. The recovery processes generally include four phases: i) pre-treatment of the LIBs for their safe management (state of charge 0%); ii) separation of the active material from the current collector; iii) leaching; and iv) separation of precious metals in leaching solutions. Physical separation is one of the most advantageous methods for pre-treating and separating valuable components from both an economic and environmental perspective. For physical separation, organic solvents with great affinity for the binder such as NMP, DMAC, DMF and DMSO are generally used which weaken the adhesion between the current collector and the active material. Therefore, for the design of a sustainable recovery of the electrodes and the definition of a reuse platform, two interesting approaches are: i) the use of green solvents for the physical separation of the active materials, ii) the use of soluble binders in water or non-toxic solvents, to produce electrodes, hence to define a production process designed for direct recycling. This study aims to demonstrate the possibility to design electrodes in view of their recovery from production scraps. To this end, the use of water processable and/or bifunctional binder like pullulan or Poly(3,4-ethylenedioxythiophene) polystyrene sulfonate (PEDOT:PSS), and graphitic conductive additive is explored to process LNMO cathodes.

References:

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