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Pretreatment by Ultrasonic-Assisted Solvent Dissolution and Electrochemical Performance of Recycled $LiNi_{0.5}Co_{0.2}Mn_{0.3}O_2$ Electrode Waste Material

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The key to electrode waste $LiNi_{0.5}Co_{0.2}Mn_{0.3}O_2$ recycling is to effectively separate the cathode material from the metal Al foil for increasing the recovery rate. The method described herein utilizes the compatibility between an organic solvent and polyvinylidene fluoride (PVDF), ultrasonic-induced cavitation and convection effects, and the decomposition temperature of PVDF. The duration of ultrasonication, type of organic solvent, ratio of organic solvent to cathode material, stirring temperature, stirring time, sequence of ultrasonication and stirring, and calcination temperature were explored for determining optimum conditions. Thus, it was determined that the optimum peeling efficiency was approximately 93 %.The cathode material pretreated by the organic solvent was calcined, and the PVDF binder was effectively removed by calcination at 600 °C. Calcination at 800 °C yielded a cathode material with a suitable lamellar structure and the highest electrochemical performance, with an initial specific discharge capacity of 164.2 mAh g^{-1}. The specific discharge capacity was 132.4 mAh g^{-1} after 50 charge-discharge cycles, which translates to a capacity retention rate of 80.6 %.

Keywords: $LiNi_{0.5}Co_{0.2}Mn_{0.3}$; Recycling and utilization; Solvent solution method; Electrode Waste; ultrasonic

FULL TEXT