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HCl-Based Hydrometallurgical Recycling Route for Metal Recovery from Li-Ion Battery Wastes

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Abstract : The demand for Li-ion-batteries owing to their benefits, such as; fast charging time, high energy density, low weight, large temperature range, and a long service life performance is increasing compared to other battery systems. These characteristics are substantial not only for battery-operated portable devices but also in the growing field of electromobility where high-performance energy storage systems in the form of batteries are highly requested. Due to the sharp rising production, there is a tremendous interest to recycle spent Li-Ion batteries in a closed-loop manner owed to the high content of valuable metals such as cobalt, manganese, and lithium as well as regarding the increasing demand for those scarce applied metals. Currently, there are just a few industrial processes using hydrometallurgical methods to recover valuable metals from Li-ion-battery waste. In this study, the extraction of valuable metals from spent Li-ion-batteries is investigated by pretreated and subsequently leached battery wastes using different precipitation methods in a comparative manner. For the extraction of lithium, cobalt, and other valuable metals, pelletized battery wastes with an initial Li content of 2.24 wt. % and cobalt of 22 wt. % is used. Hydrochloric acid with 4 mol/L is applied with 1:50 solid to liquid (s/l) ratio to generate pregnant leach solution for subsequent precipitation steps. In order to obtain pure precipitates, two different pathways (pathway 1 and pathway 2) are investigated, which differ from each other with regard to the precipitation steps carried out. While lithium carbonate recovery is the final process step in pathway 1, pathway 2 requires a preliminary removal of lithium from the process. The aim is to evaluate both processes in terms of purity and yield of the products obtained. ICP-OES is used to determine the chemical content of leach liquor as well as of the solid residue.

Keywords : hydrochloric acid, hydrometallurgy, Li-ion-batteries, metal recovery
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