Physical processes for material recovery from Li-ion batteries

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The reclamation of materials from spent lithium ion batteries is an essential part of the circular economy for battery recycling and remanufacture. EU requirements for a 45 % collection target for hazardous portable batteries has vastly improved the total amount of recycled batteries, particularly Pb-acid and Ni-Cd [1]. Nevertheless, recycling of LIBs is still not widely undertaken due to the expense. Physical processes used by four companies who recycle LIBs: Akkuser, Batrec, Recupyl and Retriev have been investigated and compared [2]. The materials reclamation from lithium ion batteries can be considered to be based around several key processes; 1. cell stabilisation and discharge 2. disassembly 3. physical sorting 4. chemical separation. Whilst there are significant investigations into the chemical extraction of the more valuable metal components of the lithium ion battery [3], the physical separation of the less and more valuable components of a lithium ion cell has been less evaluated [4].

In this study we investigate different physical processes for the reclamation of the four main components of a lithium ion cell: polymers, metal oxides, metal foils and carbons. The cells are initially shredded and four physical recovery processes are compared: flotation, density, magnetic and size separation. The separation processes complement each other, and a process tree for physical recovery of the LIB components physical separation has been mapped.

Initial results show promising recovery levels with good degrees of component separation. Good isolation is shown of the polymer materials from the remaining material, the current collectors, Al and Cu, from the metal oxides and carbons, without a complicated chemical separation processes. The concentrations and recovery percentages of these materials are compared and discussed for the different processes.

The ultimate goal of this work is to optimise low cost reclamation methods of battery materials for the synthesis of new batteries, with a desire to minimise downcycling.

References:

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