

Autonomous Battery Sorting and Disassembly: Addressing Critical Raw Material Scarcity in Modern Manufacturing

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The shortage of critical raw materials for manufacturing consumer and industrial-grade batteries threatens continued growth of modern products. As these raw materials, Lithium, Nickel, Cobalt, Graphite, and Manganese, are available in limited supply within the USA, developing a cost-effective recycling process is essential to ensure long-term sustainability and to reduce dependence on limited natural resources. Current battery recycling processes are largely manual or semi-automated. These methods are costly and result in significant raw material waste. Automation of the recycling process can improve purity and value of the resulting material.

This project addresses critical challenges in battery recycling, both in consumer batteries and large-format electric vehicle (EV) battery packs. Industrial partners from the recycling industry and automotive OEMs are providing insight and sample materials for both tracks. In the first task, consumer batteries are received within the stream of mixed recyclables. AI-based software provided by an industrial partner will be used to identify and classify batteries by chemistry. An automated sorting system will use the battery classification to collect the batteries by chemistry for shredding into high purity black mass. In the second task, efficient autonomous methods are being developed to disassemble HEV, PHEV, and BEV battery packs into modules and other sorted recyclable components that can be shredded into high purity black mass or further disassembled. As much as is practical, disassembly methods will be commonized between the selected battery packs to enable flexibility in accepting future packs. This paper will describe the current progress of the work in both tracks including plans, initial results, and ultimate outlook and technoeconomic analysis of these methods of recycling batteries.