Methods of Recycling and Replacing Lithium Ion Batteries

A method to recycle hazardous materials from lithium ion batteries and replace them with safer, more robust batteries

Georgia Tech inventors have developed both a method to recycle the hazardous metals of lithium ion batteries and a new series of compounds to replace lithium ion for batteries. To recycle the hazardous material, the inventors have developed a combined method to extract these materials from used lithium ion batteries in a way that has several advantages over current techniques. This invention consists of a chemical digestion method and a magnetic separation method to enable the recycling of the high value, hazardous materials from the batteries.

Once the used lithium ion batteries are recycled, they can be replaced with solid-state batteries. The inventors have created a new series of compounds to be used as solid-state electrolytes for solid-state batteries and ionic conductors for other electrochemical devices. These compounds are sulfide-based electrolytes and are easier to produce, are more tunable, and are more stable against moisture and air than other solid-state electrolytes. Batteries made using these compounds have the potential to increase energy density and offer greater safety than lithium ion batteries.

Summary Bullets

- **Low cost** â?? low energy use compared to other methods
- **Environmentally friendly** â?? low emissions
- **High purity** â?? accurate separation of high value metals from other components

Solution Advantages

Recycling Method

- **Low cost** â?? low energy use compared to other methods
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Solid-State Batteries

- **Improved** â?? increased safety and energy density
- **Simple** â?? synthesis is less complicated compared to other solid-state electrolytes
- **Tunable** â?? more precise control of synthesis
- **Stable** â?? chemically stable under ambient conditions

Potential Commercial Applications

- Batteries
- Electric Vehicles
- Electronics
- Military
- Medical

Background and More Information

Lithium ion batteries are widely used as the power source in many devices of different energy/power scales, ranging from high energy/high power applications. Despite their desirable power, lithium ion batteries contain high value metals which can become environmental hazards if land-filled. To handle the hazardous nature of these batteries, they need to either be recycled of replaced.

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