Application of Triboelectrification for Electrical Vehicle Active Battery Component Recycling

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Electric vehicle battery material recycling is currently pursued through two main routes: hydrometallurgical and pyrometallurgical processing. Hydrometallurgical pathways rely on substantial liquid volumes for solvent extraction, precipitation, and leaching, while pyrometallurgical pathways operate at high temperatures, resulting in high energy demands and greenhouse gas emissions. Although both pathways are successful in mineral extraction, they carry significant environmental burdens. To address this challenge, this study investigates the application of solids triboelectrification and electrostatic separation as a dry, environmentally friendly alternative for upgrading recycled battery feedstock. The technique was tested using a mixture comprised of lithium oxide, nickel oxide, and graphite – three key lithium ion battery components. The results demonstrated that each powder component was effectively separated into three distinct zones based on its triboelectric properties. The findings highlighted the potential of solids charging and their electrostatic separation as a viable and environmentally sustainable addition to the two existing main battery recycling strategies.