Direct Recycling approaches for Ionic liquid electrolyte based Lithium ion Batteries

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Ionic liquid electrolytes (ILEs) provide a safer and more sustainable alternative to the conventional organic electrolytes in lithium ion batteries. ILEs have reduced flammability and high electrochemical stability (mitigating electrolyte breakdown at voltages above 4.2V) , making them suitable for applications which requires high safety and durability for the energy storage systems [1]. Conventional electrolytes have high volatility, which often results in inefficient recovery during recycling [2]. ILEs, however, are more thermally stable and less volatile which aids in potential recovery during the recycling. Yet recycling of ILE based LI-Ion batteries remains less explored.

This study explores an experimental approach to the direct recycling of ILE based lithium ion batteries. The recycling process design integrates thermal re-lithiation of cathodes, sonication to remove binder, and solvent-based separation of ionic liquids. These are aimed at preserving the integrity of active materials, while enabling selective recovery of both electrolyte and electrode components. Recovered fractions are subjected to material characterization and electrochemical evaluation to determine if their structure and functionality is suitable for reuse. The study also considers the broader environmental implications of ionic liquid behavior during recovery, and the adjustments required to adapt existing recycling protocols to accommodate these advanced electrolyte systems.

References

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