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(57) Abstract :
This development introduces an electrochemical process designed for the efficient recycling of lithium from spent battery waste, aiming to address the growing challenge of sustainable resource management in the energy storage industry.Conventional recycling methods, such as pyrometallurgy and hydrometallurgy, often involve high energy consumption, complex chemical treatments, and environmental hazards. Our process overcomes these drawbacks by employing a cost-effective electrochemical technique that selectively extracts lithium ions from waste streams while minimizing secondary pollution. The system incorporates advanced electrode materials and optimized electrolytes to enhance recovery efficiency, reduce operational costs, and ensure high purity of the recovered lithium. With a modular and scalable design, the process can be adapted to various battery chemistries, including lithium-ion and lithium-polymer batteries. Early experimental results indicate that this method achieves higher recovery rates compared to traditional approaches, with significant reductions in chemical waste generation. This project contributes to the circular economy by promoting the reuse of critical raw materials, supporting greener energy technologies, and providing a sustainable model for large-scale battery recycling.

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