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Optimizing Sustainable Graphene Production: Extraction of Graphite from Spent Primary and Secondary Batteries for Advanced Material Synthesis

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Abstract : This research aims to contribute to the sustainable production of graphene materials by exploring the extraction of graphite from spent primary and secondary batteries. The increasing demand for graphene materials, a versatile and high-performance material, necessitates environmentally friendly methods for its synthesis. The process involves a well-planned methodology, beginning with the gathering and categorization of batteries, followed by the disassembly and careful removal of graphite from anode structures. The use of environmentally friendly solvents and mechanical techniques ensures an efficient and eco-friendly extraction of graphite. Advanced approaches such as the modified Hummers' method and chemical reduction process are utilized for the synthesis of graphene materials, with a focus on optimizing parameters. Various analytical techniques such as Fourier-transform infrared spectroscopy, X-ray diffraction, scanning electron microscopy, thermogravimetric analysis, and Raman spectroscopy were employed to validate the quality and structure of the produced graphene materials. The major findings of this study reveal the successful implementation of the methodology, leading to the production of high-quality graphene materials suitable for advanced material applications. Thorough characterization using various advanced techniques validates the structural integrity and purity of the graphene. The economic viability of the process is demonstrated through a comprehensive economic analysis, highlighting the potential for large-scale production. This research contributes to the field of sustainable production of graphene materials by offering a systematic methodology that efficiently transforms spent batteries into valuable graphene resources. Furthermore, the findings not only showcase the potential for upcycling electronic waste but also address the pressing need for environmentally conscious processes in advanced material synthesis.

Keywords : spent primary batteries, spent secondary batteries, graphite extraction, advanced material synthesis, circular economy approach
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