High Efficient and High Yield Electrochemical Exfoliation Process

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PROBLEM STATEMENT

Graphite-derived conductive carbon materials are increasingly important for batteries, supercapacitors, conductive additives, coatings, composites, sensors, and other electronic and energy-storage applications. However, scalable exfoliation of graphite remains challenging. Conventional electrochemical exfoliation processes often suffer from limited particle-electrode contact, incomplete exfoliation, batch-to-batch variability, and additional separation or purification steps that increase cost and processing complexity. The field needs a more efficient and scalable exfoliation architecture that improves graphite-electrode contact and enables continuous production of high-value conductive carbon materials.

SOLUTION

Researchers at Missouri University of Science and Technology have developed a multi-electrode electrochemical exfoliation system designed to increase the contact surface area between graphite particles and electrodes. In preliminary work, a multi-wire electrode array provided substantially greater active electrode surface area than conventional single-electrode setups, improving exfoliation efficiency and the measured conductivity of the processed carbon material.
The team also developed two flow-based exfoliation configurations. One uses a tube-and-pump system with an internal wound electrode to continuously pass graphite particles through an electrochemical field. The other uses a purpose-built chamber with internal flow channels and a separator membrane. These designs are aimed at continuous or semi-continuous production rather than conventional batch processing and are compatible with a range of common electrolytes.

VALUE PROPOSITION

This approach addresses a key limitation in electrochemical graphite exfoliation: insufficient contact between graphite particles and active electrode surfaces. By increasing electrode-particle interaction and enabling flow-through processing, the technology offers a pathway to higher-yield, more scalable production of graphite-derived conductive carbon materials. The process can use commercially available materials and standard electrolytes, while reducing reliance on complex post-processing. Potential applications include conductive additives for batteries, electrode materials for supercapacitors, conductive inks and coatings, polymer composites, sensors, and other products that require scalable, low-cost conductive carbon materials.

Opportunity

Seeking a licensing and development partner to scale into manufacturing.

Development Stage

Validated in the lab. Conductivity and yield improvements demonstrated.

Intellectual Property

U.S. Utility Application # 18/784,485

Publication

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