Carbon-Coated Graphitic Carbon Nitride for Sodium-Ion Batteries

A breakthrough in battery innovation: This next-gen anode material could double capacity and extend battery life at a fraction of the cost

Technology

The core innovation is a nanocomposite comprising:

- Graphitic carbon nitride (g-C_3N_4) - the base electrode material.
- Conductive carbon coating - derived from low-cost carbonaceous sources like asphalt.

The coating improves electron mobility and reduces sodium-ion diffusion barriers. The method involves forming a slurry of nitrogenous and carbonaceous compounds, drying and grinding the mixture, and then carbonizing it at 600°C in an inert atmosphere.

Background

Graphitic carbon nitride (g-C_3N_4) is a two-dimensional, low-cost, and chemically stable material with promise as an anode for sodium-ion batteries (NIBs), a lower-cost alternative to lithium-ion batteries (LIBs). However, its poor conductivity and limited sodium storage have hindered commercial applications. This invention, developed by researchers at New York University, addresses these limitations by coating g-C_3N_4 with a conductive carbon layer derived from asphalt, significantly enhancing its electrochemical performance

Applications

- **Sodium-ion batteries (NIBs):** Especially suited for grid-scale energy storage and electric vehicles (EVs), where low-cost and abundant materials are advantageous.
- **Next-gen anode materials:** Applicable in full and half-cell configurations for rechargeable battery technologies.
- **Sustainable energy solutions:** Could replace LIBs in markets where lithium availability and cost are limiting factors.

Advantages

Technology ID

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Category

Engineering & Physical Sciences/Materials

Engineering & Physical Sciences/Energy

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- **Enhanced performance:** Delivers up to *254 mAh/g* capacity—more than double that of unmodified g-C_3N_4.
- **Long cycle life:** Demonstrates stable performance over *12,000* cycles at high Coulombic efficiency (~99.8%).
- **Cost-effective materials:** Uses inexpensive, scalable inputs like urea and asphalt.
- **Improved ion mobility:** Reduced sodium-ion diffusion barriers via carbon coating.
- **Environmentally sustainable:** Utilizes non-toxic and recyclable components, aligning with green energy goals.

Intellectual Property

Patent Pending