INNOVATION PARTNERSHIPS
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Enriching Hard Carbon in Biochar

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Category
Hardware
Manufacturing Process

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Overview

Novel method to extract and utilize silica from biochar for nanocomposites

- Produces high-purity silicon-containing compounds without high-temperature reduction
- Useful for cement production, reinforcing materials, nanocomposites, high-purity silicon products

BACKGROUND

Elemental carbon exists in various forms, including amorphous carbon, graphite, nanotubes, and diamond. Among these, biochar, produced alongside electricity generation from agricultural residues like rice hulls and bagasse, contains significant silica. Historically, this ash has seen limited use and purification, primarily in cement and reinforcing materials, leaving its potential largely untapped. Traditional methods start by converting the silica into metallurgical grade silicon (Simet) at extremely high temperatures, which is energy-intensive and costly. There is a critical need for a more efficient approach to harness the silica in biochar for producing high-value silicon compounds, reducing environmental impact, and unlocking the material's full potential.

INNOVATION

Researchers have created a technique to extract silica from rice hull ash (RHA) and bagasse using stoichiometric and catalytic bases, bypassing the need for high-temperature carbothermal reduction. The enriched carbon content in the silica-depleted ash results in a useful nanocomposite containing dispersed carbon/silica. This mixture enables carbothermal reduction at significantly lower temperatures, producing high-purity silicon, silicon carbide, silicon nitride, and silicon oxynitride. The innovation not only optimizes the extraction process but also enhances the efficiency of producing high-value silicon compounds. Real-world applications include cement production, reinforcing materials for tires, advanced nanocomposites, and other high-purity silicon products critical to various high-tech industries.

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