

Biochar-modified alkali-activated cementitious materials for structural supercapacitors

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Cleantech



> TRL 3
> Proof of concept

Problem

Renewable energy systems and smart infrastructure are increasing demand for materials that can provide both structural support and energy storage.

Conventional batteries and supercapacitors are typically installed as separate devices, adding weight, volume, wiring and maintenance requirements while contributing nothing to structural performance. Existing structural energy-storage materials often rely on expensive conductive additives such as graphene or carbon nanotubes, and increasing electrical performance can compromise strength or durability.

A scalable, cost-effective material that balances structural integrity with electrochemical functionality remains a significant unmet need.

Solution

This technology integrates a carbonaceous conductive phase within a cementitious binder matrix to create a structural material capable of storing and releasing electrical energy.

The conductive phase, which may include low-cost or waste-derived biochar, is incorporated to support ionic transport, electronic conduction and electrochemically accessible surface area.

The approach is compatible with conventional cementitious and alkali-activated materials and is designed to maintain, and in some embodiments improve, mechanical performance while providing energy-storage functionality.

The result is a multifunctional construction material suitable for large-scale infrastructure applications.

Intellectual Property Status

Provisional patent filed.

Potential Commercial Applications

Potential applications include energy-storing building components, precast construction products, transport infrastructure and civil engineering assets.

The technology may be used in walls, slabs, panels, pavements, foundations and other structural elements that can also function as energy-storage media.

Additional opportunities may exist in smart buildings, distributed energy systems and resilient infrastructure where embedded energy storage could support sensing, monitoring, power management or integration with renewable energy technologies. The use of waste-derived carbon materials may also be attractive in sustainability-focused construction markets.

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