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Aramid thermal insulation energy storage material

Overview

Aromatic polymer films with high glass transition temperatures (Tg) exhibit superior thermal stability, making them ideal for high-temperature dielectric capacitors in advanced electrical and electronic systems. However, the leakage current can be intensified at high temperatures due to stronger.

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□□ □□□/□□□□□□□Nature Energy, Nature Communications, Energy & Environmental Science□□□□□□□□SCI□□20□□□□□□□□□3□□ □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□10□□□ 2. □□□□□□ 2022-08□□□□□□□□□□□□□□□□□□□□□□□□□□. Are aramid nanofiber aerogels suitable for thermal management?

As lightest artificial solid material, aerogels have broad application prospects in thermal management due to its low density, high porosity, and excellent thermal insulation properties. Self-supporting aramid nanofiber (ANF) hybrid aerogels were designed by two-step induced gelation.

Do aramid aerogels reduce thermal resistance?

However, wet-spinning methods, exemplified by aramid aerogels, inevitably form a dense outer layer, significantly reducing the volume fraction of efficient thermal barrier nanovoids and limiting the development of ultimate thermal resistance in fibers.

Why is aramid fiber a high-performance polymer?

Aramid fiber, as a high-performance polymer material, possesses excellent mechanical properties, thermal stability, and chemical corrosion resistance . These characteristics are closely related to its highly ordered arrangement and crystalline aggregated structure, along with strong intermolecular

hydrogen bonding .

Is aramid nanofiber an ideal nanobuilding block for Advanced aerogels?

As an ideal nanobuilding block for advanced aerogels, the research community has shown a strong interest in aramid nanofiber (ANF) aerogel materials and their applications in frontier fields.

How are self-supporting aramid nanofiber (ANF) hybrid aerogels designed?

Self-supporting aramid nanofiber (ANF) hybrid aerogels were designed by two-step induced gelation. Polyamic acid (PAA) was used to induce pregelation following protic acid to achieve full gelation. The ANF hybrid aerogel inherited excellent heat resistance and thermal stability of the aromatic polyamides.

Can microfluidic spinning be used for gradient aramid aerogels?

The authors demonstrate a microfluidic spinning process for gradient aramid aerogels, with sheath and core layers of varied pore size, creating high thermal resistance at heat transfer interfaces, with radial thermal conductivity of 0.0228 $W\,m^{-1}\,K^{-1}$

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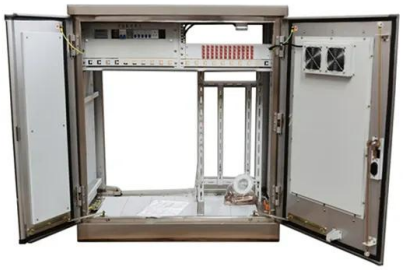

Polyimide aerogel/aramid composite with high mechanical

Polyimide (PI) aerogel, as a new organic aerogel material, has the excellent thermal properties of polyimide and the characteristic of high thermal insulation of aerogels, and has gained ...

Highly thermally conductive and insulating aramid/polyphenylene ...

This study demonstrates a novel fabrication method combining natural sedimentation filtration and thermal lamination to integrate hexagonal boron nitride (h-BN) into ...

A synergistic strategy for fabricating an ultralight and thermal

Summary: By using the aramid-coating-on-aramid method, all-aramid aerogel composite films with superior mechanical and thermal properties were successfully fabricated for thermal ...

Flexible and robust aramid/octadecane phase change materials ...

Phase change materials have been widely used in energy storage, temperature regulation, and thermal management. However, the complex preparation process and leakage ...

A lightweight, supercompressible and superelastic aramid ...

A lightweight, supercompressible and superelastic aramid nanofiber/nanocellulose-derived carbon aerogel with in-plane micro-wrinkle honeycomb structure for thermal insulation

Thermal Behavior of Mesoporous Aramid Fiber Reinforced ...

This innovative composite represents a hybrid material that combines the exceptional properties of Aramid fibers and silica aerogels, thus exhibiting remarkable potential for revolutionizing ...

Mass Produced Flexible Aramid Electrodes Via ...

Furthermore, single-pouch-type batteries can be customized for larger power needs in smart devices, demonstrating the adaptability and efficiency of aramid-based materials in wearable energy ...

A review and evaluation of thermal insulation materials and methods ...

There are essentially three methods for thermal energy storage: chemical, latent, and sensible [14]. Chemical storage, despite its potential benefits associated to high energy ...

Gradient all-nanostructured aerogel fibers for enhanced thermal

The authors demonstrate a microfluidic spinning process for gradient aramid aerogels, with sheath and core layers of varied pore size, creating high thermal resistance at ...

Mass Produced Flexible Aramid Electrodes Via ...

This study introduced a cut-to-fit approach from layer-structured aramid-based bulk aerogels to diverse form factors that are adaptable to the landscape of wearable energy devices.

Application of Aramid Nanofibers in Nanocomposites: A Brief ...

Due to their excellent mechanical properties and their chemical and thermal stability, ANFs have been widely used as novel nanomaterials and composited with other materials, mainly for use ...

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Aramid Nanofiber Aerogels: Versatile High Complexity ...

Different forms of aramid nanofibers (ANFs) and especially aerogels from them, offer a sustainable route to high-performance biomimetic nanocomposites. Due to the cartilage ...

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Aramid dielectric co-polymer: from molecular engineering to roll-to-roll scalability for high-temperature capacitive energy storage. Energy & Environmental Science 2025,

Revolutionizing thermal energy storage: An overview of porous ...

Abstract Phase Change Materials (PCMs) are capable of efficiently storing thermal energy due to their high energy density and consistent temperature regulation. ...

Aramid Nanofiber Hybrid Aerogels for Thermal ...

Additionally, the material exhibits outstanding thermal camouflage and thermal stability with a decomposition temperature as high as 540 °C. These features rendered the ANF hybrid aerogel with ...

Aramid dielectric co-polymer: from molecular ...

However, the leakage current can be intensified at high temperatures due to stronger ?-electron delocalization, leading to energy loss and degrading capacitive performance. Here, we present a poly ...

Advanced Aramid Fibrous Materials: Fundamentals, Advances, ...

Aramid fibers (AFs) are widely applied in many cutting-edge fields, due to their excellent comprehensive performance. Ongoing research efforts are therefore underway to expand the ...

Analysis of the Thermal Insulation Performance of Aramid Fiber

In industrial high-temperature equipment, such as boilers and furnaces, aramid aerogel composites can be used to make thermal insulation linings and insulation jackets, ...

Aramid nanofiber based flexible composite phase change films ...

1. Introduction Phase change materials (PCMs) are thermal energy storage materials that can adjust their phase change behavior through environmental temperature ...

Innovations Progress in Emerging Multifunctional Aramid ...

Besides, the progress of multifunctional applications in the fields of flexible thermal insulation, environmental protection, energy storage, and other fields is summarized.

Structurally resilient carbon nanofiber aerogels from aramid ...

They demonstrate superior thermal insulation performance, with a thermal conductivity of 19.93 mW/m·K at room temperature. Additionally, they exhibit excellent ...

Aramid nanofibers at ultralow loadings: driving significant

Epoxy dielectrics with superior insulation, mechanical, and thermal performance are of great interest for electrical equipment and power electronics. However, integrating these ...

Smart multi-responsive aramid aerogel fiber enabled self-powered

The woven smart fabrics coupled with thermoelectric generators realized efficient reversible thermal energy conversion and storage as well as stable solar-thermal ...

Aramid Nanofiber-Based Nitrogen-Doped Carbon Aerogel Film

Carbon materials are the most popular electrode material for supercapacitors. Among carbon electrode materials, carbon aerogel is a promising candidate for flexible ...

Tailoring a dual crosslinking network in all-organic aramid ...

This endows it with exceptional insulation strength, an ultra-high mechanical modulus, and remarkable thermal stability (Tg > 260 °C) [18]. Besides, due to the high dipole ...

A lightweight aramid-based structural composite with ultralow thermal

Such a perfect coordination between thermal insulation and impact dissipation innovates multifunctional defense design, allowing this aramid-based composite to be a ...

Mass Produced Flexible Aramid Electrodes Via Delamination of ...

Furthermore, single-pouch-type batteries can be customized for larger power needs in smart devices, demonstrating the adaptability and efficiency of aramid-based ...

(PDF) 3D-printed shapeable hybrid Nanocellulose/aramid ...

PDF , On Jul 1, 2025, Chenming Liu and others published 3D-printed shapeable hybrid Nanocellulose/aramid nanofiber aerogels for thermal insulation of portable electronics , ...

(PDF) Polyimide aerogel/aramid fiber composite ...

Polyimide aerogel/aramid fiber composite with high mechanical strength and thermal insulation for thermal protective clothing November 2023 Frontiers in Materials 10 DOI: 10.3389/fmats.2023.1224883

The Aramid-Coating-on-Aramid Strategy toward ...

Aerogel has been much highlighted as an emerging lightweight thermal insulation material, but problems such as fragility, low strength, liquid permeability, and lack of flexibility greatly limit further ...

Advances in thermal energy storage: Fundamentals and ...

Thermal energy storage (TES) is increasingly important due to the demand-supply challenge caused by the intermittency of renewable energy and waste he...

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