

What are the applications of superhydrophobic surfaces?

The ability of superhydrophobic surfaces to stay dry, self-clean and avoid biofouling is attractive for applications in biotechnology, medicine and heat transfer^{1,2,3,4,5,6,7,8,9,10}.

What is a hydrophobic surface?

When the surface CA exceeds 90° , the surface is termed hydrophobic. Further, surfaces with a CA greater than 150° are called superhydrophobic (SH) surfaces. A liquid's capability to maintain contact with the surface of a solid is referred to as wettability, and it is the net outcome of interactions among intermolecular forces.

Can superhydrophobic surfaces be used for biofouling?

The ability of superhydrophobic surfaces to stay dry, self-clean and avoid biofouling is attractive for applications in biotechnology, medicine and heat transfer¹⁻¹⁰. Water droplets that contact these surfaces must have large apparent contact angles (greater than 150 degrees) and small roll-off angles (less than 10°).

Are superhydrophobic surfaces mechanically robust?

The mechanical robustness of our superhydrophobic surfaces was demonstrated using tape-peeling tests, Taber abrasion tests (American Society for Testing and Materials standard) and scratch tests using an ultra-sharp object (Supplementary Figs. 24 - 26).

Why is superhydrophobicity a surface characteristic?

Since superhydrophobicity is a surface characteristic, any significant surface impact causes local defects in superhydrophobicity behavior. f. Wettability of activating agents: Increasing the water surface tension leads to superhydrophobicity behavior.

How does a superhydrophobic electrode work?

In this research, the superhydrophobic electrode is constructed by a chemical modification. After the water droplets impale the electrode surface, they will eject, which prompts the surface dust to roll down and demonstrate a self-cleaning property.

All weather, high-efficiency, energy-saving anti-icing/de-icing materials are of great importance for solving the problem of ice accumulation on outdoor equipment surfaces. In this study, a composite material with energy storage, active electro-/photo-thermal de-icing and passive super-hydrophobic a ...

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proposed. Fluorinated epoxy resin and MWCNTs/PTFE ...

Enhanced thermal conductivity of a superhydrophobic thermal energy storage coating based on artificially cultured diatom frustules. 2023, Applied Energy ... Fabrication of super-robust and nonfluorinated superhydrophobic coating based on diatomaceous earth. Surface and Coatings Technology, Volume 362, 2019, pp. 90-96.

DOI: 10.1016/j.apenergy.2023.121462 Corpus ID: 259671442; Enhanced thermal conductivity of a superhydrophobic thermal energy storage coating based on artificially cultured diatom frustules

The porous 3D structure of zinc-doped carbon aerogel is created from cellulose precursor extracted from banana stem--a biomass waste that is abundant in Vietnam--through a simple and easy-to-implement 2-step process. Additionally, sodium alginate was used as a crosslinker and zinc acetate as a network coupling agent that can strengthen the gel system ...

Traditional methods, such as mechanical and chemical de-icing, are often associated with high energy consumption and environmental concerns for anti-icing [10], [11] per-hydrophobic surfaces, on the other hand, exhibit remarkable anti-icing properties that can delay or even prevent the formation of ice [12], [13], [14]. This offers a more efficient and ...

@article{Li2024SuperhydrophobicMH, title={Superhydrophobic multi-shell hollow microsphere confined phase change materials for solar photothermal conversion and energy storage}, author={Jiyan Li and Yong Long and Yanju Jing and Jiaqing Zhang and Silu Du and Rui Jiao and Hanxue Sun and Zhaoqi Zhu and Weidong Liang and An Li}, journal={Applied ...

The development of efficient solar photothermal conversion and energy storage composite (SPCSC) is of great significance in solving the imbalance between supply and demand of solar energy utilization in time and space. Herein, we prepare multi-shell hollow spheres by selecting glucose as the template and magnesium carbonate trihydrate ($\text{MgCO}_3 \cdot 3\text{H}_2\text{O}$) and ...

Herein, a novel flexible superhydrophobic thermal energy storage (FSTES) coating without fluoride is prepared by spraying mesoporous 2 nanotubes (NTs) supporting materials, PCMs ...

Moreover, the superhydrophobic composite phase change materials possess excellent thermal reliability and stability, efficient solar-to-thermal energy conversion and self-cleaning property, which are potential in the application of advanced energy-related devices and systems for thermal energy storage in wet or humid environment.

Abstract Multifunctional phase change materials-based thermal energy storage technology is an important way to save energy by capturing huge amounts of thermal energy ...

Besides self-cleaning, SH surface can also be used for energy storage in wet and humid environments [103]. SH surfaces have also been employed for medical applications. ... Corrosion behavior of super-hydrophobic surface on copper in seawater. *Electrochim. Acta*, 52 (2007), pp. 8003-8007. View in Scopus Google Scholar [52]

All weather, high-efficiency, energy-saving anti-icing/de-icing materials are of great importance for solving the problem of ice accumulation on outdoor equipment surfaces. In this study, a ...

Artificial superhydrophobic coatings that are simple to prepare and practical to use are sought after. Here, the authors create versatile, complete-waterproof coatings based on a single-step ...

DOI: 10.1016/J.APENERGY.2019.01.043 Corpus ID: 116615647; Innovative design of superhydrophobic thermal energy-storage materials by microencapsulation of n-docosane with nanostructured ZnO/SiO₂ shell

Thermal energy storage, as an environment-friendly energy-saving technology, shows great promise as a means of storing energy from renewable resource and reducing energy consumption [1]. ... Superhydrophobic coating is a simple way to prepare waterproof materials, which could maintain the original properties of supporting materials and PCMs ...

Portable energy storage is developing rapidly with the miniaturization and integration of devices, and flexible supercapacitors are one of the important development directions. Nevertheless, ...

Herein, we successfully prepared a fully biomass-based ss-PCM, superhydrophobic thermal energy storage (STES) coating by employing beeswax (BW) as phase change materials (PCMs) and DFs as supporting materials via a facile spraying method. DFs can adsorb as much as 65 wt % BW without leakage, accompanied with a high heat storage capacity of 112. ...

The states of droplets on roughness surface. (a) The Wenzel model.(b) The Cassie-Baxter model.Reprinted from Ref [].Both the micro-nano roughness structures and modification with low surface energy on the surface are the important factors influencing the superhydrophobicity of a surface, while superhydrophobic surface cannot be obtained only modified by low surface ...

In this study, a composite material with energy storage, active electro-/photo-thermal de-icing and passive super-hydrophobic anti-icing properties is proposed. Fluorinated epoxy resin and MWCNTs/PTFE particles are used to prepare the top multifunctional anti-icing/de-icing layer, which exhibited super-hydrophobicity with water contact angle ...

Despite considerable success in design and preparation of superhydrophobic particles, a facile and low-cost approach to develop multifunctional particles, especially microcapsules with the ...

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applications in biotechnology, medicine and heat transfer 1,2,3,4,5,6,7,8,9,10. Water ...

With high energy storage density, enhanced thermal conductivity, and good scalability, our superhydrophobic ss-PCM coating should find potential use in energy-saving building materials and thermal management of electrical devices, as ...

The superhydrophobic coating not only prevents the support material and PCMs from coming into contact with moisture in a humid environment, but also prevents liquid leakage from TD and improves energy storage capacity. The superhydrophobic CPCMs exhibited a high energy storage density (125.40 J/g) in a humid environment, which was 29.58 J/g ...

Through a further surface modification with a low-surface-energy alkane chains, the resultant microencapsulated n-docosane was expected to achieve a superhydrophobic surface as well as good thermal energy-storage performance. The aim of this study is to open the door for design and development of superhydrophobic thermal energy-storage materials.

Multi-responsive form-stable phase change materials (FSPCMs) can convert various forms of energy to latent heat for storage and have attracted extensive attention. Superhydrophobic surfaces are garnering constant interest and can improve the long-term solar energy utilization and environmental adaptability of multi-responsive FSPCMs. However, a ...

The uoride-free superhydrophobic thermal energy storage coating exhibits excellent superhydrophobicity, durability and photothermal conversion e - ... in a variety of harsh ...

Super-hydrophobic surfaces: from natural to artificial. Adv Mater, 14 (24) (2002), pp. 1857-1860. View in Scopus Google Scholar [2] ... Fast self-healing superhydrophobic thermal energy storage coatings fabricated by bio-based beeswax and artificially cultivated diatom frustules. ACS Appl Mater Interfaces, 13 (40) (2021) ...

Superhydrophobic multi-shell hollow microsphere confined phase change materials for solar photothermal conversion and energy storage. ... DSC was employed to evaluate the thermal energy storage capabilities of pure ODA, MSHS@ODA, and MSHS@ODA after 50 and 100 thermal cycles, assessing the enthalpy of phase change, temperature ...

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Yang et al. prepared a superhydrophobic TD/DW composite, and found that the calculated energy storage efficiency of the superhydrophobic TD/DW composite can reach 449.84% (Figure 16(b1-b3)) [147]. ...

The uoride-free superhydrophobic thermal energy storage coating exhibits excellent superhydrophobicity,

durability and photothermal conversion efficiency in a variety of harsh environments. 4210. J Mater Sci (2024) 59:4209-4224 designed as a superhydrophobic surface [12]. Super-hydrophobic surfaces have special properties such as self-cleaning ...

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In this study, a composite material with energy storage, active electro-/photo-thermal de-icing and passive super-hydrophobic anti-icing properties is proposed. Fluorinated epoxy resin and ...

Superhydrophobic surfaces demonstrate excellent anti-icing performance under static conditions. However, they show a marked decrease in icing time under real flight conditions. Here we develop an ...

Superhydrophobic nanocomposite coatings, prepared using adhesive and fillers, offer advantages including ease of fabrication and suitability for large-scale applications, but compared with other types of artificial superhydrophobic surfaces, poor durability still limits these surfaces from practical applications. The utilization of micro/nanoscale particles with both ...

Organic phase change materials (PCMs) play an important role in heat energy storage, but they are also limited by the leakage problem in the process of phase change. Herein, shape-stabilized composite PCMs (ssPCMs) are successfully obtained by impregnating paraffin (PA) into the polymethylsilsesquioxane (PMSQ) aerogels. Due to abundant porosity, light ...

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