Energy storage and refractory materials

To address the growing problem of pollution and global warming, it is necessary to steer the development of innovative technologies towards systems with minimal carbon dioxide production. Thermal storage plays a crucial role in solar systems as it bridges the gap between resource availability and energy demand, thereby enhancing the economic viability of the ...

A landmark review of concrete as thermal energy storage material is presented through a bibliometric analysis approach. This study shows influential literature and the current relevant research directions. ... Molten salts are widely used, but other suitable materials such as alumina-silicate geopolymers, concretes and refractory bricks can ...

The use of a latent heat storage system using phase change materials (PCMs) is an effective way of storing thermal energy and has the advantages of high-energy storage density and the isothermal ...

The papers are mostly devoted to manufacturing refractory materials in an innovative way or enhancing their properties by introducing additives or alloying elements. The collection presents ten papers covering the research areas of extraction, cermets, composites, high-entropy alloys, additive manufacturing, single-crystal materials, and ...

The article presents different methods of thermal energy storage including sensible heat storage, latent heat storage and thermochemical energy storage, focusing mainly on phase change materials (PCMs) as a form of suitable solution for energy utilisation to fill the gap between demand and supply to improve the energy efficiency of a system.

Above results lead to a (material based) energy density in the range of 0.088-0.20 GJ/m 3 (for an ideal closed thermal energy storage cycle and considering the best tested sample). The estimated ...

Refractory materials are strategic materials taking into account the fact that they enable the production of strategic building materials, such as steel, cement, or glass. ... in green and sintered state were analyzed by digital light microscopy and scanning electron microscopy equipped with energy dispersive X-ray spectroscopy. Investigations ...

1 Introduction. To maintain the economic growth of modern society and simultaneously suitability of the Earth, it is urgent to search new and clean energy sources, and also improve the utilization efficiency of the primary energy sources. 1, 2 All the clean energy obtained from nature, such as solar, tidal, geothermal, and wind powers, need be converted ...

This issue covers the following research aspects in refractories: artificial intelligence and computer-aided methods, simulation of refractories properties, new refractory ...

nanometer-scale photodetectors; fast light modulators; and nanoscale, power-efficient lasers and light sources. Plasmonics is paving the way for optical microscopy and photolithography with nanometer-scale resolution, novel concepts for data recording and storage, improved energy harvesting through optimized light-capturing techniques, single-molecule sensing, and ...

A comprehensive review of different thermal energy storage materials for concentrated solar power has been conducted. Fifteen candidates were selected due to their nature, thermophysical ...

The paper also reviews the thermal characteristics of potential Sensible Heat Storage (SHS) materials as energy storage media in these plants and provides a critical assessment of each material. ... refractory bricks are used by tiled stoves, night-storage heaters, and Cowper regenerators on a commercial level. The refractory bricks used in ...

HEMs have excellent energy-storage characteristics; thus, several researchers are exploring them for applications in the field of energy storage. In this section, we give a ...

The emergence of high-entropy materials (HEMs) with their excellent mechanical properties, stability at high temperatures, and high chemical stability is poised to yield new advancement ...

Therefore, storage of hydrogen is a key factor enabling the development of sustainable hydrogen-based energy systems. 88-91 Gaseous, liquid and solid-state storage systems are the three main systems of hydrogen storage techniques available, chosen based on the corresponding size of storage, the application area and the specific conditions. 88 ...

1 · Lightweight refractory high-entropy alloys (LW-RHEAs) hold significant potential in the fields of aviation, aerospace, and nuclear energy due to their low density, high strength, high hardness ...

Refractory is a material that can resist heat, pressure, or chemical corrosion and decomposition, and maintain its strength and shape at high temperatures. The main raw materials used to produce refractories are usually oxides of silicon, aluminum, magnesium, calcium, and zirconium. There are some non-oxide refractory materials, such as carbides, nitrides, borides, silicates, ...

Energy Storage Materials is an international multidisciplinary journal for communicating scientific and technological advances in the field of materials and their devices for advanced energy storage and relevant energy conversion (such as in metal-O2 battery). It publishes comprehensive research articles including full papers and short communications, as well as topical feature ...

Abstract: Porous refractory ceramics combine the high thermomechanical and chemical resistances of oxide-based compounds with the low thermal conductivity and specific heat of porous materials. This two-part study is devoted to understanding and critically reviewing their outstanding behavior as thermal insulators for high-temperature industrial processes (200 ...

The phase composition, microstructure, and thermal properties of the solid heat energy storage materials with different particle size distributions and sintering temperatures ...

Such a value indicates the possibility of usage of biosilica as an electrode material in energy storage applications. ... At present, graphite is chosen as a potential refractory material for the PCM container, due to its high temperature stability, ...

Clean energy advances can drive solid heat storage technology. Because of their high-temperature, corrosion, and excellent thermal shock resistance properties, refractory oxides are widely used as solid heat storage materials. However, their applications are limited owing to their poor heat-transfer performance resulting from their multicomponent, multiphase, ...

1 Advances in the valorization of waste and by-product materials as thermal energy storage (TES) materials Andrea Gutierrez1, Laia Miró2, Antoni Gil3,8, Javier Rodríguez-Aseguinolaza3, Camila Barreneche2,4, Nicolas Calvet5, Xavier Py6, A. Inés Fernández4, Mario Grágeda1,7, Svetlana Ushak1,7,*, Luisa F. Cabeza2 1Department of Chemical Engineering and Mineral Processing, ...

Lignocellulosic biomass is a carbon neutral and renewable resource including a wide range of sources such as agricultural by-products/residues, energy crops, forest residues, grass [6], [7] mainly consists of carbohydrates (cellulose and hemicellulose) and lignin, in which these three main biopolymers are associated in non-uniform three-dimensional structures to ...

25% of global energy pollution comes from industrial heat production. However, emerging thermal energy storage (TES) technologies, using low-cost and abundant materials like molten salt, concrete and refractory brick are being commercialized, offering decarbonized heat for industrial processes. State-level funding and increased natural gas prices in key regions will drive TES ...

Thermal energy storage (TES) systems have been a subject of growing interest due to their potential to address the challenges of intermittent renewable energy sources. In this context, cementitious materials are emerging as a promising TES media because of their relative low cost, good thermal properties and ease of handling. This article presents a comprehensive ...

Solar energy is a clean and inexhaustible source of energy, among other advantages. Conversion and storage of the daily solar energy received by the earth can effectively address the energy crisis, environmental pollution and other challenges [4], [5], [6], [7].The conversion and use of energy are subject to spatial and temporal mismatches [8], [9], such as ...

The future of materials for energy storage and conversion is promising, with ongoing research aimed at addressing current limitations and exploring new possibilities. Emerging trends include the development of next-generation batteries, such as lithium-sulfur and sodium-ion batteries, which offer higher energy densities

and lower costs. ...

Porous carbon materials are at the core of many energy storage and conversion technologies. Accordingly, demand for them is steadily increasing. To satisfy this demand without compromising the environment to a larger extent, researchers are continuously looking for novel synthesis strategies.

TES systems are divided into two categories: low temperature energy storage (LTES) system and high temperature energy storage (HTES) system, based on the operating temperature of the energy storage material in relation to the ambient temperature [17, 23]. LTES is made up of two components: aquiferous low-temperature TES (ALTES) and cryogenic ...

And, from an energy security standpoint, it is worth noting that this technology avoids the use of scarce and expensive materials." Refractory brick has been used for centuries for industrial heat storage, and is made of Earth"s most abundant elements: oxygen, silicon, and ...

Lignin has gained extensive attention as an ideal carbon precursor due to its abundance and high carbon content. However, the agglomeration of lignin and additional corrosive and unrecyclable reagents in direct pyrolysis still limit the development of lignin-based porous carbons. Herein, a facile and eco-friendly strategy was proposed to fabricate ...

The laser-induced MoC x, as a conductive and refractory metallic material with hierarchical porosity (from microscale to nanoscale), was shown to be an appealing candidate for energy storage in ...