

The development of advanced carbon materials is indispensable for high-performance supercapacitors. Herein, we report the direct pyrolysis of waste coal-tar pitch (CTP) with ZnO nanoparticles (Zn NPs) to produce hierarchical porous carbon materials (HPCs). The CTP served as a carbon source, and the embedded ZnO NPs as a simultaneous templating ...

Although it has been well known that heat transfer occurs with coalbed methane desorption in porous coal matrix, little is understood about the coupling interaction between the heat transfer and ...

CBM is primarily stored in the matrix pores of coal in an adsorbed state. The storage and transport process involves adsorption, desorption, diffusion, and seepage, ...

Recently, Yang et al. developed CoAl-LDH/PANI composite for usage in energy storage, wherein the CoAl-LDH is the inner layer while PANI forms the outer layer (Yang et al. 2019). This material exhibited specific capacitance = 528 F g<sup>-1</sup> at current density = 10 A g<sup>-1</sup> and exemplary capacitance retention = 142.7% after 6000 cycles.

Hydrogen energy is considered as a promising sustainable resource under the increasingly tense situation of energy and environment [1]. However, there are some key problems restrict the further progress of hydrogen energy, especially the challenge of hydrogen storage [2], [3] recent years, plenty of efforts have been devoted to the research of hydrogen storage ...

One other way to achieve the desirable reinforcement of the hybrids is to select a highly conductive ss matrix, such as metal foams and/or ceramic porous/foam structures [23][24][25].

Coal is a porous medium, the coal matrix is compressed under a high mercury intrusion pressure ( $\geq 20$  MPa). When the mercury pressure is greater than 400 MPa, the coal ...

The rapid consumption of traditional energy urgently requires us to explore sustainable and reliable energy storage in order to alleviate ... as a new type of porous material, have excellent ... and Jiaqi Xiao. 2022. "Application of Fiber Biochar-MOF Matrix Composites in Electrochemical Energy Storage" Polymers 14, no. 12: 2419. <https://doi.org/10.3390/polym14122419>

The pore structure in a coal matrix is a dual-porosity system where fractures and pores coexist and feature scale-invariance properties, which would affect the occurrence and migration of coalbed methane (CBM) ...

The present review aims at illustrating the benefits of hierarchically structured porous materials in energy storage and will be divided into four sections. After the introduction, in the second section, a very brief

presentation on the synthesis of different hierarchically structured porous materials with various porosities at different length ...

Here we identify the pore structure in a coal matrix as a dual-complexity system consisting of original complexity and behavioral complexity independent to each other, ...

Enhancing zinc-ion storage capacity of coal tar-derived porous carbon by functionalization and hierarchical structure design ... The accelerated progress of electric vehicles and massive energy storage systems has challenged current rechargeable Li-ion batteries and conventional supercapacitors to fulfill safety, fast charging and high energy ...

Coal is fractured by nature; it is a dual porosity/permeability system made up of a porous matrix surrounded by fractures known as cleats (Fig. 1, scale II). The orientation of this quasi-orthogonal cleat network including tensile fractures or face cleats, and compressive and strike-slip fractures or butt cleats, depends on the principal stress" directions [7] and provides ...

Development of thermal storage material utilizing recycled solid wastes resources can enhance the economic and environmental benefits of thermal energy storage systems. This report focused on the processing technology and performance of composite phase change thermal storage materials, which were fabricated by direct impregnation method with ...

The preparation process of PCNSs can be found in the Fig. 1a. First, as the temperature rises, the coal tar pitch melted and coated the mixture of  $\text{KHCO}_3$  and  $\text{KHC}_2\text{O}_4$ . Then,  $\text{KHCO}_3$  and  $\text{KHC}_2\text{O}_4$  began to decompose and react with the carbon matrix to activate it and make pores. The decomposed reactions of  $\text{KHCO}_3$  and  $\text{KHC}_2\text{O}_4$  are as follow:  $2\text{KHC}_2\text{O}_4 \rightarrow \text{K}_2\text{C}_2\text{O}_4 + 2\text{CO}_2 + \text{H}_2\text{O}$  ...

separation, energy storage, and bioengineering applications and are considered key materials ... matrix, which is created from either mechanical incorporation of gasses or chemical foaming ...

Herein, the well-designed hybrid materials composed of  $\text{Fe}_2\text{O}_3$  nanoparticles embedded in hierarchical porous carbon matrix (HPCs/ $\text{Fe}_2\text{O}_3$ ) were prepared by a two-step approach, involving a salt template route followed by hydrothermal treatment. The hierarchical porous structure not only serves as a buffer matrix to alleviate the volume expansion of  $\text{Fe}_2\text{O}_3$  ...

A template-free strategy was designed to prepare hierarchical porous carbons (HPCs) using fluid catalytic cracking oil modified a coal tar pitch (CTP). The resulting HPCs possess large specific surface areas, reasonable pore size distributions, and wrinkled structures, which could improve the overall electrochemical performance. They exhibit a specific ...

Coal permeability is widely studied due to its importance for a variety of areas such as  $\text{CO}_2$  storage in coal seams. Coal swelling due to gas adsorption during  $\text{CO}_2$  injection has an important influence on the evolution

of permeability (Somerton et al. 1975; Siriwardane et al. 2009; Chen et al. 2011) is also a common issue for coalbed methane extraction and ...

In the stage of high metamorphism, the abnormally rapid temperature rise promotes the pyrolysis of alicyclic and side chains, and a large number of interchain pores and ...

CO<sub>2</sub> capture in coal bed methane (CBM) operations refers to the process of capturing CO<sub>2</sub> that is co-produced or released during the extraction of methane from coal seams. This dual operation, often called "enhanced CBM recovery" involves extracting methane for energy production while simultaneously capturing and storing CO<sub>2</sub>. The production and ...

Coal pore system is of great significance in relation to coal bed methane (CBM) because pore system controls storage of methane gas in it, flow of gas and fluid through it, adsorption/desorption, etc. (Chandra 1997). Thus proper understanding and knowledge of pore system is essential for evaluation of CBM potentiality.

In China, the exploration and development of low-rank coalbed methane (CBM) resources are in the early stage, and in-situ pyrolysis is an effective technology for mining of low-rank CBM resources. In this paper, N<sub>2</sub> adsorption method and high-pressure mercury injection test were used to study the pore structure characteristics of coal samples by water vapor ...

**Design/methodology/approach** The digital model of the microstructure of the porous coal rock was obtained, and imported into the numerical simulation software to build the finite element model of ...

A material that has a small hole in it through which water, liquid, vapors, and gas can be passed and provide large surface to volume ratio in the order of 500 m<sup>2</sup>/cm<sup>3</sup> called porous materials. Porous silicon (PS) which has accidentally discovered while Uhlir Jr. and Ingeborg Uhlir in 1956 at the Bell labs in U.S. were developing a technique for polishing and ...

Different scales of pores within the coal matrix provide storage space for CBM and restrict gas migration and flow. Compared to shale reservoirs, coal pores" heterogeneity ...

In order to study the energy storage mechanism of porous carbon electrode in 17 m NaClO<sub>4</sub> electrolyte system, ... Investigation of structural Characteristics of thermally metamorphosed coal by FTIR spectroscopy and X-ray Diffraction. *Energy Fuels*, 27 (2013), pp. 5823-5830, 10.1021/ef401276h. View in Scopus Google Scholar

The pore structure in a coal matrix is a dual-porosity system where fractures and pores coexist and feature scale-invariance properties, which would affect the occurrence and migration of coalbed methane (CBM) significantly. Therefore, it is of fundamental importance to well define complexity types and effectively characterize their assembly ...

Among the development of various materials, carbon materials have gained great interest and present promising potential in the fields of environmental remediation, energy storage, and green preparation [[15], [16], [17]] the last decade, new carbon materials such as graphene, carbon quantum dots, carbon nanotubes and carbon nanospheres have been ...

With the change of energy structure, ... The characteristics of the pore structure affect the storage and migration ... Coal is a porous medium, the coal matrix is compressed under a high mercury ...

Coal matrix deformation is one of the main controlling factors for coal reservoir permeability changes in nitrogen foam fracturing. The characteristics and mechanism of coal matrix deformation during the process of adsorption/desorption were studied by isothermal adsorption/desorption experiments with methane and nitrogen. Based on the free-energy ...

The hydrogen storage capacity of the coal-based porous carbon electrodes was measured via chronopotentiometry using a three-electrode electrolytic cell at atmospheric pressure and room temperature. The three-electrode system consisted of a coal-based porous carbon working electrode, a platinum plate as the counter electrode, Hg/HgO as the

Coal pores are the locations of coalbed methane occurrence and enrichment and the main storage space targeted in CO<sub>2</sub> sequestration. The systematic investigation of ...

To optimize the impedance matching of carbon-based microwave absorbing materials, avoid skin effect, and improve the absorption performance, three-dimensional (3D) porous nitrogen-doped carbon matrix decorated with nickel nanoparticles (CN-Ni) was prepared via a facile energy- and cost-efficient NaCl-assisted method in this work. The uniquely ...

This paper aimed to develop a novel form-stable composite phase change material (PCM) by infiltrating molten Na<sub>2</sub>SO<sub>4</sub> into a mullite-corundum porous ceramic preform (M-PCP). Sufficient coal-series kaolinite (Kc), aluminum hydroxide, aluminum fluoride and graphite were mixed and subsequently heated in air at 1450 °C to produce M-PCP.

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