High energy storage ice crystals

Can active ice store gas?

We prove that the active ice can rapidly store gaswith high storage capacity up to 185 VgVw-1 with heat release of ~18 kJ mol -1 CH 4 and the active ice can be easily regenerated by depressurization below the ice point.

Why should ice crystals be controlled?

When the size of ice crystals can be controlled so that flowing in the pipeline can prevent the occurrence of ice blockage,not only to improve pumping efficiency but also to reduce the size of the pipeline and reduce system costs.

How do ice crystals act as a template agent?

Ice crystals acted as both a template agent and a synergistic vehicle that transports activator into carbon bulks. By tunning the volume of ice template,hollow cavities formed in the inner carbon space to enlarge the accessible surface area and expose extra ion storing sites.

Why are ice crystals used in the synthesis of carbon aerogels?

Ice crystals are always used for the synthesis of carbon aerogels due to they can temporarily separate the water-dissolved precursorsto avoid self-aggregation and create hollow structure after sublimation by freeze-drying.

Why does active ice have a high gas uptake rate?

Although the porous or powdery morphologyof active ice brings high gas uptake rate,it makes the apparent specific volume of active ice packing bed much bigger than that of ice crystal and results in lower apparent storage capacity.

How do additives affect ice crystals?

The additives can also change the phase transition temperature of ice making solution and improve the fluidity of ice crystal. Then,the additives can impede or retard the recrystallizationof ice crystals through physical and chemical interactions between chemical molecules and ice crystals.

Ice slurry has been widely used for thermal energy storage system due to its high cold energy storage capacity. To effectively improve the efficiency of ice slurry generator, it is essential to have a deeper understanding about the solidification mechanism on the plate surface of ice generator, which is affected by many factors, such as the roughness of surface and the ...

Ice slurry storage and melting to obtain cold energy is a complex process that integrates fluid flow, seepage, physical changes of ice crystals, and heat and mass transfer, etc. Improving the effective utilization of ice storage tanks is ...

The ice template plays a crucial role in exposing the inner carbon space of biochar, leading to a cage-like carbon morphology with hollow cavities, layered carbon shells, ...

The process of ice crystal formation can be divided into three stages: nucleation, growth, and recrystallization (Zhang & Liu, 2018).Nucleation often occurs near or on the walls of solution containers, where the interfacial (or surface) free energy is lower, reducing the nucleation barrier (He, Liu, & Wang, 2018).The interfacial tension plays a significant role in nucleation ...

Among the many energy storage technologies, the development of cold energy storage technology can meet the current growing demand of global cooling energy demand [2]. Compared to chilled water storage, ice storage takes advantage of the high latent heat during phase change of the aqueous solution, which can make the storage tank much smaller [3].

The special issue on "Ice Crystals" includes seven contributed papers, which give the wide varieties of topics related to ice crystals. They focus on the interface structure of ice, the physical properties of hydrate crystals and the freezing properties of water controlled by antifreeze proteins. The present issue can be considered as a status report reviewing the ...

3 · Abstract. Amidst the increasing incorporation of multicarrier energy systems in the industrial sector, this article presents a detailed stochastic methodology for the optimal ...

The phase change of water occurs in biological samples during freezing and introduces significant changes to the processed materials. The phase change phenomenon includes complex processes at the macro and micro levels. At molecular levels, water undergoes a rate-limiting nucleation stage to form templates for the next step called crystal growth. The ...

We examine ice crystallization from liquid water and from water vapor, focusing on the underlying physical processes that determine growth rates and structure formation. Ice crystal growth is largely controlled by a combination of molecular attachment kinetics on faceted surfaces and large-scale diffusion processes, yielding a remarkably rich phenomenology of solidification ...

We prove that the active ice can rapidly store gas with high storage capacity up to 185 Vg Vw-1 with heat release of ~18 kJ mol-1 CH4 and the active ice can be easily ...

Trends in Food Science & Technology xx (2014) 1e13 Review The development of ice crystals in food products during the superchilling process and following storage, a review Lilian Daniel Kaalea,b,* and Trygve Magne Eikevika a Norwegian University of Science and Technology (NTNU), Dep. Energy and Process Engineering, Kolbjørn Hejes vei 1d, N-7491, Trondheim, ...

Freezing is an effective technology with which to maintain food quality. However, the formation of ice crystals during this process can cause damage to the cellular structure, leading to food deterioration. A good understanding of the relationship between food microstructure and ice morphology, as well as the ability to effectively measure and control ice ...

A high-voltage electrostatic field (HVEF) can affect the formation of ice crystals and improve food quality by inhibiting the growth of some bacteria. In this study, different intensities of HVEF were used to assist in the shrimp (Solenocera melantho) freezing process, and the effects of the HVEF were explored using the ice crystal structure, physicochemical ...

Ice-templating, also known as directional freezing or freeze-casting, features the tunability of microstructure, the wide applicability of functional nanomaterials, and the ...

At the molecular level, ice is not just water frozen in an ethereal state; it is a crystal lattice that harbors the potential for significant thermal energy storage. In recent years, ...

Among these forms, Latent heat energy storage (LHTES) is achieved by using phase change materials (PCM), and when the ambient temperature is raised or lowered, the PCM can store or release heat energy during the phase change process. PCM has the advantages of high energy density and the small temperature variation from storage to retrieval [3].

Thus, increase in temperature during frozen storage adds to the thermal energy of unstable surface water of ice crystals with radius < r c, thus exceeding the activation energy (E a) required for dissolution into aqueous phase and eventual recrystallization. Hence, during frozen storage of cheeses, variations in temperature should be avoided.

In freezing storage, small size and evenly distributed ice crystals have a positive effect on ingredient, texture, flavor, and lipid oxidation in frozen food due to the damage caused in the food structure by larger ice crystals [72,73,74,75].Therefore, the size and distribution of ice crystals in the food matrix is one of main important factors in frozen food industry.

Self-assembled porous NiFe 2 O 4 and ZnFe 2 O 4 nanostructures with plenty of voids is synthesized using rapid, self-templating ice crystal assisted precipitation approach for ...

The high-pressure and low-temperature combinations result in the formation of various polymorphous forms of ice crystals, such as ice II-VI. These ice crystals are uniformly distributed, even in size, and denser than water, thereby causing lower crystallization related damage to the food tissues (Li et al., 2018).

Herein, this review probes into the relationship of integrative ice frozen assembly with structure and describes the fundamental principles and synthesis strategies for preparing multi-scale materials with complex biomimetic structures via ice-templating. Focusing on ice crystal nucleation and growth, it summarizes the performance of ice ...

The ice-templated method (ITM) has drawn significant attention to the improvement of the electrochemical properties of various materials. The ITM approach is relatively straightforward and can produce hierarchically porous structures that exhibit superior performance in mass transfer, and the unique morphology has been shown to significantly enhance ...

The identification of crystals in the optical microscope as well as histological treatments and measurements using specific software has shown that the growth of ice crystals in the first days of ...

Although freezing has been used to delay the deterioration of product quality and extend its shelf life, the formation of ice crystals inevitably destroys product quality. This comprehensive review describes detailed information on the effects of ice crystals on aquatic products during freezing storage. The affecting factors (including nucleation temperature, ...

2.1. Water. The water in the muscle is composed of three distinct populations: bound water, immobilized water, and free water [].The free water of the product becomes ice crystals firstly, followed by the immobilized water, and the bound water is basically unchanged during the freezing process [].With the extension of freezing time, the bound water which is ...

The additives applied to ice slurry solutions in recent years are discussed in detail which can reduce the solution subcooling, increase the ice content, refine the ice crystal ...

The roundness of the ice crystals was decreasing (from 0.65 to 0.55), and the stretching elongation in the range of 1.81 and 2.29, which indicated that the shape of ice crystals was distorted and might cause damage to the tissue, so we further observed the tissue microstructure by scanning electron microscopy.

High energy storage ice crystals can be used to store energy ** efficiently and sustainably, with applications spanning from cooling systems to energy grid management. **2. These innovative crystals can maintain optimal performance for ** several years, but their effectiveness depends on **3. environmental factors, including temperature and ...

Carbonaceous materials used for energy storage can be classified into graphite, soft carbon, hard carbon, and graphene according to the degree of graphitization and disorder [] gure 2 summarizes the structures of various carbon materials and the Li/Na storage mechanisms, as well as their effects on the ICE. Graphite has a distinct layered structure with either hexagonal ABA ...

Gas hydrates have promising energy storage applications, a main bottleneck being their slow formation kinetics. Here, the authors demonstrate that by dispersing kinetic promoters in porous ice as ...

First, we will briefly introduce electrochemical energy storage materials in terms of their typical crystal structure, classification, and basic energy storage mechanism. Next, we will propose the concept of crystal packing factor (PF) and introduce its origination and successful application in relation to photovoltaic and photocatalytic materials.

Ice crystals played crucial roles in the fabrication of cage-like morphology. By tuning the volume, ice crystals grew as templates to create cavities, prevent the shrinkage of carbon framework and transport activators into carbon bulks for high accessible surface area. ... Advanced electrochemical energy storage technologies with high ...

Besides, low freezing rate favors the generation of extra-large ice crystals, hence unevenly distributed large ice crystals might irreversibly cause tissue breakage and cellular content leakage, while a high freezing rate aids to form numerous fine ice crystals more homogeneously (Chassagne-Berces et al., 2009; Liang et al., 2015; Su et al., 2014).

Ice slurry is a type of cold storage medium with the advantages of high-energy storage density, good fluidity and fast cooling rate, which has the prospect of wide application. Because, the process of making ice slurry often faces problems such as recrystallization, ice blockage and so on. It needs to add some additives, because the additives structural ...

Use the drainage pipe to drain the ice slurry suspended on the water surface of the ice storage tank to another ice storage tank to obtain high concentration ice slurry. ... The driving force required in the phase transition refers to the energy required to compensate for the diffusion of ice crystals, the surface energy added by the formation ...

The faster food freezes, the smaller the crystals that form. Small crystals do less damage to cell walls. Slow freezing produces large ice crystals that punch through cell membranes. As a result, when foods with large ice crystals thaw, there is more dripping and loss of liquid. Small crystals are unstable and over time grow to form larger ...

Methane hydrate single crystals are considered the ideal form for gas storage due to their high storage density and thermal stability [39], [40], [41]. This observation further confirms the potential of the active ice system to facilitate hydrate formation.

Thermal Energy Storage Materials (TESMs) may be the missing link to the "carbon neutral future" of our dreams. TESMs already cater to many renewable heating, cooling and thermal management applications. However, many challenges remain in finding optimal TESMs for specific requirements. Here, we combine literature, a bibliometric analysis and our ...