High energy storage ice crystal effect

How does recrystallization of ice affect aquatic products?

The recrystallization of ice in aquatic products is as follows: the average size of ice crystals increases, the number of crystals decreases, and the surface free energy of the entire crystal system decrease .

Why do small ice crystals have more free energy?

Compared with large ice crystals,the water molecules on the surface of small ice crystals have higher free energy due to the high curvatureand are more thermodynamically unstable.

Does rapid freezing reduce ice crystal size?

Although rapid freezing like air blast freezing that requires very low temperatures generates smaller and more numerous ice crystals,it also means more energy and cooling costs [17,25]. Therefore,it is a challenge to reduce ice crystal size without increasing the costs and the energy consumption to freeze aquatic product.

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.

How ice crystal nucleation and growth affect the quality of frozen aquatic products?

The nucleation and growth of ice crystals have a high effect on the quality of frozen aquatic products, so many technical research works aiming to control ice crystal nucleation and growth have been published, which will be described later. 2.2. Recrystallization

How does charge flow affect ice crystals?

Charge flow (CF) can induce a higher nucleation temperature and reduce the degree of supercooling,which will generate larger ice crystals. This can be used in the freeze-drying of aquatic products to obtain a shorter drying time in the follow-up.

Freezing is an important means for food preservation as, with this technology, long term storage of high quality foods is possible. To achieve high food quality the freezing rate is an important parameter, determining ice crystal size and shape and also the mechanical stresses imparted to the food.

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 ...

Market demand for affordable frozen foods has grown due to changes in consumer lifestyle. The quality of frozen food must be maintained throughout production, storage, transport, and distribution. Recent developments in the science and technology of food freezing have led to improvements in the quality of frozen foods. Examples include the control of ice ...

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].

High-pressure freezing is a method that creates a high supercooling effect that allows for the formation of homogenous ice crystals within the product. At high pressure, ~200-400 MPa, water remains in a liquid state at a temperature below 0 °C, and rapid ice formation occurs upon an immediate drop in pressure [125].

Freezing storage is the most common method of food preservation and the formation of ice crystals during freezing has an important impact on food quality. The water molecular structure, mechanism of ice crystal formation, and ice crystal structure are elaborated in the present review. Meanwhile the methods of ice crystal characterization are outlined. It is ...

BACKGROUND The formation of ice crystals will have adverse effects on aquatic products, and the key to ensure the long-term preservation and better quality preservations of the product is to ...

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 ...

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 ...

Energy Storage Materials. ... January 2021, Pages 716-734. Towards high-energy-density lithium-ion batteries: Strategies for developing high-capacity lithium-rich cathode materials. Author links open overlay panel Shuoqing Zhao a, ... The lithium-gradient cathode material exhibits very high ICE (90.8%) and discharge capacity (293.1 mAh g -1 ...

A large field-induced strain value of 0.76%, a giant strain memory effect of 0.51%, and a good thermal stability of energy storage performance with the recoverable energy variation less than 5% in a wide temperature range were achieved in the (Pb,La)(Zr,Sn,Ti)O 3 tetragonal antiferroeletric single crystals grown by the conventional flux method. ...

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Free, stagnant and bound water inside and outside the cells in frozen fish fillets are distributed in the form of ice crystals. The effect of temperature fluctuations on ice crystals in fish fillets is shown in Fig. 4. Observations from both cross-sectional and longitudinal perspectives revealed that within 3 times of temperature fluctuations ...

The elevated and prolonged voltage profile benefits the electrochemical augment in both specific capacity and energy density. As such, high reversible capacity and energy density of 140 mAh g -1 and 411 Wh kg -1 are achieved for HC-PB electrode at 0.2 C, outperforming the LC-PB counterpart (107 mAh g -1 and 321 Wh kg -1).

Rechargeable room-temperature sodium-sulfur (Na-S) and sodium-selenium (Na-Se) batteries are gaining extensive attention for potential large-scale energy storage applications owing to their low cost and high theoretical energy density. Optimization of electrode materials and investigation of mechanisms are essential to achieve high energy density and ...

Diagram of optical microscopes: (a) Stereomicroscope; (b) Compound microscope [] (with permission).3.2. Application of LM and Cryo-LM to Visualizate Ice Crystals in Frozen Foods. Thus, these microscopy techniques (LM and Cryo-LM) allow the observation of changes in ice crystals during the freeze-thaw process, presenting the advantage that the ...

A schematic of the synthesis of NiFe 2 O 4 NPs and ZnFe 2 O 4 NRs via the ice crystal-assisted method is presented in Fig. 1 (a-b). In a typical experiment, we prepared large ice balls by using fine ice crystal flakes. Then, 0.1 M NiCl 2. 6H 2 O (20 mL) and 0.2 M FeCl 2. 4H 2 O (20 mL) solutions along with 2 mL of an ammonia solution were infiltrated into a large ice ball.

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