The energy storage mechanism of antiferroelectric capacitor is

Why do dielectric capacitors use antiferroelectric materials?
Dielectric capacitors using antiferroelectric materials are capable of displaying higher energy densitiesas well as higher power/charge release densities by comparison with their ferroelectric and linear dielectric counterparts and therefore have greater potential for practical energy storage applications.

What is field-driven transition from antiferroelectric to ferroelectric?
Field-driven transition from antiferroelectric (AFE) to ferroelectric (FE) states has gained extensive attention for microelectronics and energy storage applications. High dielectric-breakdown-strength (DBDS) for a given material is a necessity to attain full capacity of electrical energy storage.

Are antiferroelectric ceramics a good choice for pulse capacitors?
Antiferroelectric ceramics,thanks to their remarkable energy storage density W,superior energy storage efficiency i,and lightning-fast discharging speed,emerge as the quintessential choicefor pulse capacitors [,,].

Are antiferroelectric relaxors effective in energy storage?
Antiferroelectric relaxors (AFR) have attracted increasing attention for their potential to achieve large energy storage density and high efficiency simultaneously. However,the underlying mechanism behind their superior energy storage performance remains unclear.

Can antiferroelectrics be used for energy storage and conversion applications?
Herein, we provide perspectives on the development of antiferroelectrics for energy storage and conversion applications, as well as a comprehensive understanding of the structural origin of antiferroelectricity and field-induced phase transitions, followed by design strategies for new lead-free antiferroelectrics.

Is antiferroelectricity a resurgence in energy-efficient applications?
As a close relative of ferroelectricity,antiferroelectricity has received a recent resurgence of interestdriven by technological aspirations in energy-efficient applications,such as energy storage capacitors,solid-state cooling devices,explosive energy conversion,and displacement transducers.

Materials offering high energy density are currently desired to meet the increasing demand for energy storage applications, such as pulsed power devices, electric vehicles, high-frequency inverters, and so on. ...

Keywords: antiferroelectric, structure-property relation, energy storage, capacitor. ABSTRACT Energy storage materials and their applications have long been areas of intense research interest for both the academic and industry communities. Dielectric capacitors using antiferroelectric materials

Where W toal is known as the total energy storage density, W rec is regaeded as the recoverable energy storage density and i is identified as the energy efficiency for important indicator to describe the

charge-discharge performance of dielectric capacitors. (the maximum polarization of P max, the remnant polarization of P r, samples can withstand the applied ...

Temperature-dependent stability of energy storage properties of Pb0.97La0.02(Zr0.58Sn0.335Ti0.085)O3 antiferroelectric ceramics for pulse power capacitors Appl. Phys. Lett., 106 (2015), Article 262901

Energy storage has become a crucial research topic. Dielectric capacitors play a significant role in the energy storage system and pulse power devices due to their ultra-fast charge discharge rates, high power density, and safety advantages. However, their energy storage density is inferior to that of batteries and electrochemical supercapacitors.

Here, guided by phase-field simulations, we propose a new strategy to frustrate antipolar ordering in antiferroelectrics by incorporating non-polar or polar components. Our experiments demonstrate...

Antiferroelectric relaxors (AFR) have attracted increasing attention for their potential to achieve large energy storage density and high efficiency simultaneously. However, the ...

Dielectric ceramic capacitors are critical components in pulse power systems due to their ultrafast discharge capabilities and high power density [1], [2], [3].A key factor limiting the broader application of these capacitors is energy storage density [4] nsequently, significant efforts have been directed toward enhancing energy density while considering cost-effectiveness and ...

In the past years, several efforts have been devoted to improving the energy storage performance of known antiferroelectrics. Polymers and ceramic/polymer composites can present high breakdown fields but store ...

Here, E and P denote the applied electric field and the spontaneous polarization, respectively. According to the theory of electrostatic energy storage, high-performance AFE capacitors should have a high electric breakdown strength (E b), a large DP (P max - P r), and a delayed AFE-FE phase transition electric field [10, 11] spite extensive efforts to search for ...

Lead-based antiferroelectric (AFE) material with high power density has received extensive attention for potential applications in the energy storage devices.

The unique characteristic of storing electric energy in the electric field with quick charge-discharge mechanism has made dielectric capacitors to have superior power densities compared to conventional ionic batteries and solid oxide fuel cells [1], [2].With the superior power density, dielectric capacitors have been significantly considered for energy storage ...

NaNbO3-based lead-free energy storage ceramics are essential candidates for next-generation pulsed power capacitors, especially under the background of energy saving and environmental protection.

The energy storage mechanism of antiferroelectric capacitor is

The adjustment of the antiferroelectricity of a perovskite cell and the reversibility of antiferroelectric (AFE) -ferroelectric (FE) phase transition under electric field is very important for achieving excellent energy storage properties in AFEs. In this work, obvious change of antiferroelectricity was found in novel Na(Nb 1-x Sb x)O 3 lead-free ceramics fabricated via a ...

Electric field induced antiferroelectric-ferroelectric phase transition is a double-edged sword for energy storage properties, which not only offers a congenital superiority with substantial ...

Dielectric-based energy storage capacitors characterized with fast charging and discharging speed and reliability1-4 play a vital role in cutting-edge electrical and electronic equipment. In ...

Antiferroelectric materials have attracted growing attention for their potential applications in high energy storage capacitors, digital displacement transducers, pyroelectric ...

The widespread application of dielectric materials in pulse power technologies for example accelerators and electromagnetic pulse weapons has led to their increasing attention in energy storage capacitors [1].Currently, dielectric materials used for capacitors include ceramic, polymer, glass-ceramic, and ceramic-polymer composite [2, 3].Among them, ceramic ...

Antiferroelectric capacitors are known for their high energy density and fast charge-discharge rates, making them ideal for modern electronic applications. However, a significant challenge remains in maintaining energy storage performance over a broad temperature range, particularly at low temperatures, which are often overlooked in current ...

To propel the development of dielectric capacitors marketization, in this view, we comprehensively summarized the development process of energy storage density and efficiency, improving strategy, raw materials cost and thermal steadily of ...

The MLCC with 10-thick layers exhibits compact structure, excellent energy-storage, and strain properties. For energy-storage performance, the pulsed discharge current reveals that the stored energy can be released in ...

Among them, the Nb2 has the highest energy storage density and energy storage efficiency at the same time, with energy storage density of 8.26 J/cm 3 and energy storage efficiency of 90.31% at a higher electric field of 400 kV/cm, which is much better than other reported AFE ceramics, achieving for the first time to increase the energy storage ...

High energy storage properties of NaNbO3-based relaxor antiferroelectric ceramics for capacitor ... A new generation of environmentally benign NaNbO 3 (NN)-based antiferroelectric ...

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Dielectric capacitors using antiferroelectric materials are capable of displaying higher energy densities as well as higher power/charge release densities by. comparison with ...

Enhancing the efficiency in energy storage capacitors minimizes energy dissipation and improves device durability. A new efficiency-enhancement strategy for antiferroelectric ceramics, imposing relaxor characteristics through forming solid solutions with relaxor compounds, is demonstrated in the present work.

Dielectric ceramic capacitors, with the advantages of high power density, fast charge- discharge capability, excellent fatigue endurance, and good high temperature stability, have been acknowledged to be promising candidates for solid-state pulse power systems. This review investigates the energy storage performances of linear dielectric, relaxor ferroelectric, and ...

In comparison, AN has energy storage density in the range of 1.6 J/cm 3 at electric field of 14 kV/mm [54] and with compositional modifications AN-based materials can exhibit energy storage density even close to 6.5 J/cm 3 at 37 kV/mm [55]. However, all reports on the AN-based energy storage materials were made on bulk ceramics.

With the increasing demand for electrical energy in electronic applications and pulsed power technology, dielectric capacitors have attracted much attention due to their high power density, good thermal stability, and ultra-fast charge/discharge capability [[1], [2], [3]].The dielectric materials used for dielectric capacitors mainly include ceramics, glass, polymers, and ...

To enhance the comprehensive energy storage performance of AFEs, the methods of stabilizing AFE phase by reducing tolerance factor and B-site polarizability, forming relaxor ...

Due to high power density, fast charge/discharge speed, and high reliability, dielectric capacitors are widely used in pulsed power systems and power electronic systems. However, compared with other energy storage devices such as batteries and supercapacitors, the energy storage density of dielectric capacitors is low, which results in the huge system volume when applied in pulse ...

Dielectric capacitors, as a crucial constituent of power and electronic systems, have garnered considerable attention in recent years owing to their merits of rapid discharge rate, ultrahigh power density, and exceptional stability [1], [2], [3].The energy storage performance of a specific dielectric capacitor, including energy storage density W rec and efficiency i, can generally be ...

Dielectric-based energy storage capacitors characterized with fast charging and discharging speed and reliability1, 2, 3-4 play a vital role in cutting-edge electrical and electronic equipment.

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