Antiferroelectric material energy storage effect

Can antiferroelectric materials be used for energy storage?
Nature Communications 11, Article number: 3809 (2020) Cite this article Benefitting from the reversible phase transition between antiferroelectric and ferroelectric states, antiferroelectric materials have recently received widespread attentions for energy storage applications.

Are antiferroelectric films suitable for dielectric capacitors?
Antiferroelectric materials represented by PbZrO 3 (PZO) have excellent energy storage performance and are expected to be candidates for dielectric capacitors. It remains a challenge to further enhance the effective energy storage density and efficiency of PZO-based antiferroelectric films through domain engineering.

Are antiferroelectrics a promising material with high energy density?
Continued efforts are being devoted to find materials with high energy density,and antiferroelectrics (AFEs) are promisingbecause of their characteristic polarization-electric field (P - E) double hysteresis loops schematized in Fig. 1a (ref. 4).

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.

Will antiferroelectric energy storage and conversion devices become eco-friendly?
We expect that the realization of efficient and eco-friendly antiferroelectric energy storage and conversion devices will take place in the near future. The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Do ferroelectric materials improve energy storage density?
Traditional ferroelectric (FE) materials have large residual polarization under external electric fields,which seriously hindersthe improvement of energy storage density.

We report on the correlated investigation between crystal structures, field-induced phase transition, and energy storage properties of both polycrystalline and epitaxial ...

The values of recoverable energy storage density of 32.6 J/cm 3 and efficiency of 88.1% are obtained for trilayer films annealed at 550 °C, meaning that the design of ...

As one of the efforts to reduce CO 2 emission and consumption of fossil fuels, energy storage by dielectric materials possesses advantages of higher charging/discharging ...

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The development of antiferroelectric (AFE) materials with high recoverable energy-storage density (Wrec) and energy-storage efficiency (i) ...

In addition to FE-based materials, antiferroelectrics (AFEs) are highly promising for energy storage because their unique double hysteresis loop inherently integrates many merits ...

Among solid-state dielectric energy storage materials, antiferroelectrics (AFEs) ... Giant negative electrocaloric effect in antiferroelectric La-doped Pb(ZrTi)O 3 thin films near ...

In AFE family, lead zirconate titanate (PZT)-based systems have been widely investigated recent years because of their high-efficient energy storage and unrivaled electric ...

High energy-storage density and giant negative electrocaloric effect in PLZS antiferroelectric thick film ceramics prepared via the tape-casting process. Author links open ...

Here, we use first-principles-based simulation methods to investigate the energy-storage properties of a lead-free material, that is, Bi 1-x Nd x FeO 3 (BNFO), which is ...

Various Pb-based antiferroelectric materials exhibit a typical double hysteresis loop and subsequently high discharge energy density. Ba 2+ is considered as the perfect substitute of ...

Here, using low-energy proton irradiation, a high-entropy superparaelectric phase is generated in a relaxor ferroelectric composition, increasing polarizability and enabling a capacitive energy ...

In this work, we systematically investigated the effects of single-step and two-step sintering methods on the structural, dielectric and energy storage properties of pure AgNbO3 ...

Recently, on account of the rising demands of high power systems, the exploration of high energy-storage capacitors are attracting increasing attention, in order to minimize the ...

Among these materials, antiferroelectric (AFE) materials play a crucial role in dielectric energy storage capacitors. However, achieving high energy storage density typically ...

With an ever increasing dependence on electrical energy for powering modern equipment and electronics, research is focused on the development of efficient methods for the generation, storage and distribution ...

Antiferroelectric materials are considered as promising materials for energy storage application. The reversible AFE-FE phase transition increases the polarization change ...

The recoverable energy density (W rec) of a high-permittivity dielectric material is calculated by [5, 6] (1) W

rec = ? P r P max E appl d P Where P max and P r are the maximum ...

Energy storage materials such as capacitors are made from materials with attractive dielectric properties, mainly the ability to store, charge, and discharge electricity. Liu et al. developed a nanocomposite of lead ...

Benefitting from the electrical field induced reversible phase transition between antiferroelectric (AFE) and ferroelectric (FE) states, AFE perovskite oxides (ABO 3) become ...

Based on the proposed critical field theory, further predictions can be made for the energy storage and thermal switching properties of hafnium oxide-based antiferroelectric materials, such as ...

In the quest to improve energy density of capacitors, research over the past two decades has focused on enhancing the dielectric properties of various materials including ...

The high dielectric constant and the distinct phase transition in AFE materials provide great opportunities for the realization of energy storage devices like super-capacitors ...

Lead zirconate-based (PZ) antiferroelectric materials were the earliest discovered and most typical dielectric energy storage materials [1], [2]. In recent decades, the energy ...

The requirement for energy in many electronic and automotive sectors is rising very quickly as a result of the growing global population and ongoing economic development ...

PbZrO 3 (PZO) as a typical antiferroelectric (AFE) material possesses a unique double hysteresis loop due to the electric field-induced antiferroelectric-ferroelectric (AFE-FE) ...

Cai et al. found that La-doped antiferroelectric films showed high energy storage, high efficiency and good cycling stability [7]. By replacing Pb 2+ with La 3+ at A site, the long ...

Antiferroelectric materials, which exhibit high saturation polarization intensity with small residual polarization intensity, are considered as the most promising dielectric energy ...

The recoverable energy density (W rec) and efficiency (i) are two important parameters for evaluating the energy storage characteristics of dielectric materials, which are ...

Antiferroelectric materials represented by PbZrO 3 (PZO) have excellent energy storage performance and are expected to be candidates for dielectric capacitors. It remains a ...

Antiferroelectric ceramics that offer negative electrocaloric effect (ECE) near the electric field induced phase transition are also receiving increasing attention [13, 14].ECE is a ...

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Reversible field-induced phase transitions define antiferroelectric perovskite oxides and lay the foundation for high-energy storage density materials, required for future green ...

Enhancing the efficiency in energy storage capacitors minimizes energy dissipation and improves device durability. A new efficiency-enhancement strategy for antiferroelectric ...

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