# Energy storage properties of antiferroelectric films

Do anti-ferroelectric thin films have high energy storage performance?
Zuhuang Chen; Exploring anti-ferroelectric thin films with high energy storage performance by moderating phase transition. 1 December 2024; 11 (4): 041410.

Can nanoscale structural heterogeneity improve energy storage performance in antiferroelectric thin films?
A synergistic approach is proposed to achieve state-of-the-art energy storage performance in antiferroelectric thin films,involving the engineering of nanoscale structural heterogeneity to minimize hysteresisand the precise control of epitaxy orientation to enhance the polarization.

How can antiferroelectric and relaxor properties improve energy storage performance?
This shows that the combination of antiferroelectric properties and relaxor properties is an effective way to improve the energy storage performance. And it is easier to obtain a higher energy storage density by forming a composite film than by replacing elements. Fig. 5.

What are anti-ferroelectric thin films?
Anti-ferroelectric thin films are renowned for their signature double hysteresis loopsand sheds light on the distinguished energy storage capabilities of dielectric capacitors in modern electronic devices.

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 suitable for high-performance energy storage?
Antiferroelectrics with antiparallel dipole configurations have been of significant interest for high-performance energy storage due to their negligible remanent polarization and high maximum polarization in the field-induced ferroelectric state 6, 7, 8.

A huge recoverable energy-storage density of 56 J/cm 3 was obtained in antiferroelectric thick films with x = 0.40. Moreover, a good temperature-dependent stability of ...

Antiferroelectrics have received blooming interests because of a wide range of potential applications in energy storage, solid-state cooling, thermal switch, transducer, ...

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Abstract Undoped and Eu-doped (1, 3 and 5 mol%) PbZrO 3 (PZ) antiferroelectric (AFE) thin films have been deposited on Pt (111)/Ti/SiO 2 /Si substrates by a sol-gel method. ...

Abstract PbZrO 3 (PZO)-based antiferroelectric thin films are of great interest due to their high-power density and fast charging and discharging capability. However, the ...

The energy storage properties of antiferroelectric (AFE) Pb 0.96 La 0.04 Zr 0.98 Ti 0.02 O 3 (PLZT 4/98/2) thin films were investigated as a function of temperature and applied ...

The compositionally graded multilayer Pb (1-3x/2)La x Zr 0.85 Ti 0.15 O 3 (PLZT) antiferroelectric (AFE) thick films were deposited on LaNiO3/Si (100) substrates by using a ...

Using the radio frequency magnetron sputtering process, NaNbO3-based antiferroelectric thin films were obtained on Pt(111)/Ti/SiO2/Si substrates. The effects of ...

PYZST thin-films exhibited a high recoverable energy density of Ureco = 21.0 J/cm 3 with a high energy-storage efficiency of ? = 91.9% ...

This strategy presents new opportunities to manipulate polarization profiles and enhance energy storage performances in antiferroelectrics.

The microstructures of PCZ thin films were controlled via annealing temperature, and the effects of microstructures on electric properties and energy storage performance were ...

The findings reported herein help to elucidate the relationship between energy storage performance and thin-film microstructure, thereby providing an effective way for ...

Antiferroelectric (AFE) thick (1 um) films of Pb(1-3x/2)LaxZr0.85Ti0.15O3 (PLZT) with x = 0.08, 0.10, 0.12, and 0.14 were ...

The improvement in energy storage was owing to the change in the phase transition behavior from antiferroelectric-to-ferroelectric by Mn doping. A enhanced recoverable ...

Hence, in order to fully reveal the energy storage advantages of antiferroelectric films and obtain excellent energy storage performance, PLZT with the Zr/Ti ratios in the vicinity ...

This study reports that incorporating non-polar nanodomains into antiferroelectrics greatly enhanced the energy density and efficiency.

In recent years, antiferroelectric materials have been attracting considerable attention as energy storage

capacitors due to their potential applications in pulsed power systems. In this work, ...

Among all dielectrics, antiferroelectric (AFE) materials have attracted wide attention due to the excellent energy-storage performance. In this paper, PbHfO3 (PHO) AFE ...

The increase of dielectric constant when subjected to an electric field can greatly enhance the energy storage density, making AFEs as excellent candidates for the application of dielectric ...

Abstract Antiferroelectric film capacitors have attracted increasing attention due to their excellent energy storage properties. In this work, PbZrO 3 (PZO) antiferroelectric films ...

The energy density required to charge the system (Win) is equal to the recovered energy density upon discharge (Wout) plus the loss (L). ...

Energy-Storage Properties and Electrocaloric Effect of Pb(1-3x/2)La Zr0.85Ti0.15O3 Antiferroelectric Thick Films x,, Ye Zhao,+ Xihong Hao,* + and Qi Zhang? §

However, low energy-storage density for dielectric capacitors, inferior to other energy storage devices, such as batteries and electrochemical capacitors, has impeded their ...

Antiferroelectric materials with double hysteresis loops are attractive for energy storage applications, which are becoming increasingly important for...

These features make them excellent candidates for high-power pulse capacitor applications. However, PZ-based antiferroelectric materials currently suffer significant ...

Large energy storage density and high thermal stability in a highly textured (111)-oriented Pb 0.8 Ba 0.2 ZrO 3 relaxor thin film with the ...

The structure of the antiferroelectric intermediate phase is also discussed in conjunction with a comprehensive summary of the crystal structure and phase transition ...

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

Large energy storage density and high thermal stability in a highly textured (111)-oriented Pb 0.8 Ba 0.2 ZrO 3 relaxor thin film with the coexistence of antiferroelectric and ...

For application of antiferroelectric materials in dielectric energy storage capacitors, how to improve their electrical breakdown strength is currently a key issue that ...

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In this work, the effects of three variables, misfit strain between the thin film and substrate, defect dipoles doping, and film thickness, on the domain structure and energy ...

Flexible thin-film capacitors have gained a lot of attention in energy storage applications because of their high energy storage densities and ...

By controlling annealing temperature, PZ thin films showed different microstructures and phase compositions, whose impact of electrical properties and energy ...

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