

Are flexible ferroelectric films suitable for energy storage and electrocaloric refrigeration?

Flexible ferroelectric films with high polarization hold great promise for energy storage and electrocaloric (EC) refrigeration. Herein, we fabricate a lead-free Mn-modified 0.75 Bi (Mg 0.5 Ti 0.5 )O<sub>3</sub>-0.25 BaTiO<sub>3</sub> (BMT-BTO) thin film based on a flexible mica substrate.

How can flexible ferroelectric thin films improve energy storage properties?

Moreover, the energy storage properties of flexible ferroelectric thin films can be further fine-tuned by adjusting bending angles and defect dipole concentrations, offering a versatile platform for control and performance optimization.

What is the energy storage density of ferroelectric film?

Meanwhile, a good energy storage density of ~70.6 J cm<sup>-3</sup> and a quite high efficiency of ~82% are realized in the same ferroelectric film, accompanied by excellent stability of frequency and electric fatigue (500-10 kHz and 10<sup>8</sup> cycles). Furthermore, there is no apparent variation in performance under different bending strains.

What are the characteristics of ferroelectric thin films?

Ferroelectric thin films exhibit tensile strain, strain gradient, and defect dipole states. b) The double-well potential of Landau free energy with the strain (defect)-free state (blue curve) and with strain and strain gradient engineering as well as defect engineering (red curve).

What is the recoverable energy storage density of PZT ferroelectric films?

Through the integration of mechanical bending design and defect dipole engineering, the recoverable energy storage density of freestanding PbZr<sub>0.52</sub>Ti<sub>0.48</sub>O<sub>3</sub> (PZT) ferroelectric films has been significantly enhanced to 349.6 J cm<sup>-3</sup> compared to 99.7 J cm<sup>-3</sup> in the strain (defect)-free state, achieving an increase of ~251%.

Which ferroelectric materials improve the energy storage density?

Taking PZT, which exhibits the most significant improvement among the four ferroelectric materials, as an example, the recoverable energy storage density has a remarkable enhancement with the gradual increase in defect dipole density and the strengthening of in-plane bending strain.

The lead-based thin film capacitors such as Pb (Zr 1-x Ti x)O<sub>3</sub> (PZT) have been widely researched in the past fifty years. However, toxicity of lead limits their integration in ...

Ferroelectric thin film materials have been widely applied in a great many fields for their robust spontaneous electric polarization and strong coupling with optical, electric and magnetic fields. ...

In this work, the dielectric, ferroelectric, energy storage, electrocaloric (EC), and pyroelectric properties of

(Pb<sub>0.92</sub>La<sub>0.08</sub>) (Zr<sub>0.55</sub>Ti<sub>0.45</sub>)O<sub>3</sub> (PLZT) thin film (704 nm) are ...

This review starts with a brief introduction of different energy storage devices and current advances of dielectric capacitors in PPT. The latest developments on lead-free RFEs ...

How can flexible ferroelectric thin films improve energy storage properties? Moreover, the energy storage properties of flexible ferroelectric thin films can be further fine-tuned by adjusting ...

The findings in this work present a genuine opportunity to develop ultrahigh-energy-density thin-film capacitors for low-electric-field-driven nano/microelectronics.

Several experimental approaches, such as design of novel micro-/nanostructures, chemical modification, and optimization of the deposition method, are discussed and ...

Among typical ferroelectric materials, Bi<sub>0.5</sub>Na<sub>0.5</sub>TiO<sub>3</sub> (BNT) has attracted significant research attention owing to its high intrinsic polarization and polymorphic phase ...

The increased energy storage density and efficiency in these BZCT-STO thin film capacitors at a low electric field make them one of the most promising systems reported in the literature for ...

For solving the trade-off relationship of the polarization and breakdown electric field, ferroelectric films with high polarization are playing a critical role in energy storage ...

1. Introduction Ferroelectrics are materials that possess spontaneous polarization without an external electric field, and the orientations of the polarization vector ...

Furthermore, the strong coupling relationship between strain and ferroelectric polarization in super-elastic ferroelectric nanostructures is confirmed and discussed, resulting ...

The document explores dielectric materials, including dielectrics, piezoelectrics, pyroelectrics, and ferroelectrics, detailing their properties, polarization mechanisms, and applications. It ...

Normal materials with symmetric charge distribution have dielectric constant in the range of 2-20 but ferroelectric materials have 20,000, this allows their use to make super ...

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Moreover, their ultra-thin and flexible nature facilitates seamless integration into microelectronic devices, enabling miniaturized designs without compromising performance. ...

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