

Fatigue phenomenon of energy storage film

Ultimately, a recoverable energy density of 38.3 J/cm^3 and an energy storage efficiency of about 89.4% can be realized at 1.5% tensile strain and 2% defect dipole concentration. Our work provides a new idea for the preparation of antiferroelectric thin films with high energy storage density and efficiency by domain engineering modulation.

PbZrO₃ (PZ) thin films as typical anti-ferroelectric materials have been widely explored by researchers [2, 11, 12]. Qiao et al. discovered that La-doped PZ anti-ferroelectric thin films obtained the high energy storage density of 34.9 J/cm^3 and the energy storage efficiency of 59.2% at 800 kV/cm [13]. Interestingly, it was found that the energy storage density of about 16 J/cm^3 ...

Electrostatic energy-storage capacitors, with their ultrahigh storage density and high temperature stability, have been receiving increasing attention of late for their ability to meet the critical requirements of pulsed power devices in low-consumption systems. In such a context, this work reports on the successful production of anti-ferroelectric (AFE) thin films with ...

DOI: 10.1016/j.jeurceramsoc.2020.01.049 Corpus ID: 213556174; Impact of fatigue behavior on energy storage performance in dielectric thin-film capacitors @article{Nguyen2020ImpactOF, title={Impact of fatigue behavior on energy storage performance in dielectric thin-film capacitors}, author={Minh Duc Nguyen}, journal={Journal of The European Ceramic Society}, year={2020}, ...

polycrystalline silicon films display failure stresses of approximately half their (single-cycle) fracture strength after fatigue lives in excess of $\sim 10^{11}$ cycles. Although static fatigue of the native silica layer has been suggested (6), until now the mechanism of fatigue in silicon thin films has essentially remained a mystery.

In addition, from 20 to 140°C , no significant changes were observed in energy storage density and efficiency, and the energy storage performance did not decrease significantly after 1.6×10^8 charge-discharge cycles, indicating that the film has excellent thermal stability and fatigue resistance. These results not only show that the BBT ...

Fatigue-Free and Bending-Endurable Flexible Mn-Doped Na_{0.5}Bi_{0.5}TiO₃-BaTiO₃-BiFeO₃ Film Capacitor with an Ultrahigh Energy Storage Performance May 2019 Advanced Energy Materials ...

In particular, the LBFO thin films tended to increase energy storage efficiency as the concentration of La increased, ... Regarding the fatigue phenomenon, a decrease in recoverable energy density due to a slight decrease in saturation polarization and remanent polarization was observed after 10^7 cycles. Finally, a decrease in the recoverable ...

A/B-site doping in influencing the antiferroelectricity of PZO has a similar effect in only considering t value,

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and A-site doping would be better than B-site one in energy storage properties. PBZ films achieve a high W_{rec} of 26.4 J/cm³ with a η of 56.2 % under an applied electric field of 1278 kV/cm, accompanying a suitable temperature and ...

The collective impact of two strategies on energy storage performance. a-d) Recoverable energy storage density W_{rec} and energy efficiency η for 5 nm thin films of BTO, BFO, KNN, and PZT under various defect dipole densities and different in-plane bending strains (Different colored lines represent in-plane bending strains ranging from 0% to 5%).

In addition to energy storage density (W_{rec}) and energy efficiency (η), electrical fatigue characteristic is also an important factor affecting the performance of anti-ferroelectric (AFE) capacitors. The main impacts of electrical fatigue characteristic are strain and thermal shock. The AFE ceramic materials will undergo AFE-FE phase transition, when the applied ...

2 Mn thin film exhibits strong fatigue endurance behavior after 10⁸ cycles. ... which has the similar phenomenon in Nb-doped BiFeO₃ and Mn-doped BiFeO₃ thin films [46, 47]. More carriers are stimulated and new conduction mechanism arises when electric field increases. ... the inset shows breakdown strength of xMn thin films. (c) Energy ...

The energy storage efficiency increases from 56.8% to 74.1%, while a high energy density of ~20 J/cm³ is maintained under an electric field of 1200 kV/cm. Additionally, the operating frequencies ...

In order to better evaluate the energy storage properties of C-n films, ... the C-3 film exhibits nice fatigue durability of at least 1 × 10⁵ cycles with $U_e \sim 33.36$ J cm⁻³ and ...

The Mn-doped PLZT AD thick films exhibit high dielectric breakdown strength (DBS) of ~ 5420 kV/cm, energy-storage density (ESD) of ~ 38.7 W/cm³, with high energy efficiency of ~ 71%. Additionally, the Mn-doped PLZT AD thick films demonstrate a low leakage current and excellent fatigue properties, as indicated by the obtained polarization, DBS ...

For the composite films prepared using the NiO precursor solution with 0.05 mol/L, the recoverable energy storage density of the NiO-PZO composite film is up to 19.6 J/cm³ under the electric field of 1038 kV/cm, which is 30% higher than that of the pure PZO film under the same conditions. Also, the energy storage efficiency of the composite ...

We measured the ferroelectric hysteresis, dielectric properties and the fatigue performance of the BFBT thin film with thickness of about 200 nm. It was found that the film ...

A clear relaxation phenomenon is observed that agrees well with the reported ... Moreover, the multilayer films show almost fatigue-free energy-storage performance after 10¹⁰ switching cycles ...

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The energy-storage performance of dielectric capacitors is directly related to their dielectric constant and breakdown strength []. For nonlinear dielectric materials, the polarization P increases to a maximum polarization P_{\max} during charging. Different materials have different P_{\max} , and a large P_{\max} is necessary for high-density energy storage. During ...

Compared with films annealed at $750\text{ }^{\circ}\text{C}$, the recoverable energy-storage density and energy efficiency in $650\text{ }^{\circ}\text{C}$ annealing samples increased by 50% and 100%, respectively. ...

Recently, film capacitors have achieved excellent energy storage performance through a variety of methods and the preparation of multilayer films has become the main way to improve its energy ...

Relaxor ferroelectric capacitors receive extensive attention for the energy storage applications due to their slim polarization-electric field hysteresis loops. Typically, relaxor ferroelectrics can be designed through introducing multiple heterovalent cations in the ferroelectrics to break the long-range ferroelectric order and form polar nanoregion. Here, ...

The booming wearable/portable electronic devices industry has stimulated the progress of supporting flexible energy storage devices. Excellent performance of flexible devices not only requires the component units of each device to maintain the original performance under external forces, but also demands the overall device to be flexible in response to external ...

Lead-free inorganic dielectric film capacitors have ignited plenty of interest in developing the dielectric energy storage. Here, we obtained a 0.5 mol% Ce and 2 mol% Mn-codoped $0.94\text{Na}_0.5\text{Bi}_0.5\text{TiO}_3\text{-}0.06\text{BaTiO}_3$ [(Ce,Mn):NBT-BT] ceramic film capacitor on Pt/TiO₂/SiO₂/Si substrate, which has a significantly improved recoverable energy storage ...

Fatigue and retention loss are largely unreported in nitride wurtzite ferroelectrics. Therefore, this paper discusses the mechanisms for polarization loss due both to bipolar cycling of the ...

With the decreasing size of storage devices, the problem of ferroelectric fatigue has become increasingly prominent [17][18][19]. Reducing ferroelectric fatigue can greatly extend the lifespan of ...

In addition, the flexible ferroelectric film capacitor also exhibits good thermal stability ($25\text{-}200\text{ }^{\circ}\text{C}$), high frequency reliability (500 Hz-10 kHz), excellent electrical (10^8 ...

Oxygen processed BCZT thin films showed energy storage density (ESD) of 64.8 J/cm^3 and energy storage efficiency (ESF) of 73% at 2000 kV/cm. Apart from that, the films showed very low leakage ...

The validity of Mn element on enhanced energy storage performance and fatigue resistance of Mn-doped

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$0.7\text{Na}0.5\text{Bi}0.5\text{TiO}3\text{-}0.3\text{Sr}0.7\text{Bi}0.2\text{TiO}3$ lead-free ferroelectric ceramics (BNT-BST-xMn) is certified by doping. The effects of Mn modification on the dielectric behavior, ferroelectric, energy storage properties, and AC impedance are comprehensively investigated. ...

The important application potential of flexible energy storage materials in new portable and wearable electronic devices has aroused a research upsurge in performance optimization. Here, the flexible $(1\text{-}x)\text{Na}0.5\text{Bi}0.5\text{TiO}3\text{-}x\text{Bi}(\text{Mg}0.5\text{Zr}0.5)\text{O}3$ (NBT-xBMZ) film capacitors were obtained via a simple sol-gel method based on a nickel foil substrate. The ...

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