

This semiconducting material, then, allows the energy storage, with a density up to 19 times higher than commercially available ferroelectric capacitors, while still achieving 90 percent ...

Under the background of the rapid development of the modern electronics industry, higher requirements are put forward for the performance of energy storage ceramics such as higher energy storage density, shorter discharge time and better stability. In this study, a comprehensive driving strategy is proposed to drive the grain size of ceramic materials to the ...

Here  $P_m(E_m)$  is the polarization of the device at the maximum applied  $E_m$ . The storage "fudge" factor  $f_s$  accounts for the deviation of the  $P-E$  loop from a straight line. From this simple approximation it is obvious that for maximum recoverable stored energy one needs to maximize the maximum attainable field, usually taken to be close to the breakdown ...

Ferroelectric glass-ceramic materials have been widely used as dielectric materials for energy storage capacitors because of their ultrafast discharge speed, excellent high temperature ...

This study provides evidence that developing high-entropy relaxor ferroelectric material via equimolar-ratio element design is an effective strategy for achieving ultrahigh ...

For the study of ferroelectric energy storage materials and devices, the phase-field model oriented to the mesoscopic scale is the most concise and effective theoretical calculation method. ... Xu, J. Tian, Q. Zhu, T. Zhao, Y. Feng, X. Wei and Z. Xu, Effects of La-induced phase transition on energy storage and discharge properties of PLZST ...

A typical antiferroelectric  $P-E$  loop is shown in Fig. 1. There are many researchers who increase the  $W_{re}$  by increasing DBDS [18, 19], while relatively few studies have increased the  $W_{re}$  by increasing the  $E_{FE-AFE}$ . Pursuit of a simpler method to achieve PLZST-based ceramic with higher  $W_{re}$ , energy storage efficiency and lower sintering temperatures, many ...

Request PDF | A new strategy to realize high energy storage properties and ultrafast discharge speed in  $Sr_{0.7}Bi_{0.2}TiO_3$ -based relaxor ferroelectric ceramic | Although tremendous studies have been ...

The development and integration of high-performance electronic devices are critical in advancing energy storage with dielectric capacitors. Poly(vinylidene fluoride-trifluoroethylene-chlorofluoroethylene) (P(VTC)), as an energy storage polymer, exhibits high-intensity polarization in low electric strength fields. However, a hysteresis effect can result in ...

With the increasing demand for miniaturization and integration in electronic equipment, environmental-friendly  $\text{K}_{0.5}\text{Na}_{0.5}\text{NbO}_3$  (KNN) based lead-free energy storage ceramic capacitors have caused extensive concern not only for their ultrahigh power density but also for ultrafast charging/discharging rates. However, their recoverable energy storage ...

The early discharge process can be accelerated, while the following stage is obviously delayed. The simplicity of the hierarchical interfacial engineering method provides a ...

The ferroelectric polymers, e.g., PVDF, PVDF-based copolymers, and terpolymers with high- $k$  (i.e.,  $> 10$ ), have been extensively studied for capacitive energy storage order to increase the discharged energy density and the charge/discharge efficiency, the efforts have been focused on the structural modification of ferroelectric polymers to increase the ...

Guo, M. et al. High-energy-density ferroelectric polymer nanocomposites for capacitive energy storage: enhanced breakdown strength and improved discharge efficiency. *Mater. Today* 29, 49-67 (2019).

Renewable energy can effectively cope with resource depletion and reduce environmental pollution, but its intermittent nature impedes large-scale development. Therefore, developing advanced technologies for energy storage and conversion is critical. Dielectric ceramic capacitors are promising energy storage technologies due to their high-power density, fast ...

Apart from the dielectric properties, electric polarization, charge transform, and charge-discharge characteristics will be discussed in terms of material structure. This review ...

In this chapter, we will introduce an advanced electric energy storage device, named a polymeric film capacitor, which is made of ferroelectric polymer materials with excellent dielectric properties and mechanical properties, such as high permittivity, low loss tangent, high dielectric strength, and high-density energy storage.

Anti-ferroelectric materials possess relatively larger energy storage density, have lower values of remnant polarization and coercive electric field and faster discharge rates for dissipating stored electrical energy, due to ferroelectric to anti-ferroelectric phase transition [42,43]; see Figure 1d. Due to the lack of ferroelectric domains at ...

Ferroelectric ceramics have low energy storage performance due to their nearly square hysteresis loops and low dielectric breakdown strength, which affects their practical applications for high-power energy storage capacitors. Therefore, we solve this problem by introducing a linear dielectric additive and r *Journal of Materials Chemistry C HOT Papers*

Doping is a feasible way to tailor the energy-storage performance of ferroelectric materials. ... only increased the relaxor characteristics of BT materials but also improved the temperature stability of the energy-storage properties. The discharge-energy density of 14 mol% BZT at 25, 50, 100, 150, and 180 °C remained nearly constant [37].

Since the first discovery of ferroelectricity in Rochelle salt in 1920, ferroelectric materials, as an analog of ferromagnetic materials, have evolved from fundamental investigation to practical application. [7] With the enrichment of the material systems, an indisputable fact is that recently the investigations of ferroelectrics have been widely extended to energy-related ...

In order to promote the research of green energy in the situation of increasingly serious environmental pollution, dielectric ceramic energy storage materials, which have the advantages of an extremely fast charge and discharge cycle, high durability, and have a broad use in new energy vehicles and pulse power, are being studied. However, the energy storage ...

In this chapter, we will introduce an advanced electric energy storage device, named a polymeric film capacitor, which is made of ferroelectric polymer materials with excellent dielectric ...

Ferroelectric polymers are attractive candidates as dielectric materials for electrical energy storage applications, but suffer from large dielectric loss. ... charge-discharge efficiency, (c ...

Ceramic capacitors are promising candidates for energy storage components because of their stability and fast charge/discharge capabilities. ... in a ferroelectric BaTiO<sub>3</sub> ceramic is coupled with ...

Ferroelectric polymers are attractive candidates as dielectric materials for electrical energy storage applications, but suffer from large dielectric loss. Here, the authors ...

This work provides a simple and effective strategy to tailor the ferroelectric response of polymeric materials with great potential for flexible electrical energy storage applications. Ferroelectric polymers are the mainstay of advanced flexible electronic devices.

Compared with the other types of ceramic capacitors, relaxor ferroelectric ceramics demonstrate superior potential in energy-storage fields due to their higher energy efficiency, faster charge-discharge rate, and better temperature stability. In this study, we designed and synthesized a novel high performance BaTiO<sub>3</sub>-based ((1-x)BaTiO<sub>3</sub>-xBi(Ni<sup>2/3</sup> ...

Tremendous efforts have been made for further improvement of the energy storage density of BTO ceramic. The nature of strongly intercoupled macrodomains in the FE state can be modified to nanodomains as a characteristic of the relaxor-ferroelectric (RFE) state that lowers the energy barriers for polarization switching, and gives rise to a slimmer ...

A high recoverable energy density ( $W_{rec}$ ) of  $5.1 \text{ J cm}^{-3}$ , a high efficiency ( $\eta$ ) of 88% and an ultrafast discharge time of 28 ns were finally achieved in NBBT ceramics with  $x = \dots$

It is widely recognized that achieving high energy storage density and efficiency in ferroelectric ceramics relies on their ability to exhibit high saturation polarization and low ...

Here, we present a review of the recent progress on BiFeO<sub>3</sub>-based relaxor ferroelectric for energy storage, discussing various issues to meet practical applications. We first discuss the fundamentals of energy storage in dielectrics and the pros and cons of various nonlinear dielectrics with respect to their applications in energy storage ...

Pulse systems have extensive applications in the area of high-power laser systems, medical treatment and oilfield drilling, and their development tendency is size miniaturization and component integration [1, 2]. Dielectric capacitors have potential application in alternating the liquid medium of energy-storage systems in pulse techniques due to their fast ...

The rapid development of clean energy provides effective solutions for some major global problems such as resource shortage and environmental pollution, and full utilization of clean energy necessitates overcoming the randomness and intermittence by the integration of advanced energy storage technologies. 1-4 For this end, dielectric energy-storage capacitors ...

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