

In this work, an exceptional room-temperature energy storage performance with $W_r \sim 86 \text{ J cm}^{-3}$, $\eta \sim 81\%$ is obtained under a moderate electric field of 1.7 MV cm^{-1} in $0.94(\text{Bi}, \text{Na})\text{TiO}_3$ - 0.06BaTiO_3 (BNBT) thin films composed of super-T polar clusters embedded into normal R and T nanodomains. The super-T nanoclusters with a c/a ratio up to ~ 1.25 are ...

Ren, L. L. et al. High-temperature high-energy-density dielectric polymer nanocomposites utilizing inorganic core-shell nanostructured nanofillers. *Adv. Energy Mater.* 11, 2101297 (2021).

Currently, $\text{Bi}_{0.5}\text{Na}_{0.5}\text{TiO}_3$ -based lead-free ferroelectrics have attracted considerable attention as one of the promising candidates for dielectric materials due to their large spontaneous polarization, environmental friendliness and low cost. However, their poor energy density hinder the practical application of the materials. Herein, a novel ceramic of $(1-x)$...

Dielectric ceramics are widely used in advanced high/pulsed power capacitors. Here, the authors propose a high-entropy strategy to design "local polymorphic distortion" in lead-free ceramics ...

As shown in Fig. 6 d, the hopping distance l calculated from the fitting curves decreases from 1.84 nm for pure PEI to 0.56 nm for PEI/15% PEEU, indicating a deeper trap depth in PEI/15% PEEU, which leads to a drop in the leakage current density and an improvement in the dielectric energy storage performance at high temperatures [17].

The energy density of dielectric ceramic capacitors is limited by low breakdown fields. ... A. K. et al. High energy storage density and stable fatigue resistance of $\text{Na}_{0.46}\text{Bi}_{0.46}\text{Ba}_{0.05}\text{La}_0$...

Dielectric polymer materials with high energy density can be used as dielectric materials for developing advanced high-density energy capacitors. In order to realize high energy density, two important parameters, both dielectric permittivity and breakdown strength of the dielectric polymer materials, should be high at the same time in terms of ...

The fabricated polymers containing 3.6 mol% VK units show the maximum discharged energy density of 15.7 J cm^{-3} at 750 MV m^{-1} along with an ultra-high discharging efficiency of 88%. ...

In this article, an overview of recent progress in linear polymers and their composites for high-energy-density electrostatic capacitors at elevated temperatures is presented. Three key factors determining energy storage performance, including polarization, breakdown strength, and thermal stability, and their couplings are discussed.

Materials exhibiting high energy/power density are currently needed to meet the growing demand of portable electronics, electric vehicles and large-scale energy storage devices. The highest energy densities are achieved for fuel cells, batteries, and supercapacitors, but conventional dielectric capacitors are receiving increased attention for pulsed power ...

Dielectric ceramic capacitors with ultrahigh power densities are fundamental to modern electrical devices. Nonetheless, the poor energy density confined to the low breakdown strength is a long ...

The progress of novel, low-cost, and environmentally friendly energy conversion and storage systems has been instrumental in driving the green and low-carbon transformation of the energy sector [1]. Among the key components of advanced electronic and power systems, polymer dielectrics stand out due to their inherent high-power density, fast charge-discharge ...

1 INTRODUCTION. Energy storage capacitors have been extensively applied in modern electronic and power systems, including wind power generation, 1 hybrid electrical vehicles, 2 renewable energy storage, 3 pulse power systems and so on, 4, 5 for their lightweight, rapid rate of charge-discharge, low-cost, and high energy density. 6-12 However, dielectric polymers ...

However, the low dielectric constant of polymer films limits the maximal discharge energy density, and the energy storage property may deteriorate under extreme conditions of high temperature and high electric field [10], [11], [12]. For instance, commercially available biaxially oriented polypropylene (BOPP) films can withstand electric fields ...

Dielectric materials are candidates for electric high power density energy storage applications, but fabrication is challenging. Here the authors report a pressing-and-folding processing of a ...

Note that the most important requirement for capacitor films is not necessarily high energy density, but low dielectric loss to avoid significant heat generation in wound capacitors [1, 9]. ... Polymer-based dielectrics with high energy storage density. *Annu Rev Mater Res*, 45 (2015), pp. 433-458. Crossref View in Scopus Google Scholar

reported an all-organic dielectric polymer/molecular semiconductor composite that exhibits a high energy density of $3.0 \text{ J} \cdot \text{cm}^{-3}$ and high discharge efficiency of 90% up to $200 \text{ }^\circ\text{C}$ through the suppression of electrical conduction. The obtained energy storage performance is much higher than that of the existing dielectric polymers and polymeric ...

Relaxor ferroelectrics are the primary candidates for high-performance energy storage dielectric capacitors. ... featuring a high energy density of 178.1 J cm^{-3} with efficiency exceeding 80% and ...

In this article, an overview of recent progress in linear polymers and their composites for high-energy-density electrostatic capacitors at elevated temperatures is ...

To improve the energy storage density, high permittivity of the dielectrics as well as high breakdown strength should be considered. Among the Polymer-based dielectrics, one method to improve the energy density is using polymer nanocomposites as an alternative. ... high energy density and low dielectric loss, and easy processability. However ...

Next-generation advanced high/pulsed power capacitors rely heavily on dielectric ceramics with high energy storage performance. However, thus far, the huge challenge of realizing ultrahigh ...

Managing high energy density has become increasingly important in applications ranging from electric power systems to portable electronic devices (1-3). Electrostatic capacitors have been widely used for high energy storage and release owing to their ultrafast charge and discharge rate, but their performance is limited by the low maximum polarization ...

Not only in films, high entropy strategy was successfully implemented in lead-free relaxor ferroelectric (Bi 0.5 Na 0.5)(Ti 1/3 Fe 1/3 Nb 1/3)O 3 ceramics, which exhibited an ultrahigh energy storage density of 13.8 J/cm³ and a high efficiency of 82.4%, the energy storage density increased via ~10 times compared with low-entropy materials [32].

where the ϵ_0 is the vacuum dielectric permittivity (8.85×10^{-12} F m⁻¹), and the ϵ_r and E_b are the dielectric constant and breakdown strength of polymer dielectrics, respectively. ϵ_r ...

Polymer film capacitors are critical components in many high-power electrical systems. Because of the low energy density of conventional polymer dielectrics, these capacitors currently occupy significant volume in the entire electrical system. This article reviews recent progress made in the development of polymer dielectrics with high energy storage density, which can potentially ...

(a) The dielectric permittivity (ϵ_r) distribution on the phase diagram of Ba(Ti 1-x% Sn x%)O 3 (BTS), and the maximum value can reach to 5.4×10^4 at the multi-phase point which is also a ...

Here we report record-high electrostatic energy storage density (ESD) and power density, to our knowledge, in HfO₂-ZrO₂-based thin film microcapacitors integrated into ...

Ferroelectric polymers are being actively explored as dielectric materials for electrical energy storage applications. However, their high dielectric constants and outstanding energy densities are ...

To minimise global CO₂ emissions, renewable, smart, and clean energy systems with high energy storage performance must be rapidly deployed to achieve the United Nation's sustainability goal. 2 The energy density of electrostatic or dielectric capacitors is far smaller than in batteries and fuel cells. 3-5 However, they possess the highest ...

Dielectric ceramic capacitors, with the advantages of high power density, fast charge-discharge capability, excellent fatigue endurance, and good high temperature stability, have been acknowledged to be promising candidates for solid-state pulse power systems. This review investigates the energy storage performances of linear dielectric, relaxor ferroelectric, ...

Many of the discovered dielectrics exhibit high thermal stability and high energy density over a broad temperature range. One such dielectric displays an energy density of 8.3 ...

Electrostatic capacitors based on dielectric materials are critical components widely used in electronic devices and electrical power systems because of their distinctive features of ultrahigh power densities (ultrafast charging and discharging rates), high voltage endurance, and good reliability (1-3). However, the energy storage capability of dielectric ...

High energy storage density and low energy loss achieved by inserting charge traps in all organic dielectric materials ... Herein, a family of all organic linear dielectric polymers containing varied contents of p-p conjugated N-vinyl carbazole (VK) units as charge traps are reported. The polymers are synthesized from the copolymerization of ...

Capacitor dielectric films exhibiting high energy storage density and efficiency within a wide operating temperature range are crucial for advancing electrical and electronic ...

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