

# Improving the energy storage properties of ferroelectric materials

How to improve energy storage performance of ferroelectric materials?

The improvement in energy storage performance of ferroelectric (FE) materials requires both high electric breakdown strength and significant polarization change. The phase-field method can couple the multi-physics-field factors. It can realize the simulation of electric breakdown and polarization evolution.

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.

Can ferroelectric ceramics improve energy storage performance in high-temperature capacitors?

Ye, H.; Yang, F.; Pan, Z.; et al. Significantly improvement of comprehensive energy storage performances with lead-free relaxor ferroelectric ceramics for high-temperature capacitors applications. *Acta. Mater.* 2021, 203, 116484. 79.

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.

Can phase-field method improve energy storage performance of ferroelectric materials?

*J. Mater. Inf.* 2025, 5, 24. 10.20517/jmi.2024.97 |&#169; The Author (s) 2025. The improvement in energy storage performance of ferroelectric (FE) materials requires both high electric breakdown strength and significant polarization change. The phase-field method can couple the multi-physics-field factors.

Are ferroelectrics used in electrochemical storage systems?

In this review, the most recent research progress related to the utilization of ferroelectrics in electrochemical storage systems has been summarized. First, the basic knowledge of ferroelectrics is introduced.

To improve the dielectric and energy storage properties as well as reduce the energy loss induced by the ferroelectric relaxation of P (VDF-co-TrFE), unsaturation containing P (VDF-co-TrFE) films were uniaxially stretched after ...

However, the low energy storage density and low breakdown strength (BDS) of ceramic capacitors limit the practical applications of energy storage technologies. In this work, we ...

Lead-free ceramic materials have been widely studied since dielectric capacitors became a key component for

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energy storage. In this work, we adopted defect dipole ...

Research on Improving Energy Storage Density and Efficiency of Dielectric Ceramic Ferroelectric Materials Based on BaTiO<sub>3</sub> Doping with Multiple Elements June 2023 ...

However, the low energy storage density is one of most critical issues hindering their miniaturization and integration development in cutting-edge technologies. In this ...

Starting with the models of electric breakdown and polarization evolution, this work reviews the latest theoretical progress on FE materials with high energy storage performance.

High power density electrostatic capacitor is a fundamental component of advanced electrical and electronic systems. Herein, the (Zn<sup>1/3</sup>Nb<sup>2/3</sup>)<sub>4+</sub> complex ion was ...

Abstract While epitaxial thin films and polymer films exhibit superior voltage endurance and higher maximum polarization (P<sub>max</sub>), making them advantageous for achieving ...

To achieve a high energy storage density at lower electric fields for antiferroelectric materials, it is necessary to decrease their antiferroelectric to ferroelectric phase transition electric fields (EAFE-FE) and acquire double ...

Hence, this review provides a systematic summary of recent research advances in improving the energy storage properties of polymer-based composites from several aspects, ...

The paper explores strategies to enhance the energy storage efficiency (?) of relaxor- ferroelectric (RFE) ceramics by tailoring the structural parameter tolerance factor (t), ...

Next, the methods of improving the energy storage density of dielectric capacitors are concluded. For ceramic blocks and films, methods, such as element doping, multi-phase solid ...

In this study, the excellent energy storage performance of the ceramics prepared by the buried sintering method provides an effective idea for the design of lead-free ferroelectric ceramics with ...

High power density electrostatic capacitor is a fundamental component of advanced electrical and electronic systems. Herein, the (Zn<sup>1/3</sup>Nb<sup>2/3</sup>)<sub>4+</sub> complex ion was introduced into the B-site of ...

Dielectric capacitors are widely used in fields such as high-frequency pulse systems and communication due to their high power density. However, their energy storage ...

The crystal structure, surface morphology, dielectric properties, energy-storage properties, and

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charge-discharge characteristics were studied in detail. The energy-storage ...

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