

Do coated PI films have high field energy storage performance at 175 °C?

We then explored the high field energy storage performance of coated PI films at 175 °C using the electric displacement-electric field loop (DE loop) method.

Does ultra-thin N24 film improve energy storage performance?

Ultimately, in the ultra-thin N24 film, with each layer having a thickness of 6.7 nm, we achieved a remarkable enhancement of energy storage performance, with  $W_{rec}$  reaching 65.8 J/cm<sup>3</sup> and efficiency reaching 72.3%.

2. Experimental 2.1. Synthesis of BiFeO<sub>3</sub> and SrTiO<sub>3</sub> precursors

How to improve energy storage performance of multilayer films?

Current methods for enhancing the energy storage performance of multilayer films are various, including component ratio tuning, interface engineering, diffusion control, stress manipulation, and conduction mechanism modulation.

Which dielectric materials have the best energy storage performance?

Among the different dielectric materials studied so far, including polymers, glasses, and both bulk and film-based ceramics, dielectric ceramic films, which are of particular interest for miniature power electronics and mobile platforms, have demonstrated the greatest energy storage performances.

What is the energy loss of coated PI films at 400 mV/m?

At 400 MV/m, the energy loss of coated PI films is 0.55 J/cm<sup>3</sup>, which is only 4.3% of uncoated PI films and 18.5% of PEI films. The substantial suppression of energy loss further gives rise to the excellent charge-discharge efficiency of coated PI films, as demonstrated in Fig. 4 (d).

Can ultra-thin N24 Bf/St multilayer film be used for high-performance energy storage dielectrics?

An optimal  $W_{rec}$  of 65.8 J/cm<sup>3</sup> and a high  $\eta$  of 72.3% are achieved in the ultra-thin N24 BF/ST multilayer film. This work provides a novel perspective for the development of high-performance energy storage dielectrics and can be widely applied to other combinations of material systems.



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