Supplementary Material

Optimization of high-temperature energy storage properties of polyetherimide-based nanocomposite films via BST@CdS core-shell structure

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Calculation of band structure

The UV–Vis/DRS were recorded to determine the band gap energy of samples. The Tauc' plots i.e., $(\alpha h\nu)^2$ versus photon energy ($\hbar\nu$) based on the power-law relation for samples were considered to estimate band gap (E_g) values. The E_g energy The band gap (E_g) energy could be determined by Eq. (S1) [1,2]:

$$\alpha h\nu = A(h\nu - E_g)^{\frac{n}{2}} \quad \text{(S1)}$$

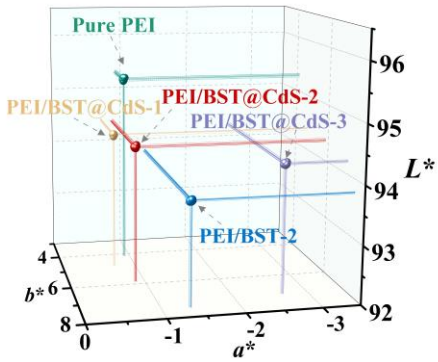
where α, h, ν, and A are absorption coefficient, Planck's constant, light frequency, and proportionality constant, respectively

Calculation of color difference

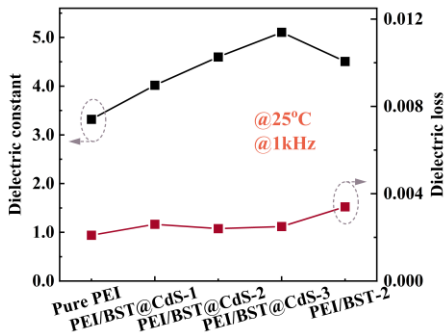
The degree of change in its color is represented by the symbol ΔE, which can be calculated using the following Eq. (S2)[3,4]:

$$\Delta E = \sqrt{(L_n^* - L_0^*)^2 + (a_n^* - a_0^*)^2 + (b_n^* - b_0^*)^2} \quad \text{(S2)}$$

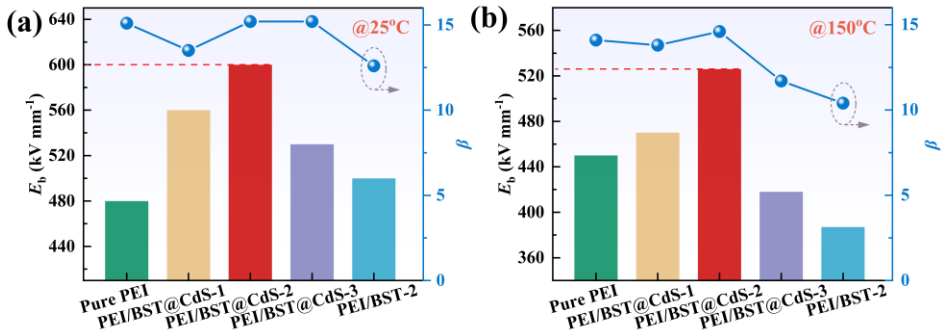
Here, (L_0^*, a_0^*, b_0^*) is the baseline reference value, which corresponds to the first test point of the pure PEI film in this work. (L_n^*, a_n^*, b_n^*) is the measured color values at multiple test points of each film.



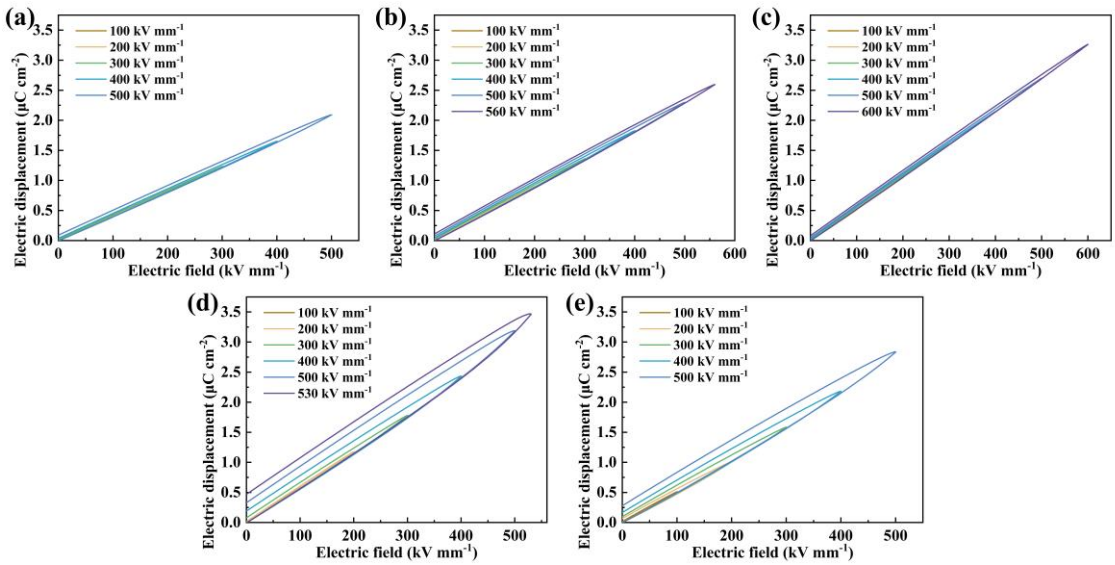
Supplementary Figure 1. The color values of the films within the CIELAB coordinate system. For each film, 10 test points were randomly selected for color measurement. Firstly, distinct color values are observed among all composite films, which is attributed to the introduction of fillers. Secondly, for each film, the color values of the 10 test points show excellent color repeatability, indicating good uniformity across the film.



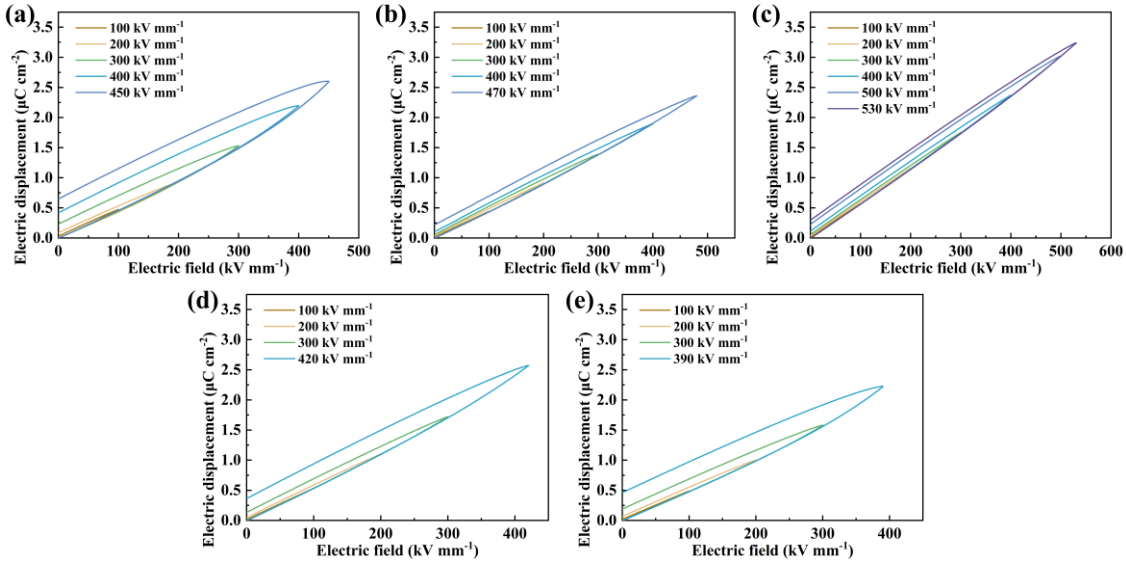
Supplementary Figure 2. Comparison of dielectric constant and dielectric loss of nanocomposites films measured at 1 kHz and 25 °C.



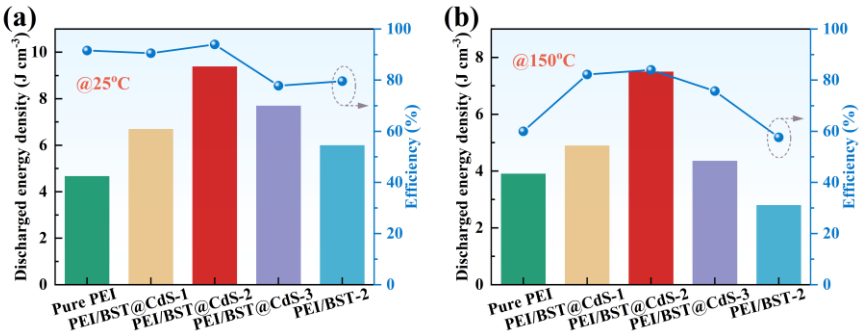
Supplementary Figure 3. Comparison of E_b and β value of nanocomposites films measured at (a) 25 °C and (b) 150 °C.



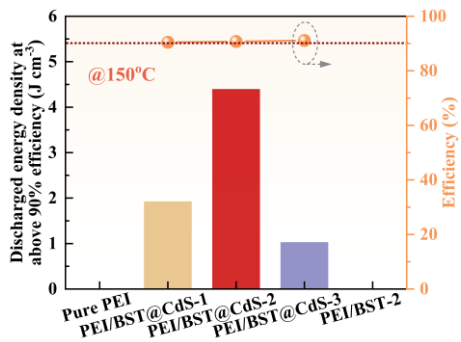
Supplementary Figure 4. *D–E* curves of nanocomposites films measured at 25 °C: (a) Pure PEI film, (b) PEI/BST@CdS−1 film, (c) PEI/BST@CdS−2 film, (d) PEI/BST@CdS−3 film, and (e) PEI/BST−2.



Supplementary Figure 5. *D–E* curves of nanocomposites films measured at 150 °C: (a) Pure PEI film, (b) PEI/BST@CdS−1 film, (c) PEI/BST@CdS−2 film, (d) PEI/BST@CdS−3 film, and (e) PEI/BST−2.



Supplementary Figure 6. Comparison of maximum energy storage properties of nanocomposite films measured at (a) 25 °C and (b) 150 °C.



Supplementary Figure 7. Comparison of energy storage properties of nanocomposite films with efficiency above 90% measured at 150 °C.

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