Supplementary Information

Ultra-high energy-storage density and fast discharge speed of $(Pb_{0.98-x}La_{0.02}Sr_x)(Zr_{0.9}Sn_{0.1})_{0.995}O_3$ antiferroelectric ceramics prepared via tape-casting method

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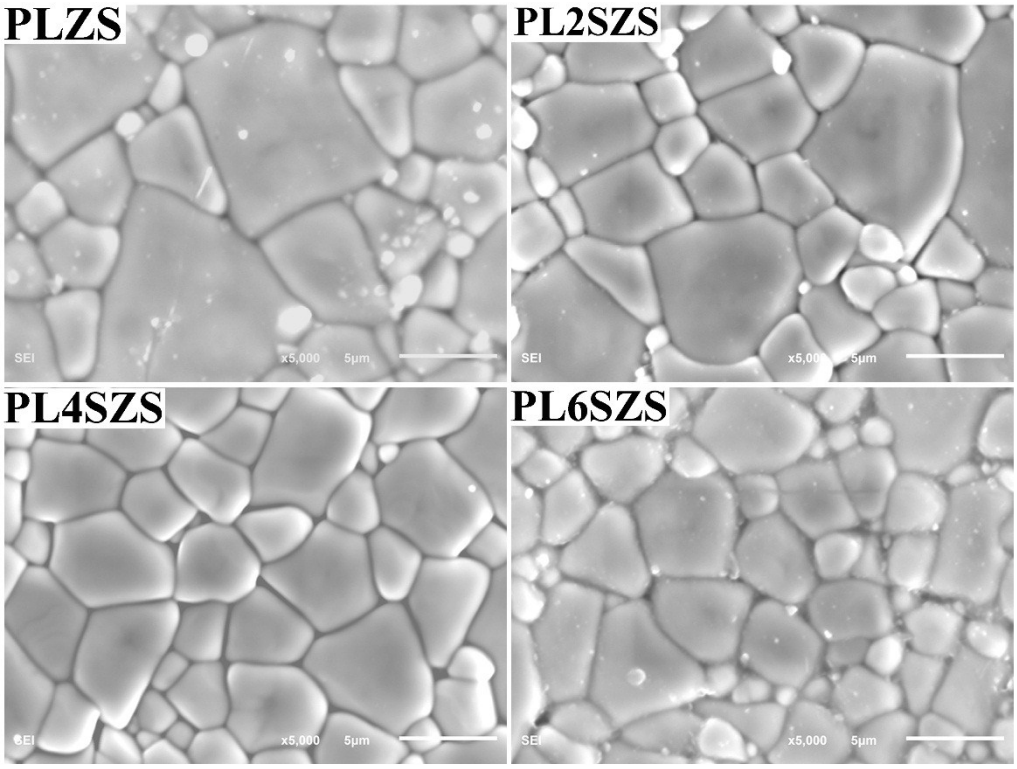

Fig. S1 The SEM images of PLSZS AFE ceramics with different Sr^{2+} contents.

Evidently, all ceramics exhibit dense microstructure. With the increase of Sr^{2+} concentration, the grain sizes gradually decrease and have a more uniform distribution, which in turn is beneficial to improve breakdown strength (BDS).

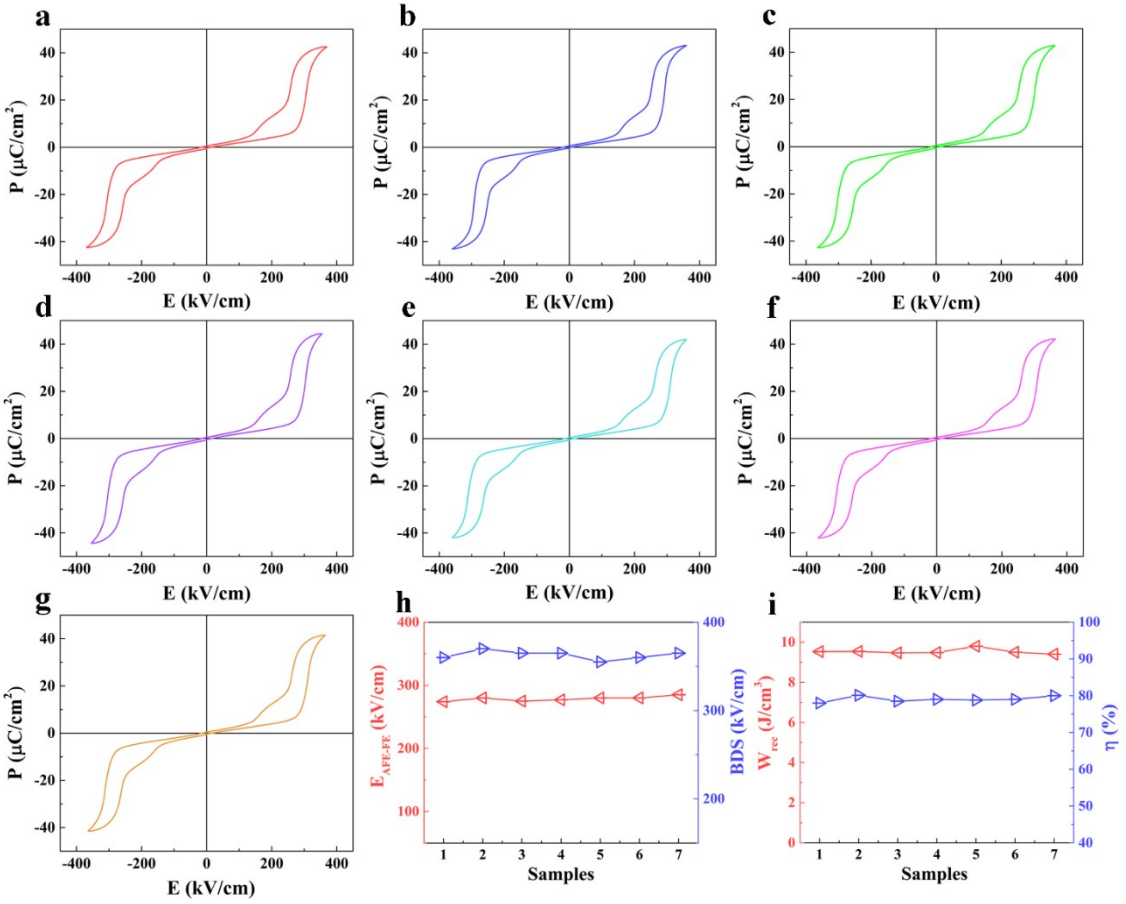

Fig. S2 (a–g) The P–E loop of the PL2SZS ceramics with different samples under the breakdown electric field. (h) The $E_{\mathrm{AFE–FE}}$ and BDS of the PL2SZS ceramics with different samples. (i) The W_{rec} and η of the PL2SZS ceramics with different samples.

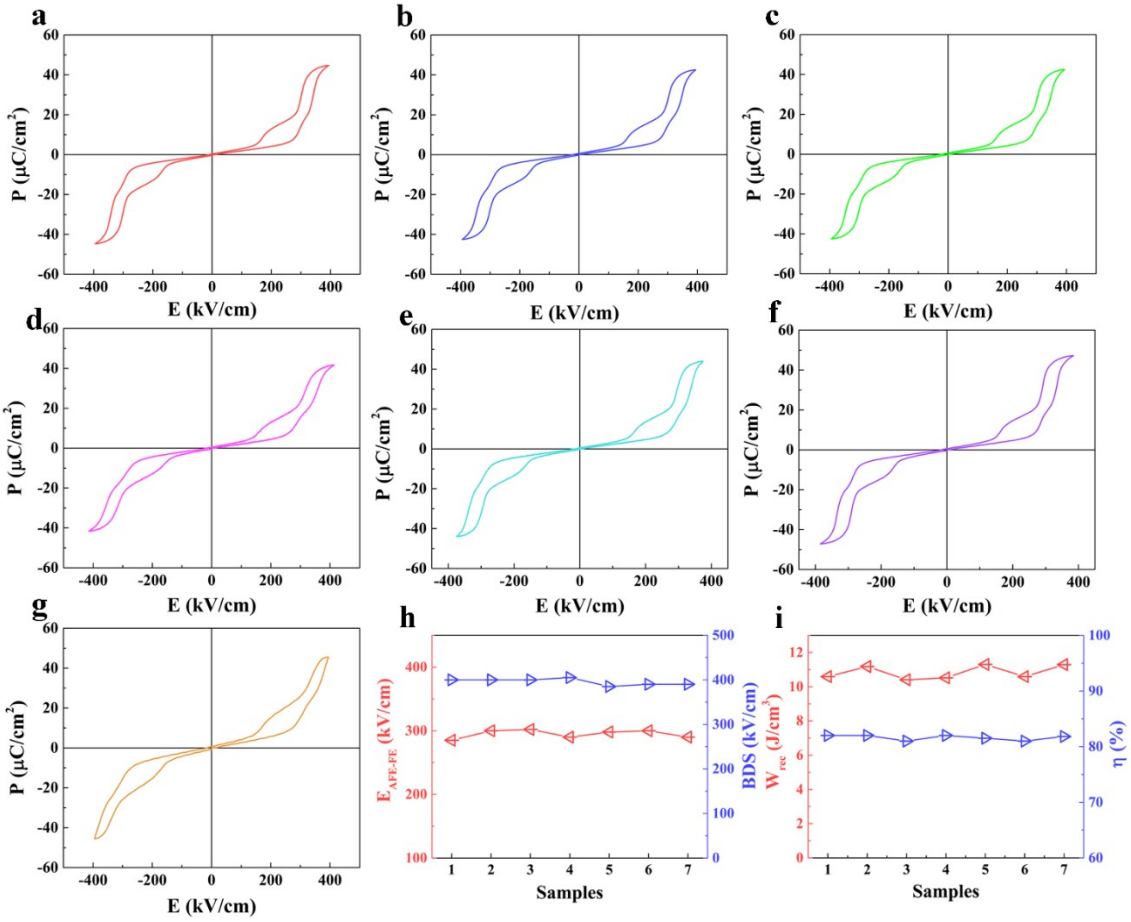

Fig. S3 (a–g) The P–E loop of the PL4SZS ceramics with different samples under the breakdown electric field. (h) The $E_{AFE–FE}$ and BDS of the PL4SZS ceramics with different samples. (i) The W_{rec} and η of the PL4SZS ceramics with different samples.

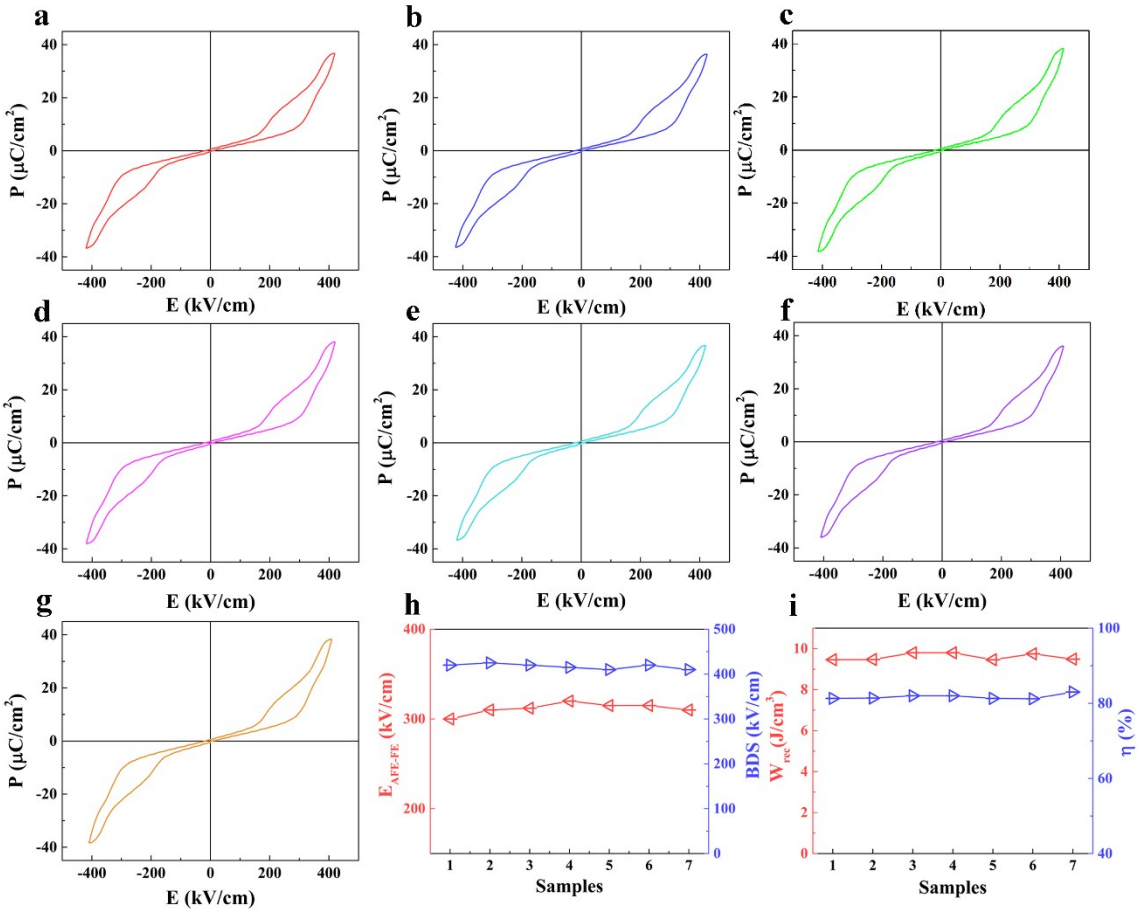

Fig. S4 (a–g) The P–E loop of the PL6SZS ceramics with different samples under the breakdown electric field. (h) The $E_{\mathrm{AFE–FE}}$ and BDS of the PL6SZS ceramics with different samples. (i) The W_{rec} and η of the PL6SZS ceramics with different samples.

Supplementary Note S2–S4:

we prepared ten samples for PL2SZS, PL4SZS and PL6SZS ceramics respectively, and randomly selected seven samples of each component for P–E loops tests. Through P–E loops tests, we calculated the phase switching field ($E_{\mathrm{AFE\text{-}FE}}$), breakdown strength (BDS), energy-storage density (W_{rec}) and energy efficiency (η). As a result, the rate of variation of these parameters for the same component is very small, indicating that high energy-storage performance is not an accidental factor.