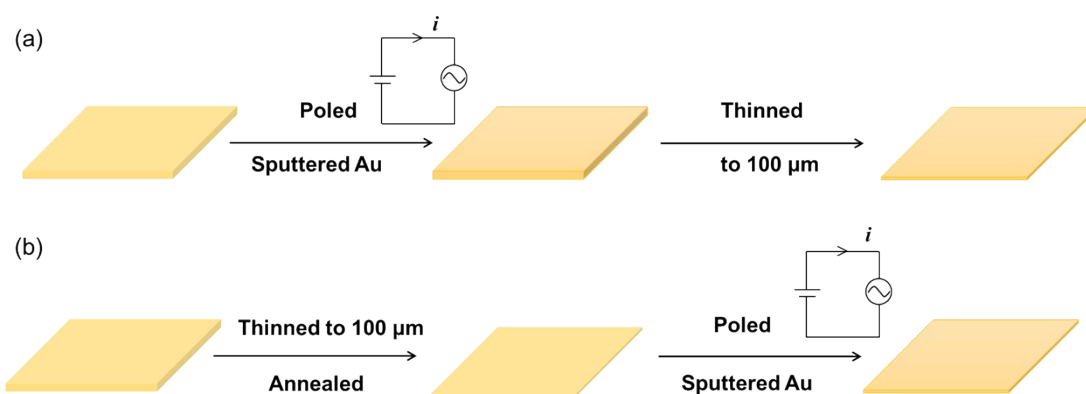
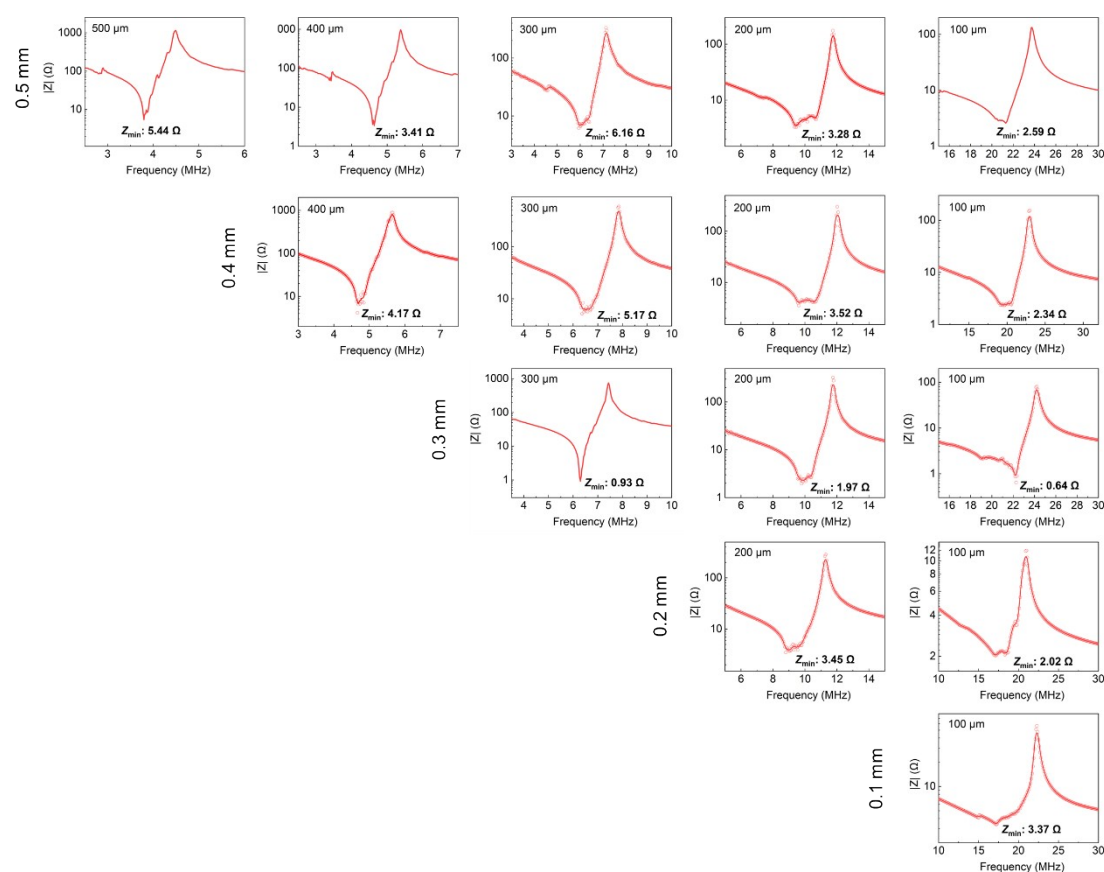


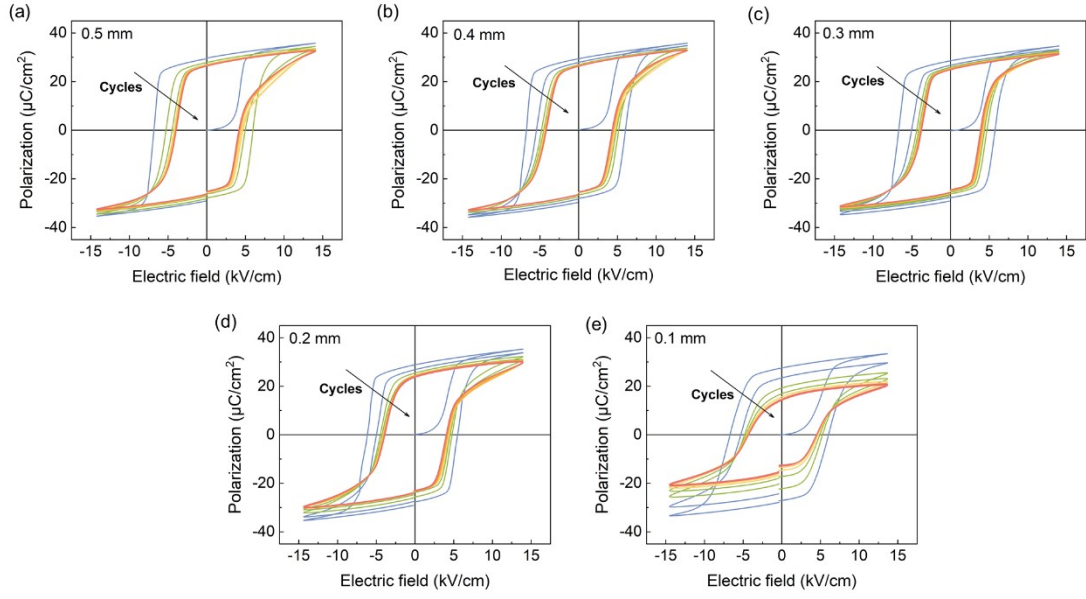
## Supplementary materials:



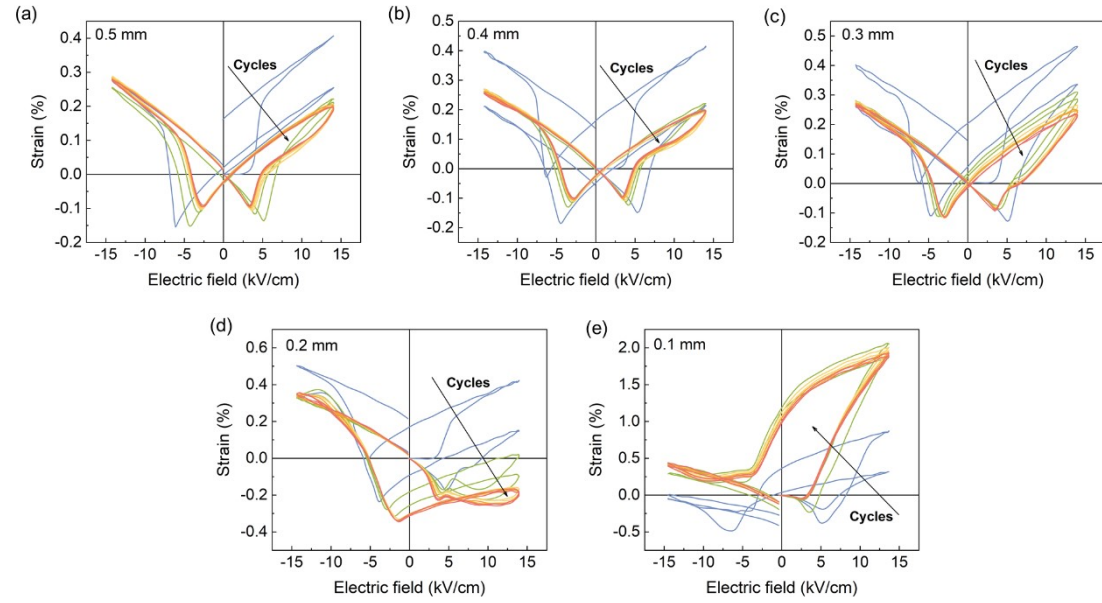
**Fig. S1** Two preparation methods for a single crystal sheet with a thickness of approximately 100  $\mu\text{m}$  for an ultrasonic transducer.



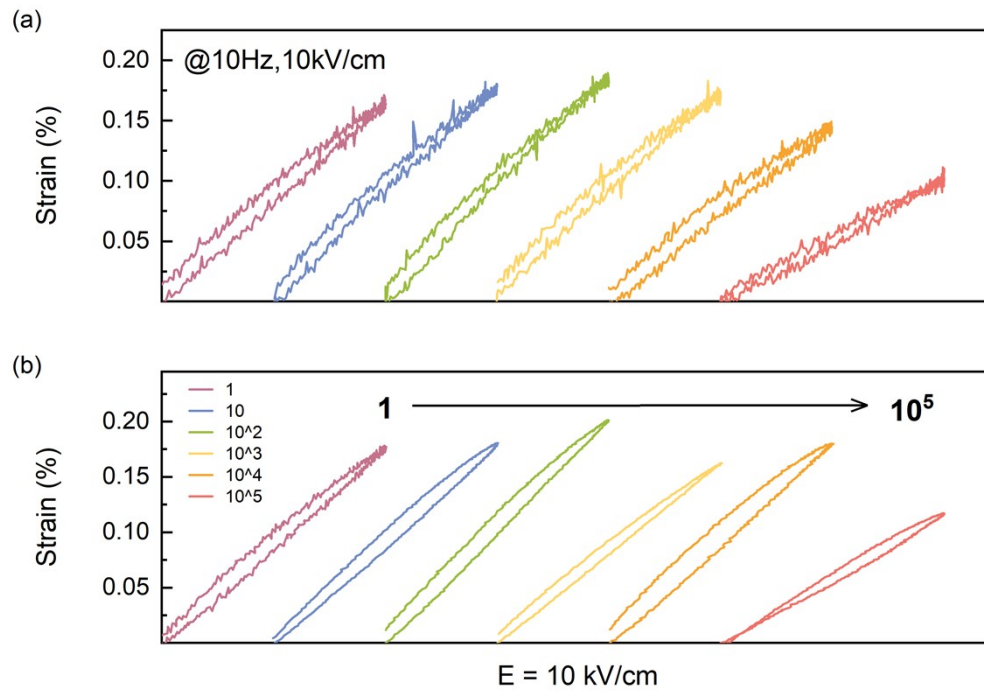
**Fig. S2** Impedance-frequency spectra of the PIN-PMN-PT SC plates with different thicknesses (0.5, 0.4, 0.3, and 0.2 mm) after mechanical treatments, gradually decreasing to 100  $\mu\text{m}$  sheets.



**Fig. S3** Polarization versus electric field (P-E) hysteresis loops of the PIN-PMN-PT SCs with thickness from 0.5 to 0.1 mm.



**Fig. S4** Strain versus electric field (S-E) behavior of PIN-PMN-PT SCs with thicknesses from 0.5 to 0.1 mm.



**Fig. S5** Strain versus electric field (S-E) behavior of PIN-PMN-PT SCs with thicknesses from 0.5 to 0.1 mm.