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Electronic supplementary information (ESI)

A compounding strategy to boost transduction coefficient in KNN-based piezoelectric composite ceramics for ultrasonic energy harvesting

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This supporting file includes:

1. Supporting Figures
2. Supporting Tables
3. Supporting References

1. Supporting Figures

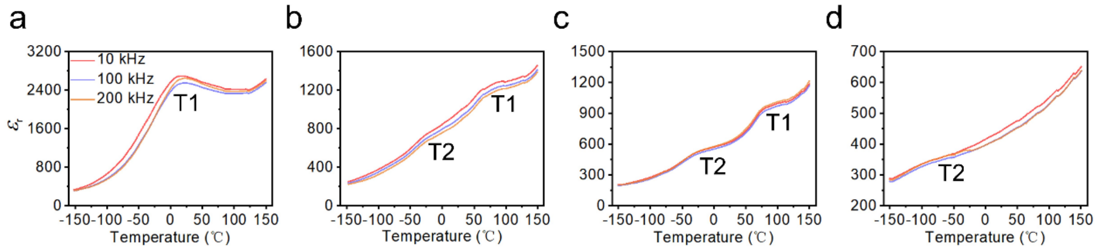

Fig. S1 Temperature-dependent of ε_r curves of KNNS-BAZH-*x*KNN-Fe ceramics measured at -150-150 °C with different frequency. (a) x = 0. (b) x = 0.4. (c) x = 0.5. (d) x = 1. T1: $T_{R\text{-}O\text{-}T}$ of KNNS-BAZH; T2: $T_{R\text{-}O}$ of KNN-Fe.

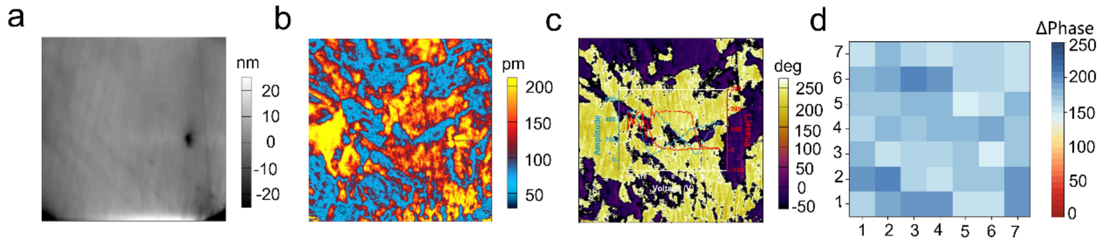

Fig. S2 Domain structural characterizations of the ceramic with x = 0.5 measured by PFM. (a) Topography (b) Amplitude (c) Phase. (d) Phase contrast mappings of the PFM hysteresis loops collected at 7 × 7 grid positions of KNN barriers.

Fig. S3 Typical SS-PFM loops. Amplitude and phase measured at different points with $x = 0$.

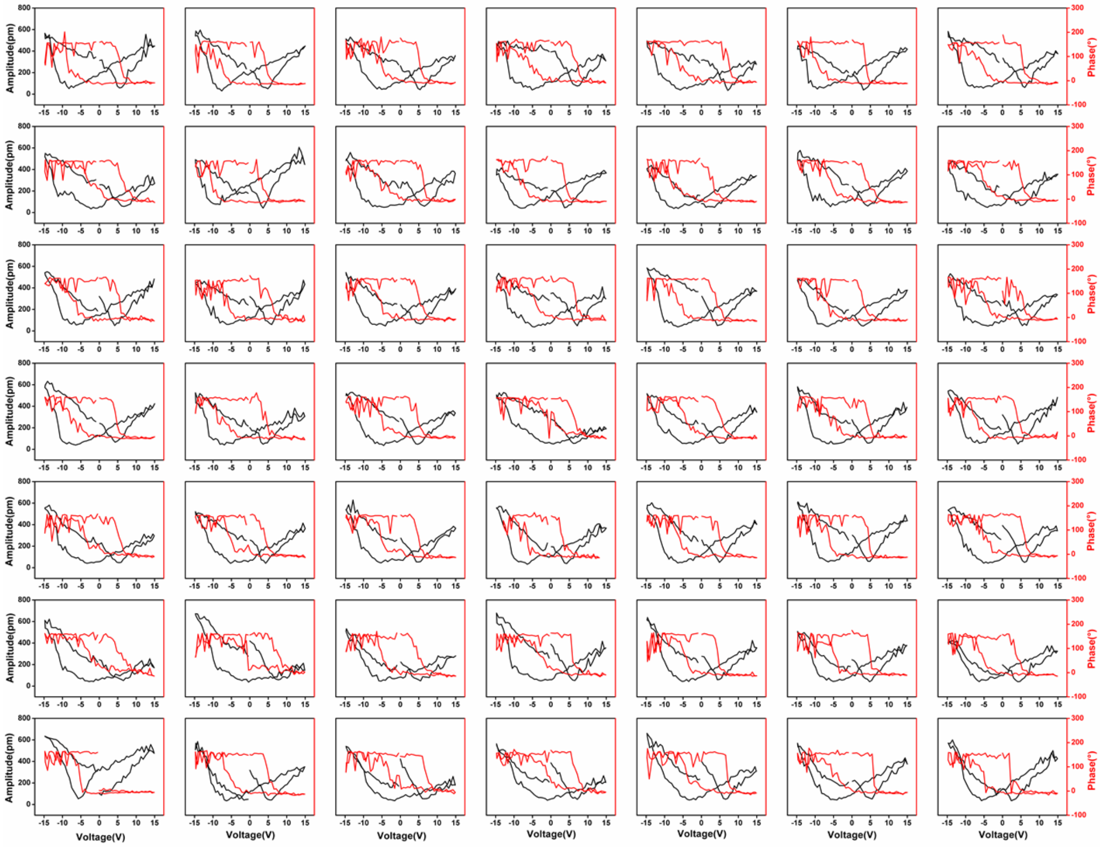

Fig. S4 Typical SS-PFM loops. Amplitude and phase measured at different points with $x = 0.4$.

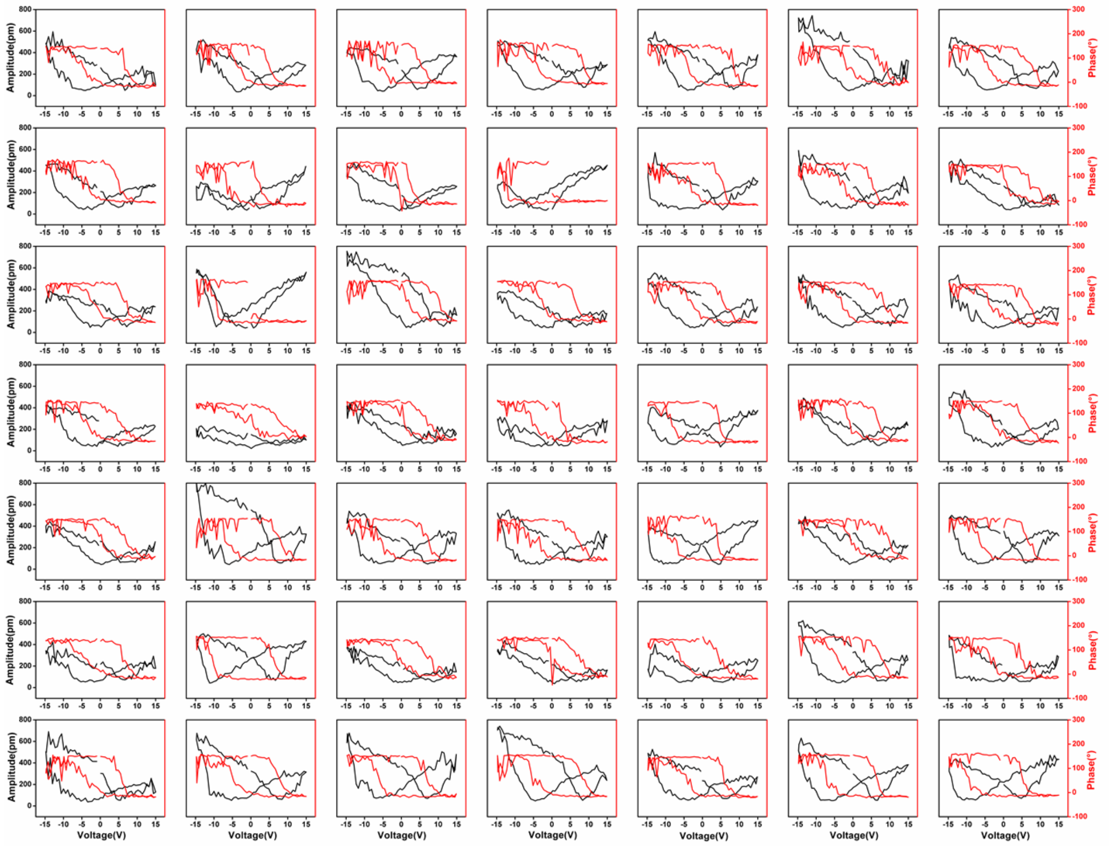

Fig. S5 Typical SS-PFM loops. Amplitude and phase measured at different points with $x = 1$.

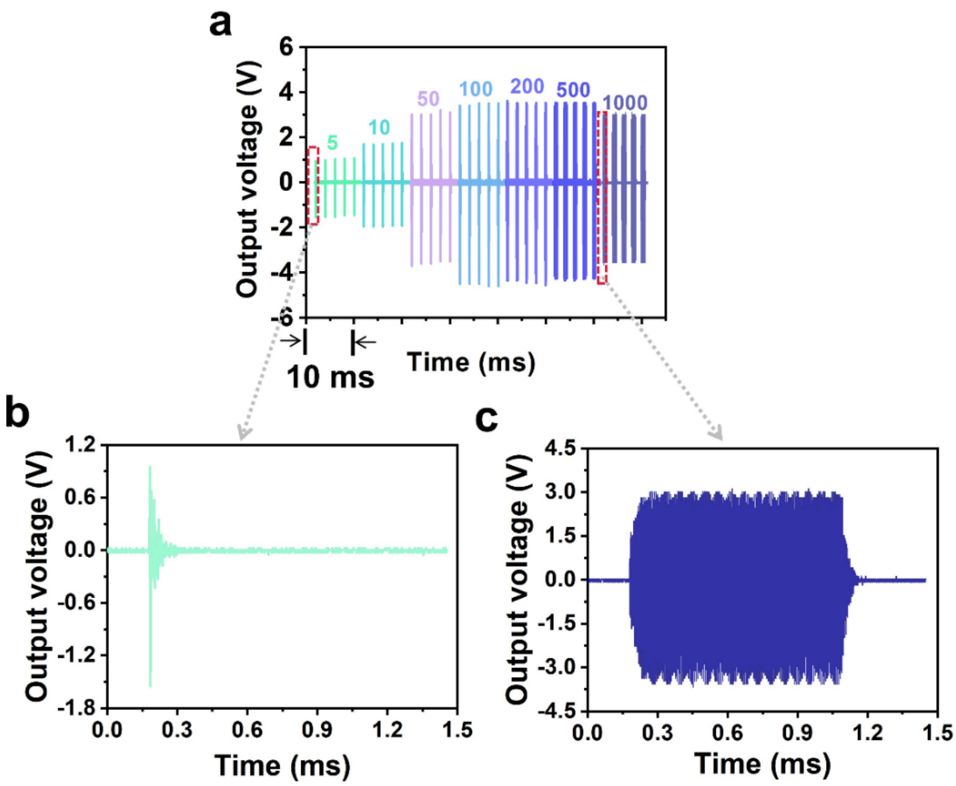

Fig. S6 Characterizations of the output voltage. a Output voltage signal of the PUEH measured at different cycles. Ultrasound-induced energy transmission can be regulated by setting trigger cycles. b and c output voltage of part of the 5 cycles and 1000 cycles respectively.

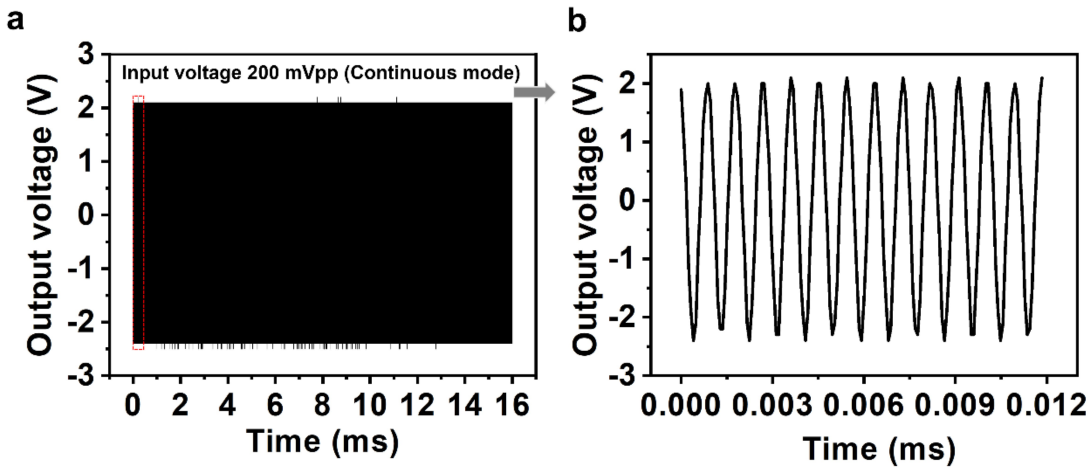

Fig. S7 Output voltage in a continuous mode. (a) and (b) Characterizations of the output voltage of the PUEH when the input voltage is 200 mVpp in a continuous mode. A continuous 200 mVpp 200 kHz sinusoidal signal was switched to drive the ultrasonic transmitter, generating a continuous sinusoidal signal, indicating the output signals are purely induced by the piezoelectric effect of the PUEH device.[1]

2. Supporting Tables

Table S1. The average charging power of the ultrasonic energy harvesters to charge the capacitors.

Name of devices	Materials	Charging power (nW)	Ref.
KNNS-BFC-UEH	1–3 type KNN-based piezocomposite	42	2
Piezo-helix	KNN composite-based lead-free piezoelectric helix	103	3
LF-PUEH	KNNS-based 1-3 composite	160.38	4
3D-twining UEH	KNN-based 1–3 piezo-composites	307	5
Flexible PUEH	PZT/epoxy 1–3 piezoelectric composites	40	1
KNN-based PUEH	KNN-based composites	737	This work

3. Supporting References

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