

**Electronic Supplementary Information, ESI.**

**A hybrid piezoelectric and triboelectric  
nanogenerator with lead-free BZT-BCT/PDMS  
Composite and PVA film for scavenging  
mechanical energy**

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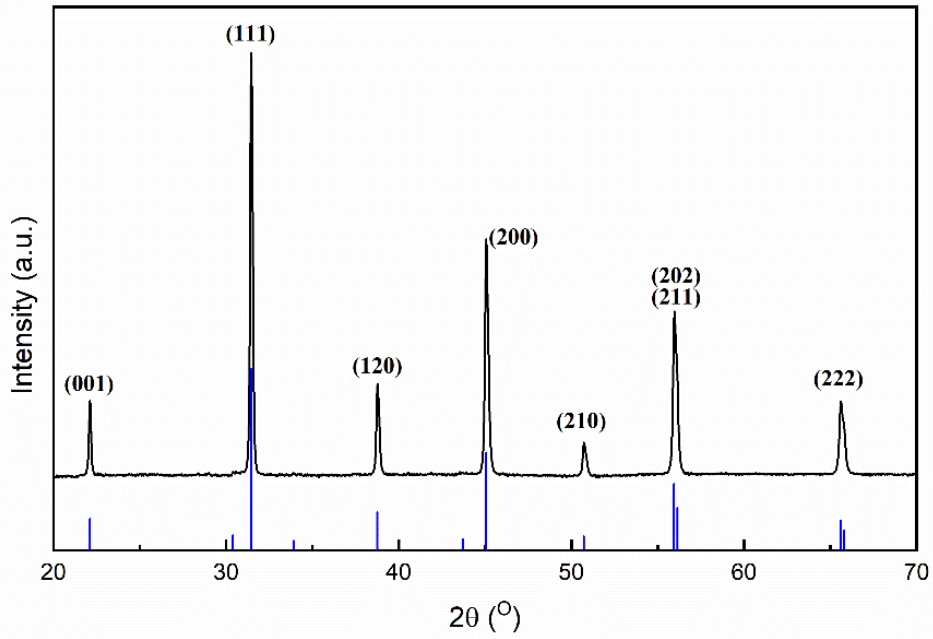


Figure SI1: XRD Analysis of Sintered BZT-BCT Ceramic Pellet.

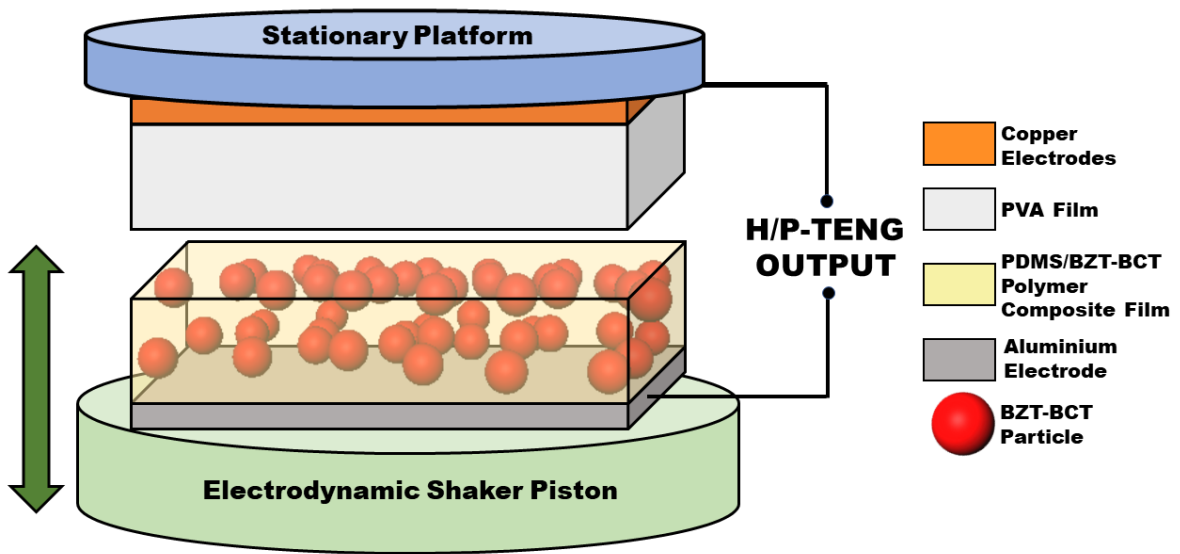


Figure SI2: Schematic diagram of PVA /PDMS/BZT-BCT H/P-TENG construction.

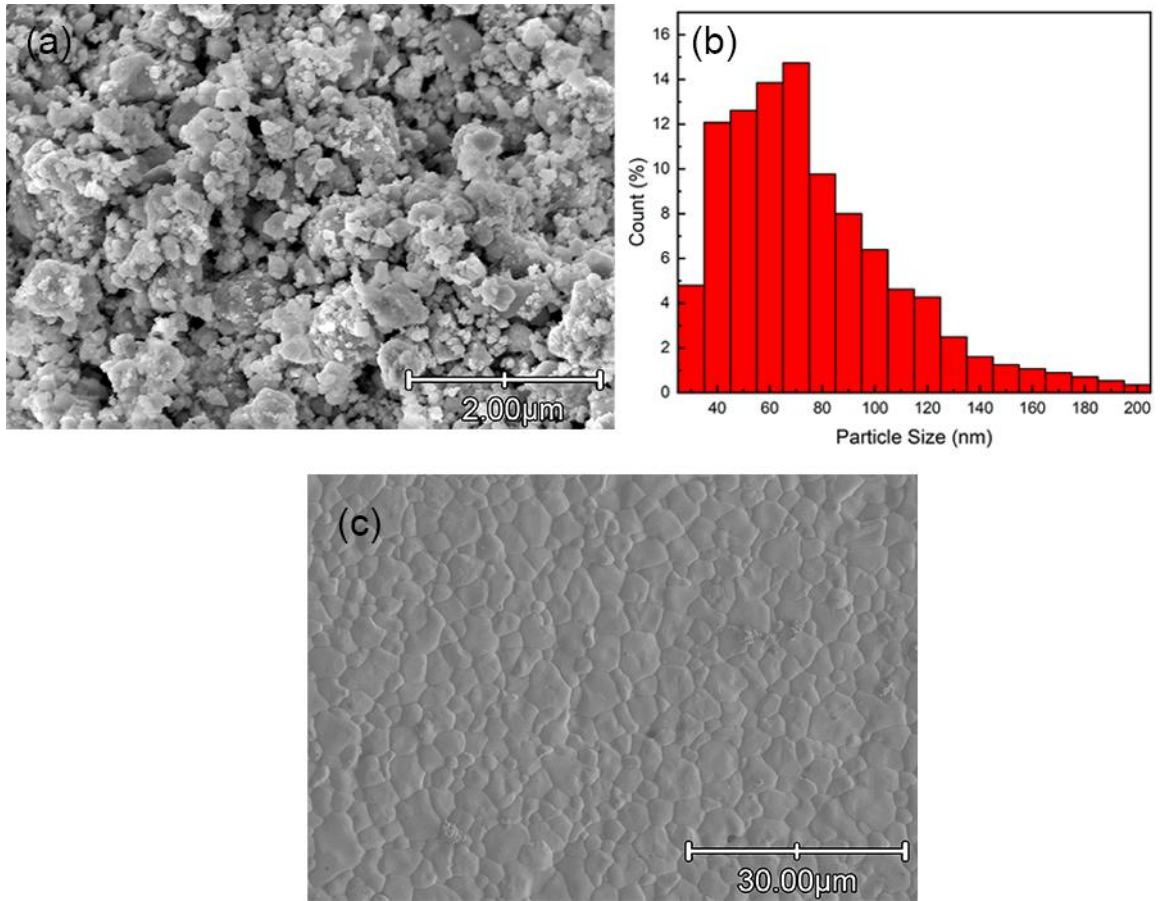


Figure S13: (a) FESEM micrograph of BZT-BCT particles; (b) histogram showing the particle size distribution; (c) FESEM image of sintered ceramic pellets with homogeneous grain growth.

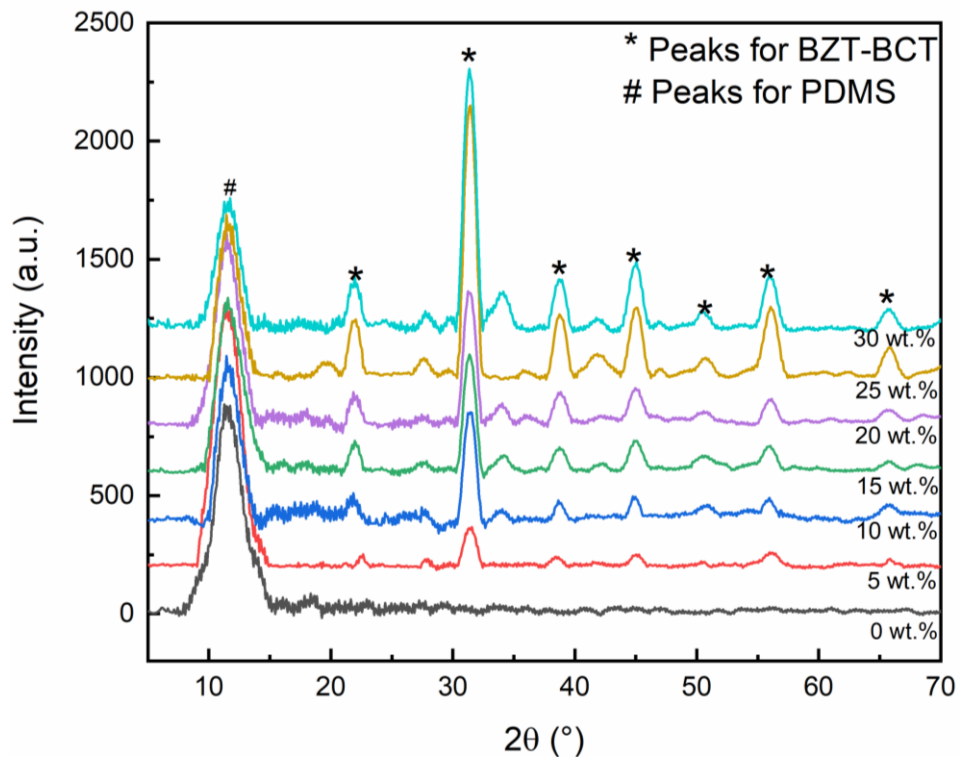


Figure SI4: XRD Analysis of BZT-BCT Polymer Composite Films with Varying wt.% of BZT-BCT inclusion.

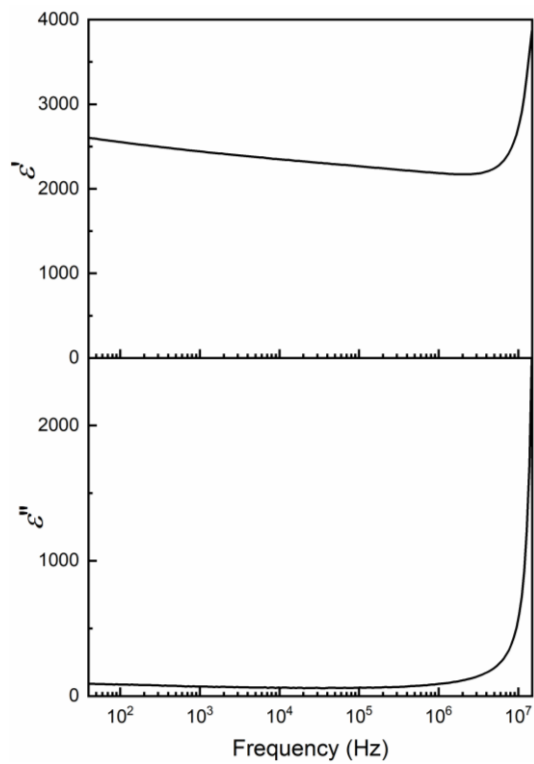


Figure SI5: Dielectric spectra of BZT-BCT ceramic pellet.

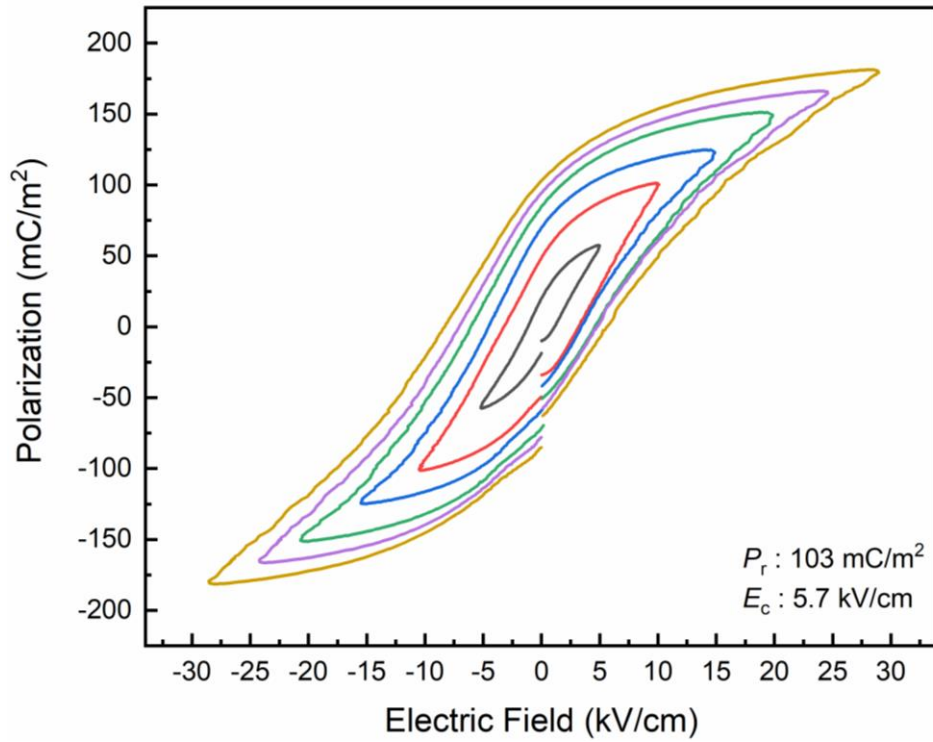


Figure SI6: P-E Hysteresis Loop of BZT-BCT Ceramic Pellet.

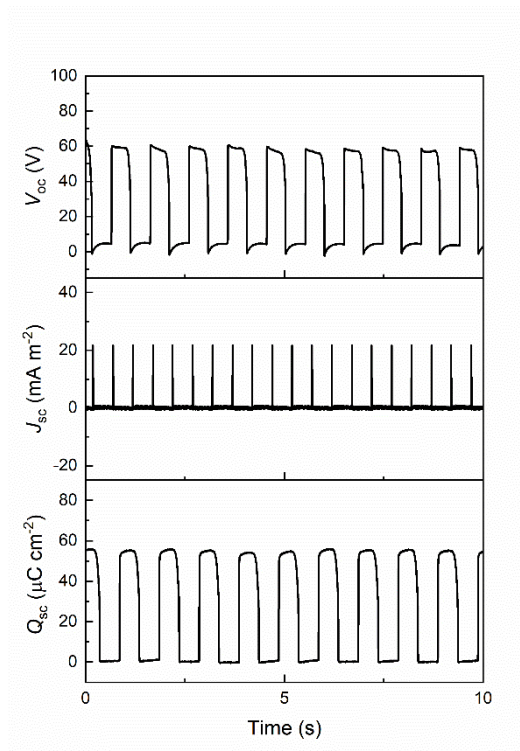


Figure SI7: Open-circuit voltage ( $V_{oc}$ ), short-circuit current density ( $J_{sc}$ ), short-circuit charge density ( $Q_{sc}$ ) of H/P-TENG constructed with pure PDMS film.

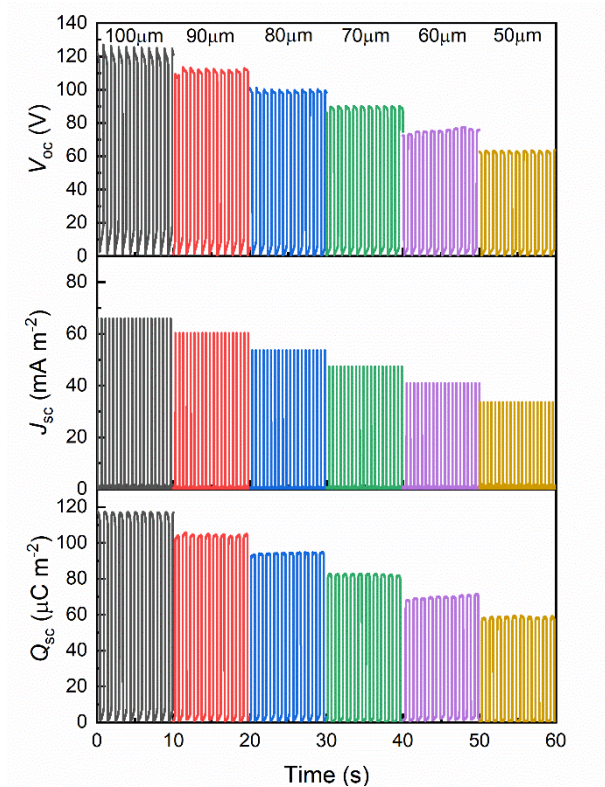


Figure S18:  $V_{oc}$ ,  $J_{sc}$  and  $Q_{sc}$  output of H/P-TENG constructed with 15 wt.% PDMS/BZT-BCT composite films of various thickness.

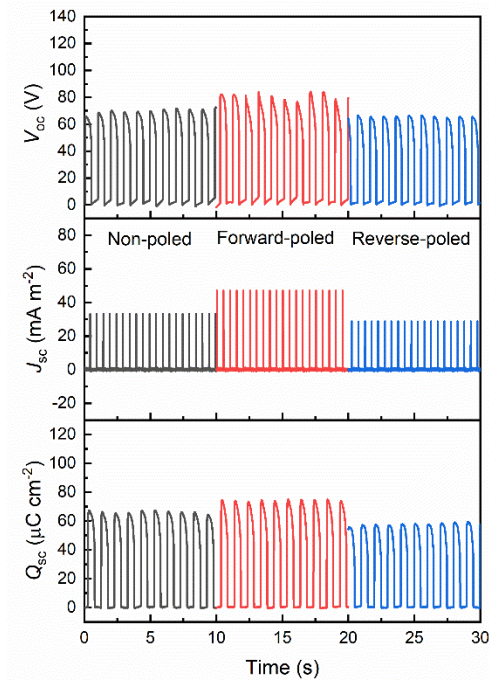


Figure SI9: Open-circuit voltage ( $V_{oc}$ ), short-circuit current density ( $J_{sc}$ ), short-circuit charge density ( $Q_{sc}$ ) of H/P-TENG constructed with 5 wt.% PDMS/BZT-BCT polymer composite film under non-poled, forward-poled, and reverse-poled conditions.

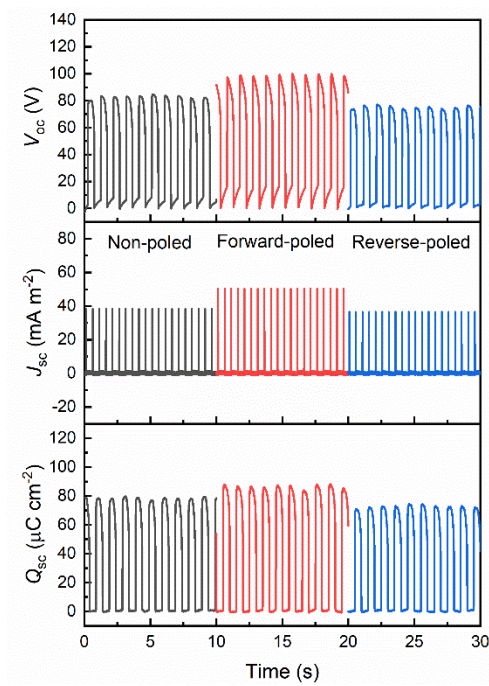


Figure SI 10: Open-circuit voltage ( $V_{oc}$ ), short-circuit current density ( $J_{sc}$ ), short-circuit charge density ( $Q_{sc}$ ) of H/P-TENG constructed with 10 wt.% PDMS/BZT-BCT polymer composite film under non-poled, forward-poled, and reverse-poled conditions.



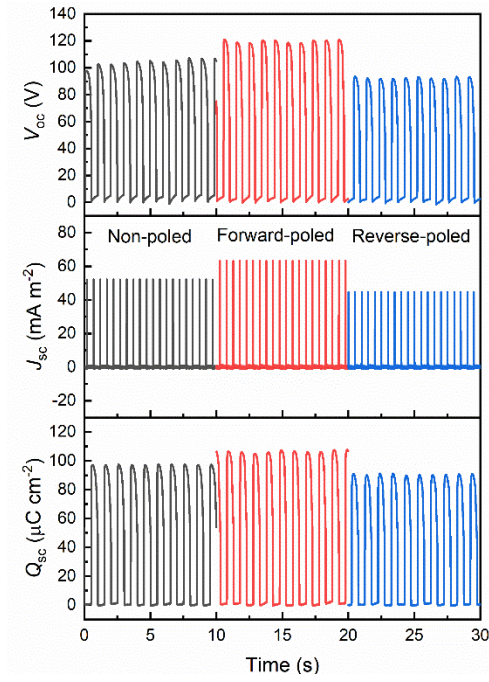


Figure SI 11: Open-circuit voltage ( $V_{oc}$ ), short-circuit current density ( $J_{sc}$ ), short-circuit charge density ( $Q_{sc}$ ) of H/P-TENG constructed with 20 wt.% PDMS/BZT-BCT polymer composite film under non-poled, forward-poled, and reverse-poled conditions.

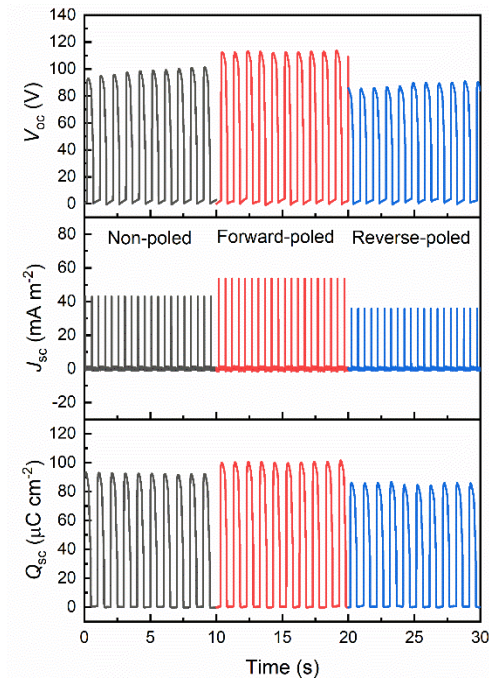


Figure SI 12: Open-circuit voltage ( $V_{oc}$ ), short-circuit current density ( $J_{sc}$ ), short-circuit charge density ( $Q_{sc}$ ) of H/P-TENG constructed with 25 wt.% PDMS/BZT-BCT polymer composite film under non-poled, forward-poled, and reverse-poled conditions.



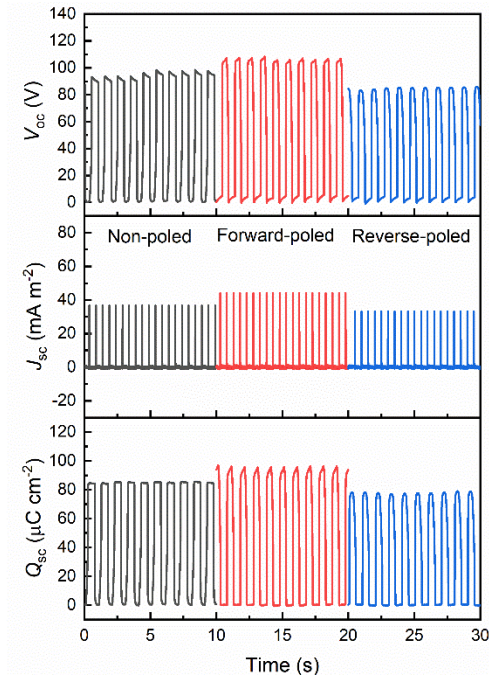


Figure SI2: Open-circuit voltage ( $V_{oc}$ ), short-circuit current density ( $J_{sc}$ ), short-circuit charge density ( $Q_{sc}$ ) of H/P-TENG constructed with 30 wt.% PDMS/BZT-BCT polymer composite film under non-poled, forward-poled, and reverse-poled conditions.

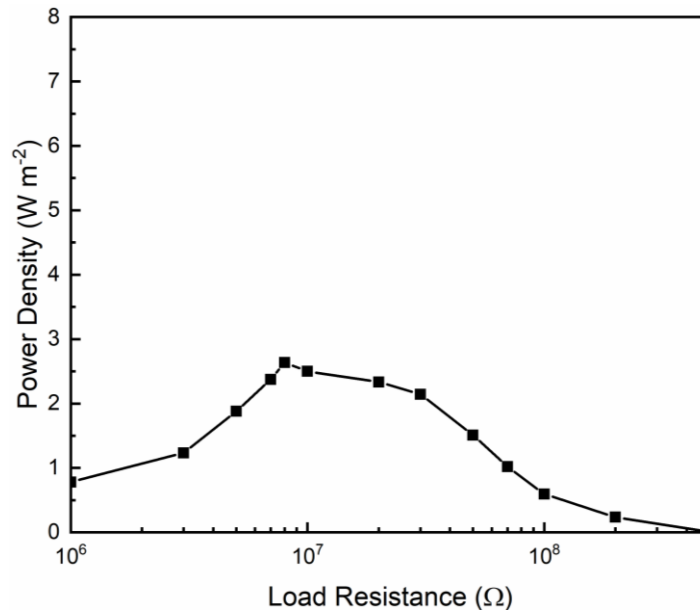


Figure SI3: Power density output of H/P-TENG constructed with pure PDMS film with increasing load resistances.

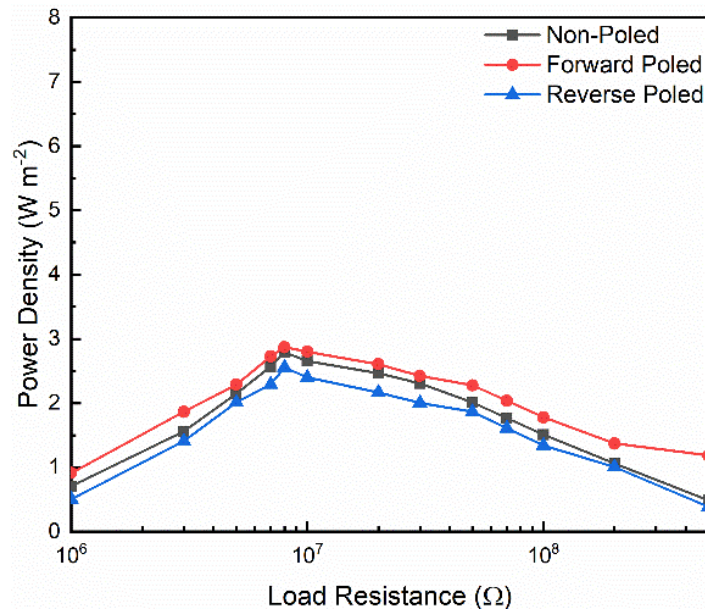


Figure SI4: Power density output of H/P-TENG constructed with 5 wt.% polymer composite film with increasing load resistances under non-poled, forward-poled, and reverse-poled conditions.

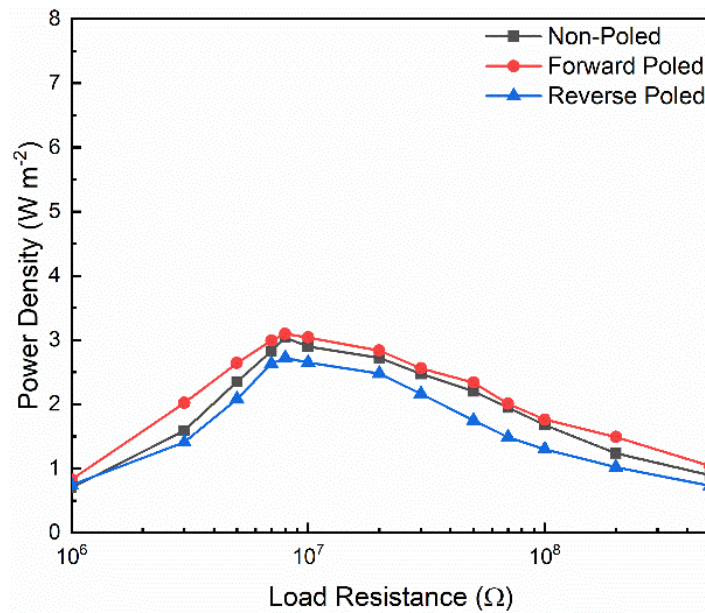


Figure SI5: Power density output of H/P-TENG constructed with 10 wt.% polymer composite film with increasing load resistances under non-poled, forward-poled, and reverse-poled conditions.

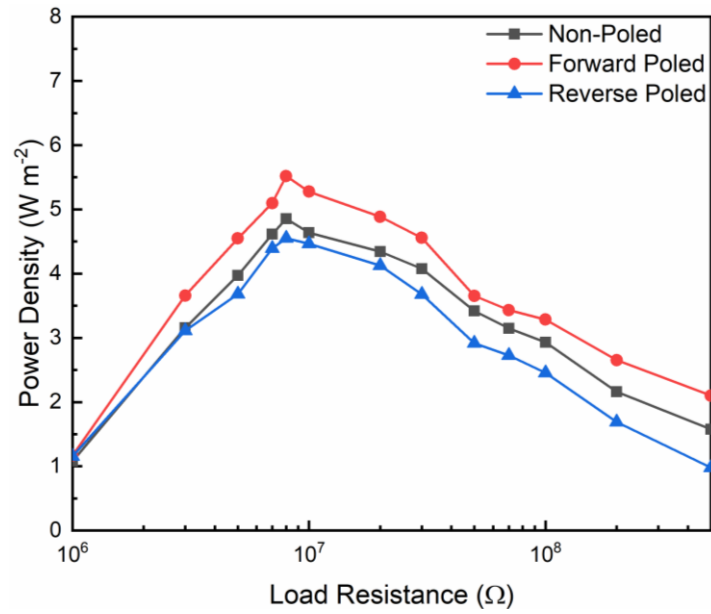


Figure SI6: Power density output of H/P-TENG constructed with 20 wt.% polymer composite film with increasing load resistances under non-poled, forward-poled, and reverse-poled conditions.

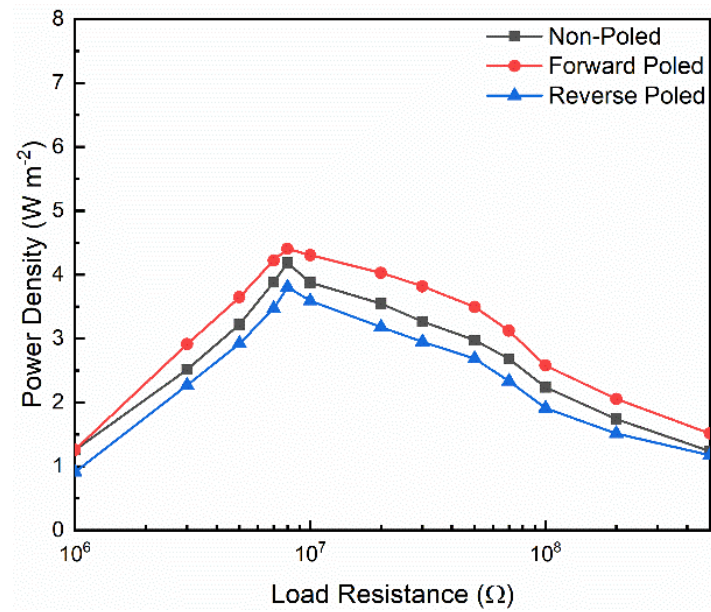


Figure SI7: Power density output of H/P-TENG constructed with 25 wt.% polymer composite film with increasing load resistances under non-poled, forward-poled, and reverse-poled conditions.

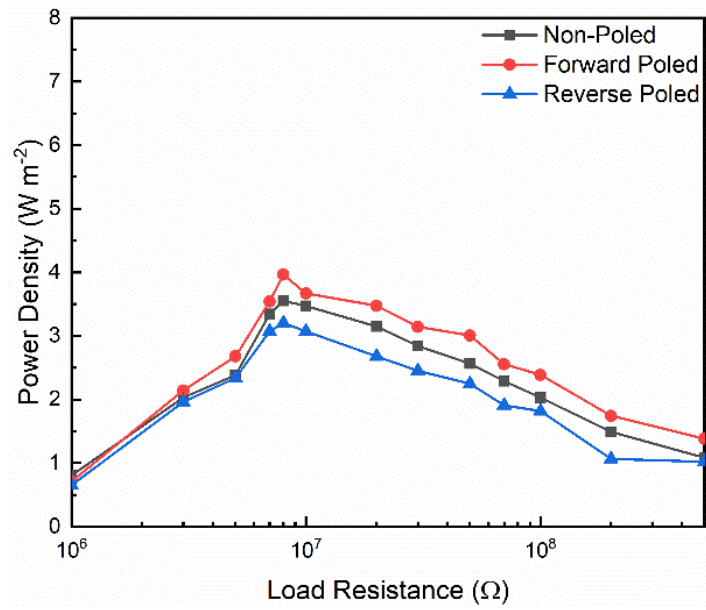


Figure SI19: Power density output of H/P-TENG constructed with 30 wt.% polymer composite film with increasing load resistances under non-poled, forward-poled, and reverse-poled conditions.