Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Supporting Information

Three-dimensional helical inorganic thermoelectric generators and photodetectors for stretchable and wearable electronic devices

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Experimental section

Preparation of different polymer substrates. PDMS was mixed with curing agent (weight ratio of 9/1) and cured in an oven box at 80 °C for 30 min. For the other polymer substrates including poly(vinyl alcohol) (PVA) and poly(ethylene terephthalate) (PET), they were dissolved in deionized water and trifluoroacetic acid, respectively. The resulting viscous polymers were filled in the pitch of the screws and dried naturally to form the substrates.

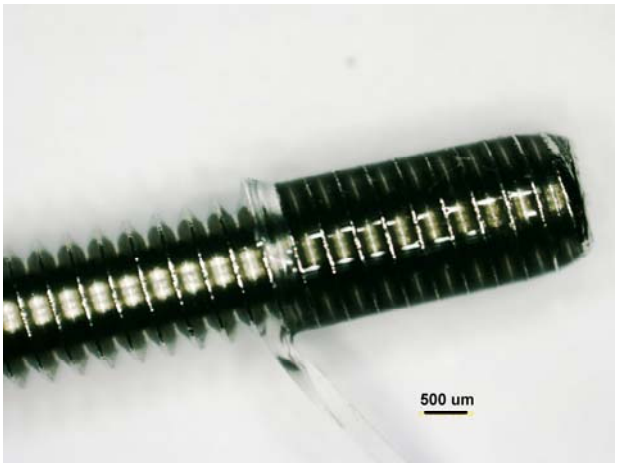

Fig. S1. Photograph of a PDMS layer peeled off the screw along the screw thread.

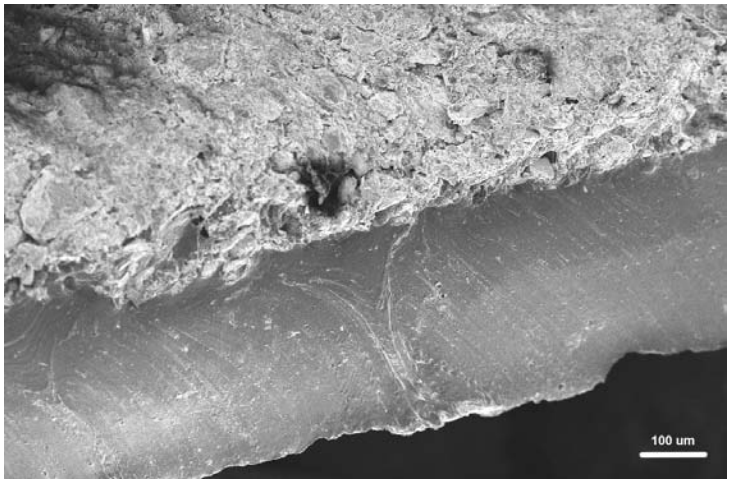

Fig. S2. Cross-sectional SEM image of n-type Bi_2Se_3 on the helical PU substrate.

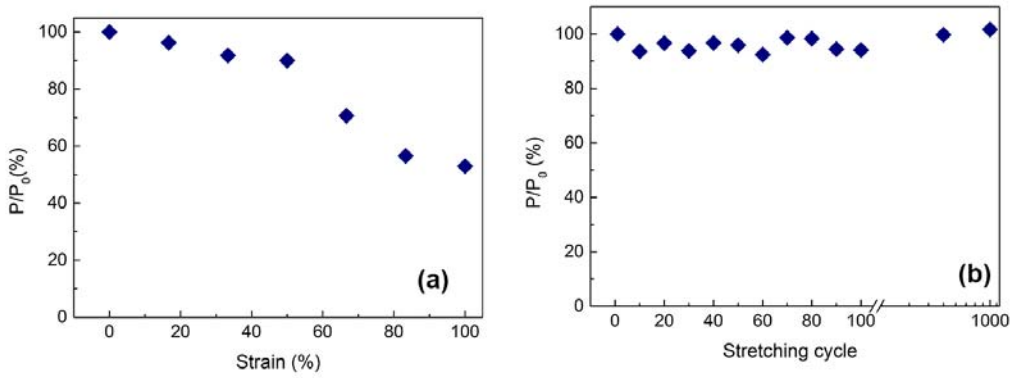

Fig. S3. Stretchability and stability test of the helical TE generator. (a) The output power of the helical TE generator at a ΔT of 15 K under stretching from 0 to 100%. (b) The output power of the helical TE generator at a ΔT of 15 K after 1000 stretching cycles (strain of ~60%). Here P_0 and P correspond to the output power before and after stretching, respectively.

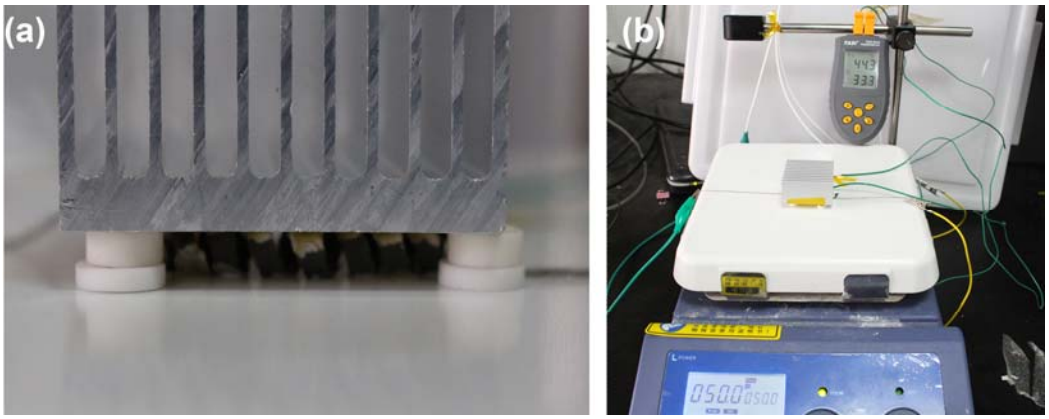

Fig. S4. Home-built TE testing system. (a) Zoomed-in photograph of a helical TE generator under measurement, with one side on the surface of a hot plate and the other attached to the aluminum heat sink. (b) Photograph of a TE generator under measurement. Two thermocouples were attached to the surface of the hot plate and heat sink to monitor the temperature difference all the time.

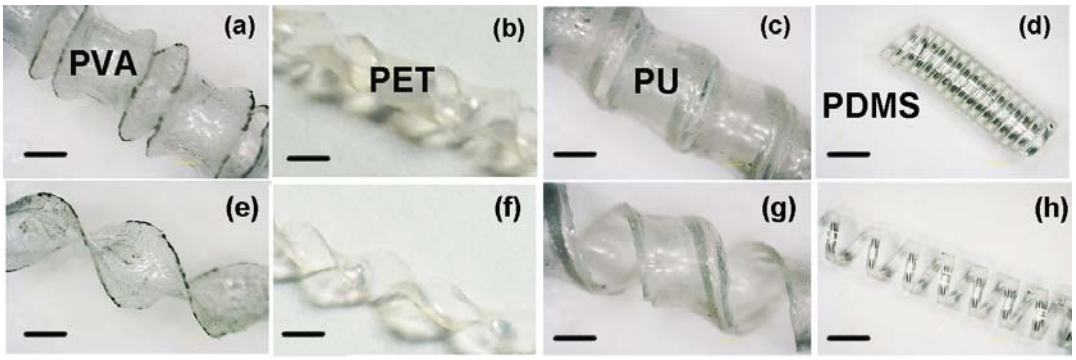

Fig. S5. Photographs of a variety of helical polymer substrates prepared *via* the template method. Photographs of (a) PVA, (b) PET, (c) PU and (d) PDMS helical substrate at rest. (e)-(h) The corresponding polymer substrate under stretching. The scale bar, 1 mm.

Fig. S6. Photograph of the helical PDMS substrate with ZnO nano-aggregates grown on it *via* a hydrothermal synthesis.

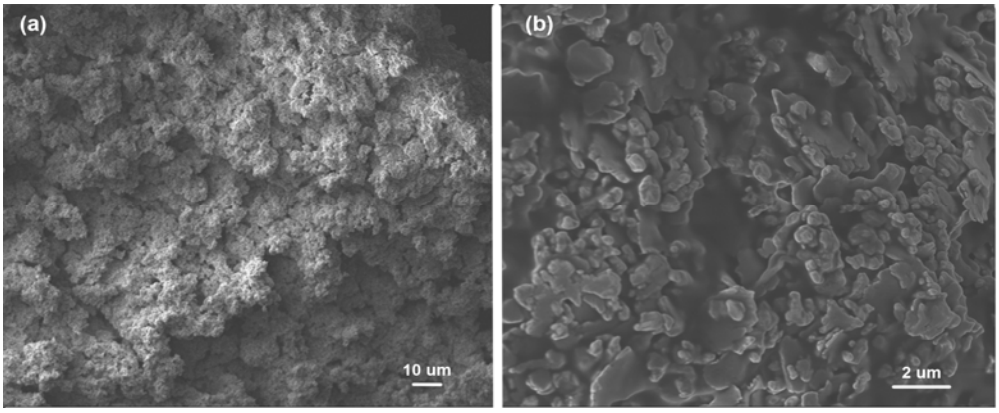

Fig. S7. (a) SEM image of ZnO nano-aggregates grown on the PDMS substrate from ZnO nanoparticles (~30 nm) *via* hydrothermal synthesis. (b) SEM image of Ag paste coated on the designated area of the PDMS substrate to connect ZnO photodetectors.

Fig. S8. SEM image of ZnO nanobranches grown on the PDMS substrate from a sputtered ZnO seed layer *via* hydrothermal synthesis.

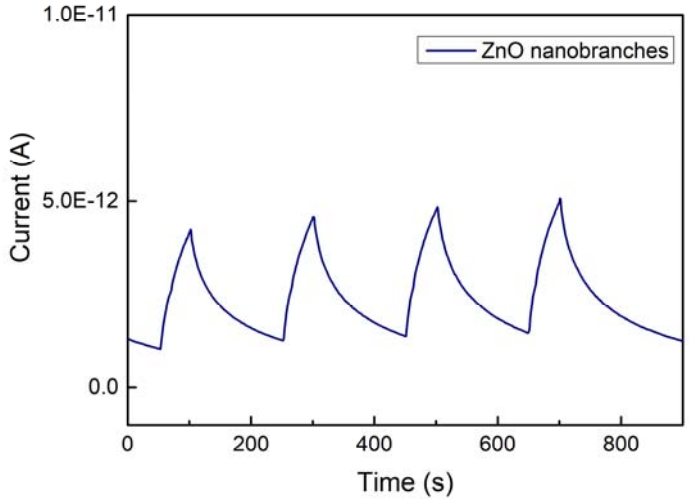

Fig. S9. The on-off *I-t* characteristics of ZnO nanobranches on PDMS under the illumination of 365 nm (1.26 mW/cm^2).

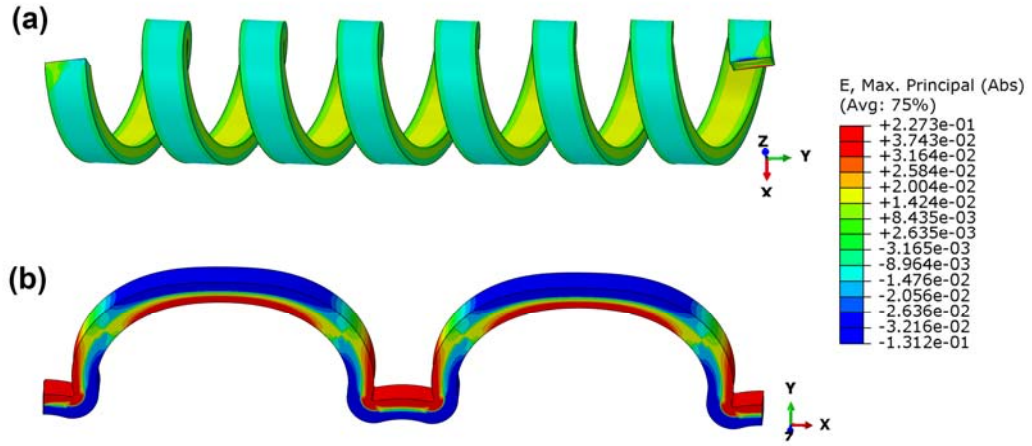

Fig. S10. Simulated strain distributions of the helical (a) and serpentine (b) structure stretched by 100%.