Supporting Information

A systematic study on synthesis parameters and thermoelectric properties of tellurium nanowire bundles

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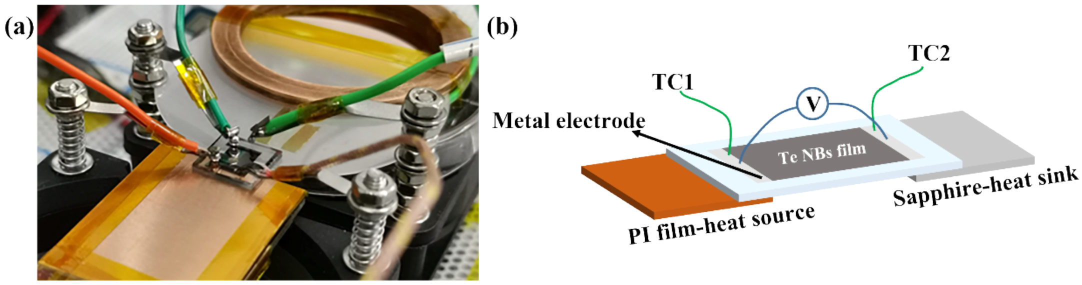


Fig. S1 (a) The home-made apparatus for Seebeck coefficient measurement, (b) Schematic diagram of Seebeck coefficient measurement.

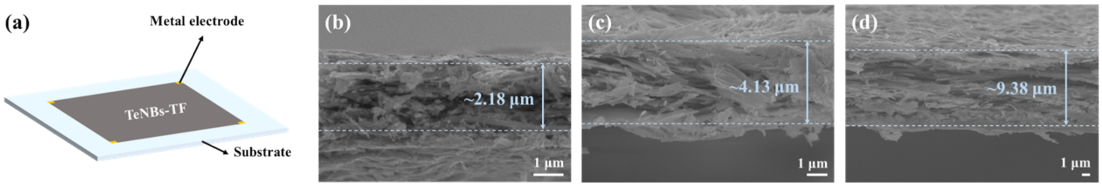


Fig. S2 (a) Sample preparation diagram of the square resistance of thin film tested by the Van Der Pauw method. The thickness of the Te-NBs-TF obtained at different reaction temperature (b) 50 °C, (c) 70 °C and (d) 90 °C.

Note 1

Te-NBs-TF was placed on glass substrates for conductivity and Seebeck coefficient measurement. The PI heating plate is the hot end and the sapphire heat sink is the cold end (Fig. S1a). Figure S1b shows the schematic of the Seebeck coefficient measurement apparatus. A set of parallel and narrow line-shaped Ag electrodes with spacing of 10 mm were onto the sample to get an accurate determination of the actual thermoelectric voltage (ΔV)[1]. Two thermocouples were placed on the sample to determine the temperature difference (ΔT). The electrical conductivity was measured based on the Van der Pauw method[2].As shown in Fig. S2a, copper electrodes were located on the four corners of the thin film. Four probes are pressed on the electrodes. *I-V* sweep was performed using a Keithley 2450 as constant current source and voltage meter. The film thickness was tested by SEM. The thickness of Te-NBs-TF is shown in Fig. S2b-d.

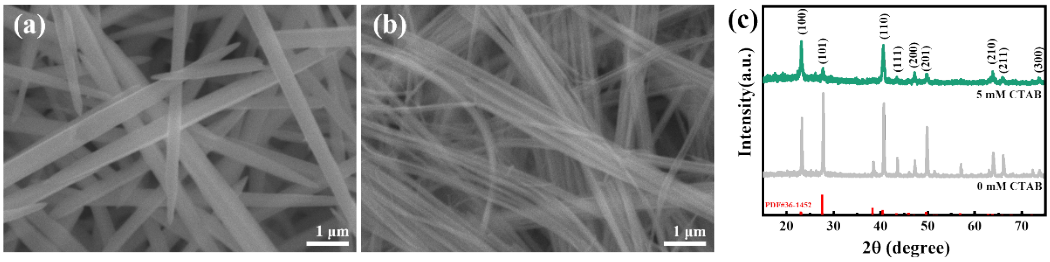
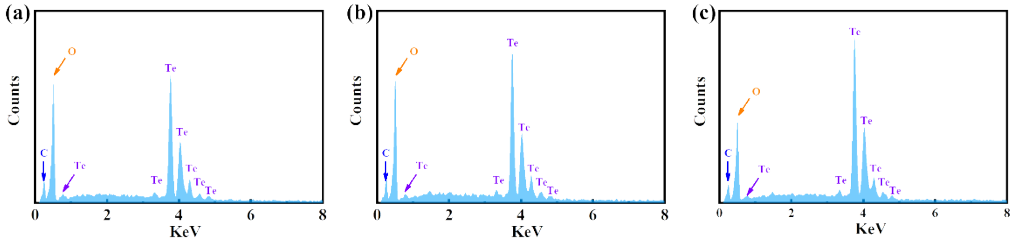


Fig. S3 SEM of Te nanostructures with (a) 0 mM and (b) 5 mM CTAB and c. corresponding XRD patterns.



Element	Atom(%)	Conc(wt.%)
Te	50.012	89.242
O	42.348	9.475
C	7.640	1.283

Element	Atom(%)	Conc(wt.%)
Te	53.554	90.606
O	37.759	8.010
C	8.687	1.383

Element	Atom(%)	Conc(wt.%)
Te	64.979	93.899
O	29.601	5.363
C	5.420	0.737

Fig. S4 EDS diagram and element ratio of Te-NBs at different reaction temperature (a) 50 °C, (b) 70°C and (c) 90 °C.

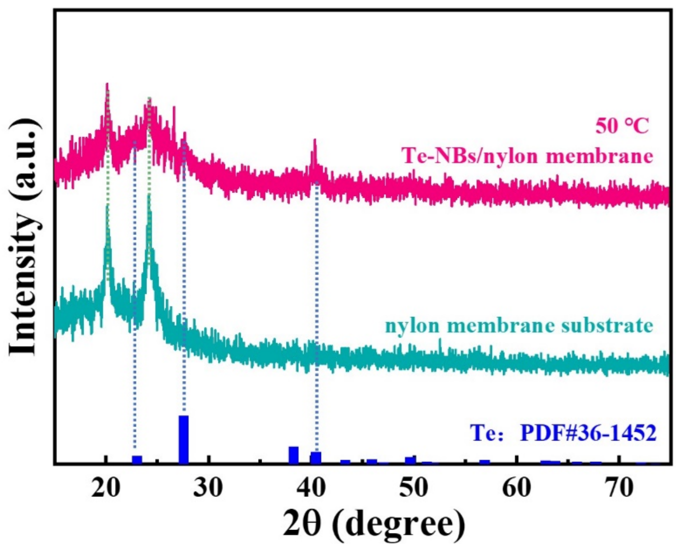


Fig. S5 The comparison XRD patterns of Te-NBs/nylon membrane and nylon membrane substrate.

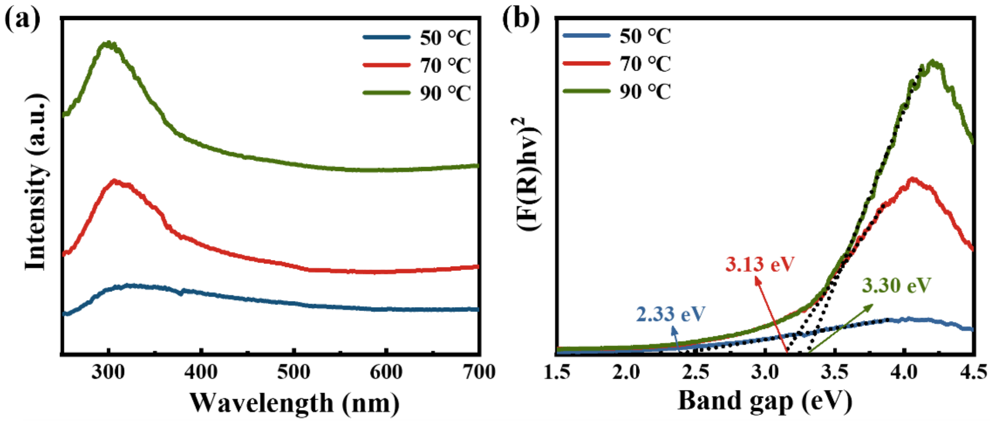


Fig. S6 (a) UV-Vis DRS spectra and (b) the corresponding bandgap energies of the Te-NBs at different reaction temperature.

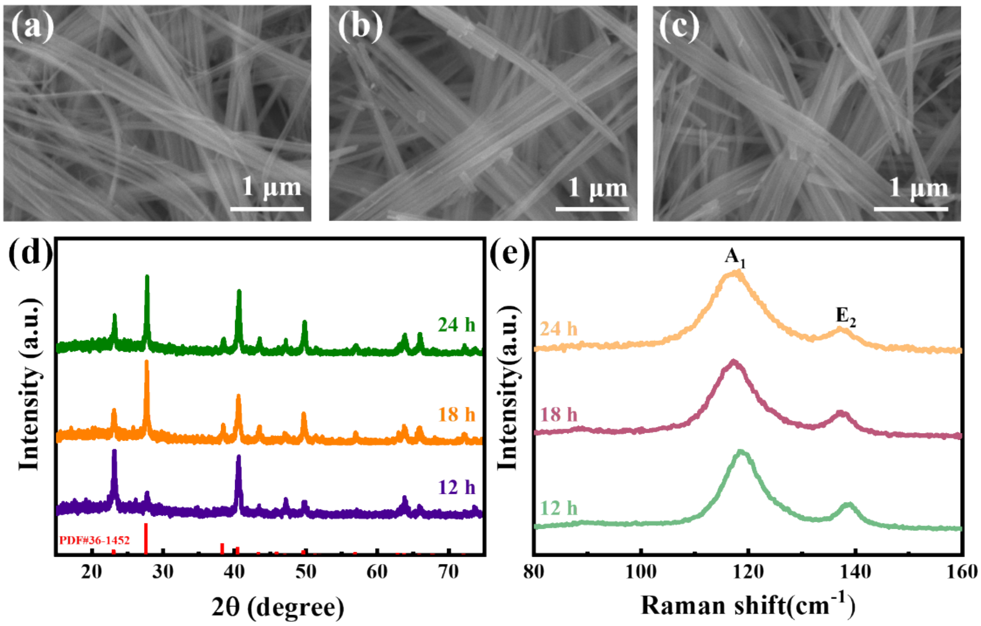


Fig. S7 SEM images of Te-NBs grown for (a) 12 h, (b) 18 h, (c) 24 h. The corresponding (d) XRD patterns and (e) Raman spectra.

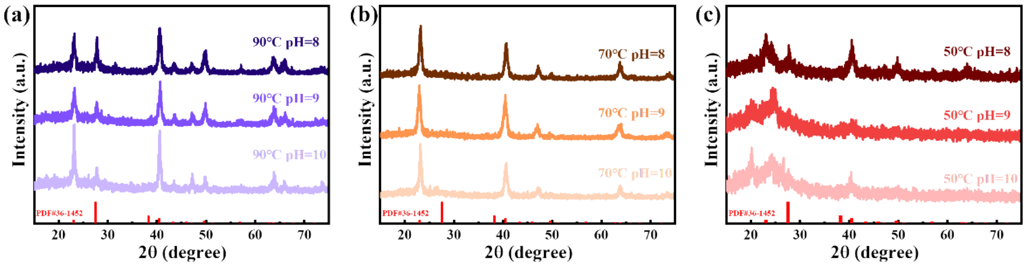


Fig. S8 XRD patterns of Te-NBs-TF with different Te nanostructures obtained at different reaction temperature and initial solution pH value (a) 90 °C, (b) 70 °C and (c) 50 °C.

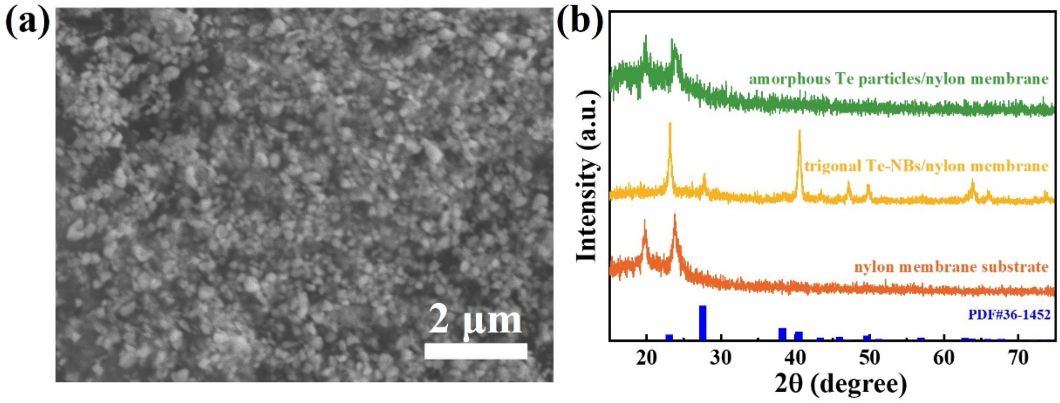


Fig. S9 (a) SEM image of amorphous Te. (b) the comparison XRD patterns of trigonal Te-NBs/nylon membrane, amorphous Te/nylon membrane and nylon membrane substrate.

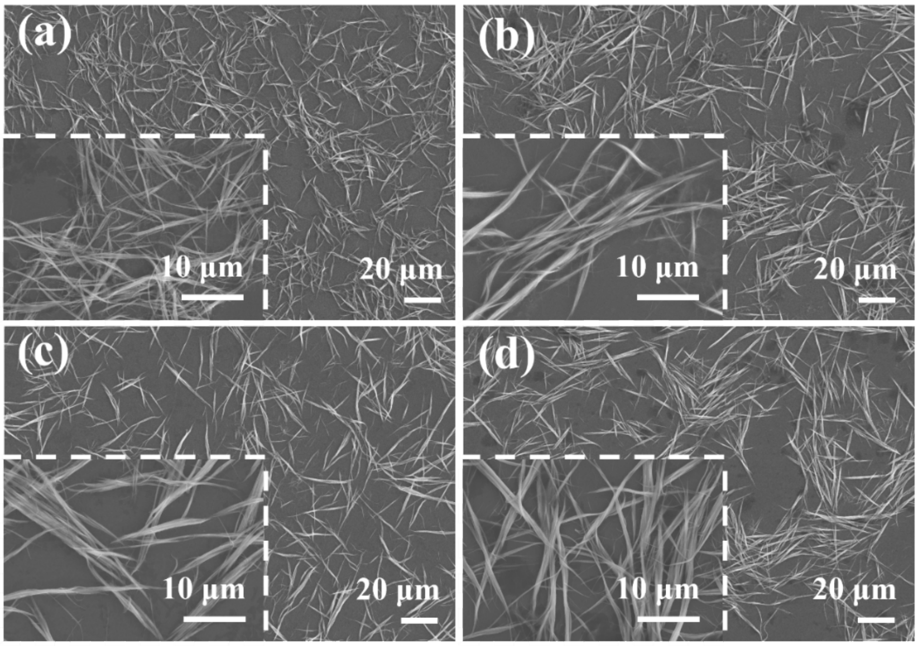


Fig. S10 The corresponding low-magnification SEM images of (a) Fig. 5g, (b) Fig. 5h, (c) Fig. 5i, (d) Fig. 5j.

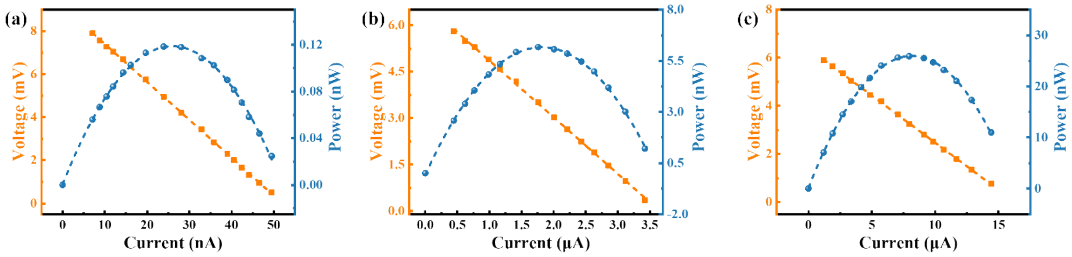


Fig. S11 The output voltage and output power versus current of the Te-NBs-TF obtained at different reaction temperature (a) 50 °C, (b) 70 °C and (c) 90 °C at ΔT=15 K and room temperature.

Table S1. The output power of different Te-NBs-TF.

Sample / **ΔT**	**50 °C**	**70 °C**	**90 °C**
5 K	/	/	3.04 nW
10 K	/	/	11.94 nW
15 K	0.12 nW	6.16 nW	25.94 nW
20 K	/	/	44.62 nW

References

[1] S.v. Reenen, M. Kemerink, Correcting for contact geometry in Seebeck coefficient measurements of thin film devices, Organic Electronics, 15 (2014) 2250-2255.

[2] K. Zhang, S. Wang, J. Qiu, J.L. Blackburn, X. Zhang, A.J. Ferguson, E.M. Miller, B.L. Weeks, Effect of host-mobility dependent carrier scattering on thermoelectric power factors of polymer composites, Nano Energy, 19 (2016) 128-137.