Electronic Supplementary Material (ESI) for Materials Advances.

Supporting Information

Green synthesis of air-stable tellurium nanowires via biomolecule-assisted hydrothermal for thermoelectrics

Youfa Liu,[1] Qinglin Jiang,[2,*] Jiang Zhang,[2] Wenjun Ding,[1] Jingkun Xu,[1,3,*] Peipei Liu,[1] Guangming Nie,[3] Haolai Mao,[1] Fengxing Jiang[1,*]

[1] Flexible Electronics Innovation Institute, Jiangxi Science and Technology Normal University, Nanchang 330013, P. R. China.

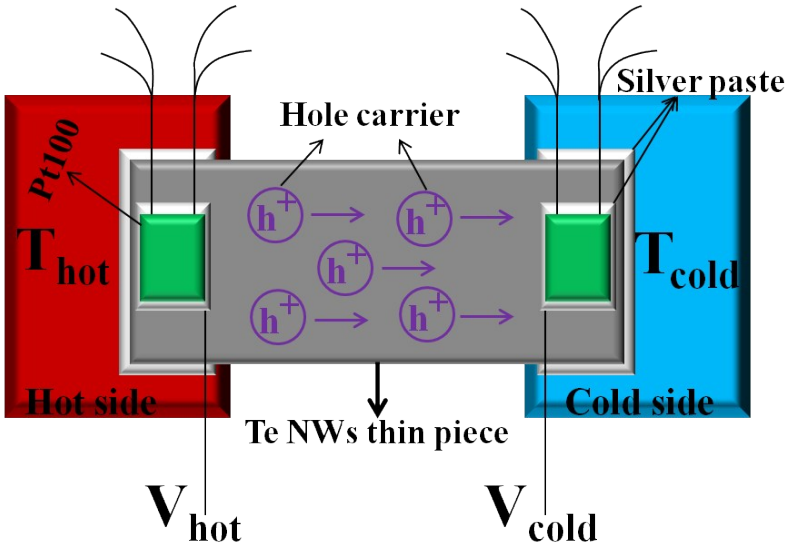
[2] Institute of Polymer Optoelectronic Materials and Devices, State Key Laboratory of Luminescent Materials and Devices, South China University of Technology, Guangzhou 510640, P. R. China.

[3] School of Chemistry and Molecular Engineering, Qingdao University of Science and Technology, Qingdao 266042, Shandong, P.R. China.

* Correspondence: jiangql@scut.edu.cn (Q. Jiang); xujingkun1971@yeah.net (J. Xu); f.x.jiang@live.cn (F. Jiang)

Fabrication of Te NWs thin piece with $N_2H_4 \cdot H_2O$ synthesized Te NWs

The fabrication of Te NWs thin piece with $N_2H_4 \cdot H_2O$ synthesized Te NWs was as following: 200 mL of acetone was added into the cool reaction solution to aggregated Te NWs in the solution, and them gathered the Te NWs by vacuum filtrating. Redispersing the Te NWs into 40 mL of DI to obtain a homogeneous dispersion. Dividing the dispersion into two evenly. Then, each one was fabricated into a thin piece (diameter ~ 2.0 cm) with PVDF microporous membrane filter (0.22 μm) as substrate by vacuum filtrating, and then cleaned with DI and EtOH for several times. The cleaned thin piece was dried in vacuum oven at 60 ^oC for 12 h, and then a free-standing Te NWs thin piece was fabricated by pealing it from substrate. Finally, pressing this thin piece under 15 MPa for 15 min.



Scheme S1 The schematic measurement of Seebeck coefficient for Te NW film.

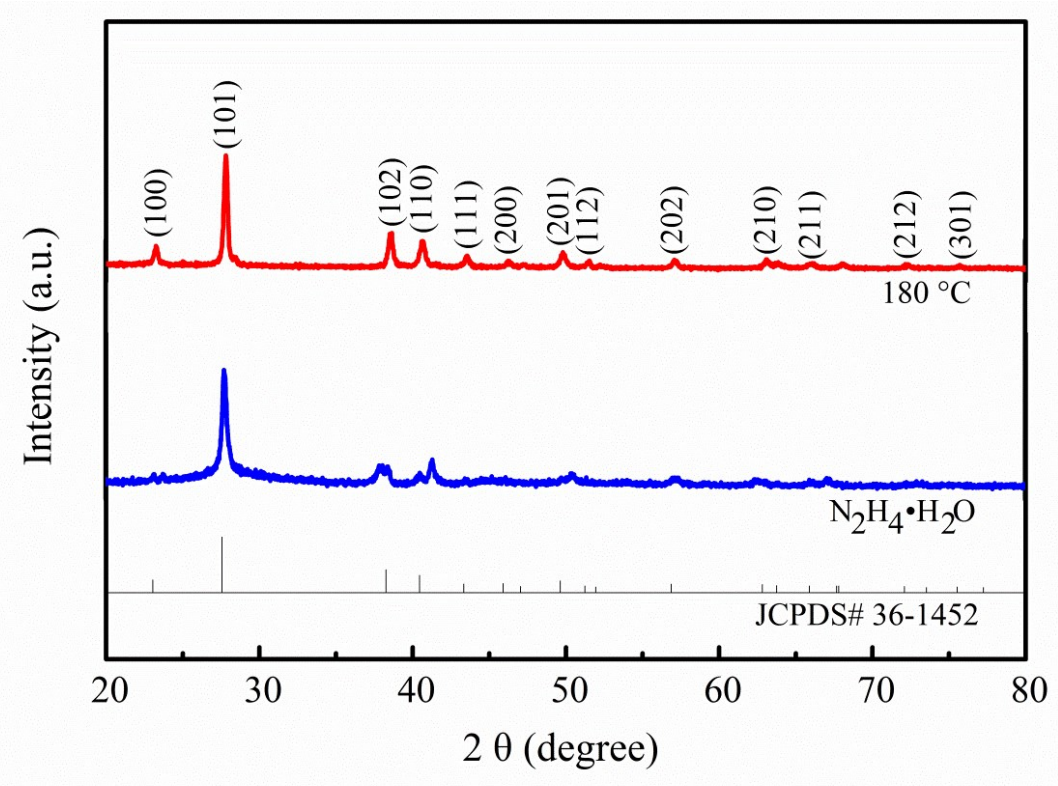


Fig. S1 XRD pattern of the as-synthesized Te NWs with glucose at 180 °C for 12 h and the N_2H_4•H_2O synthesized one.

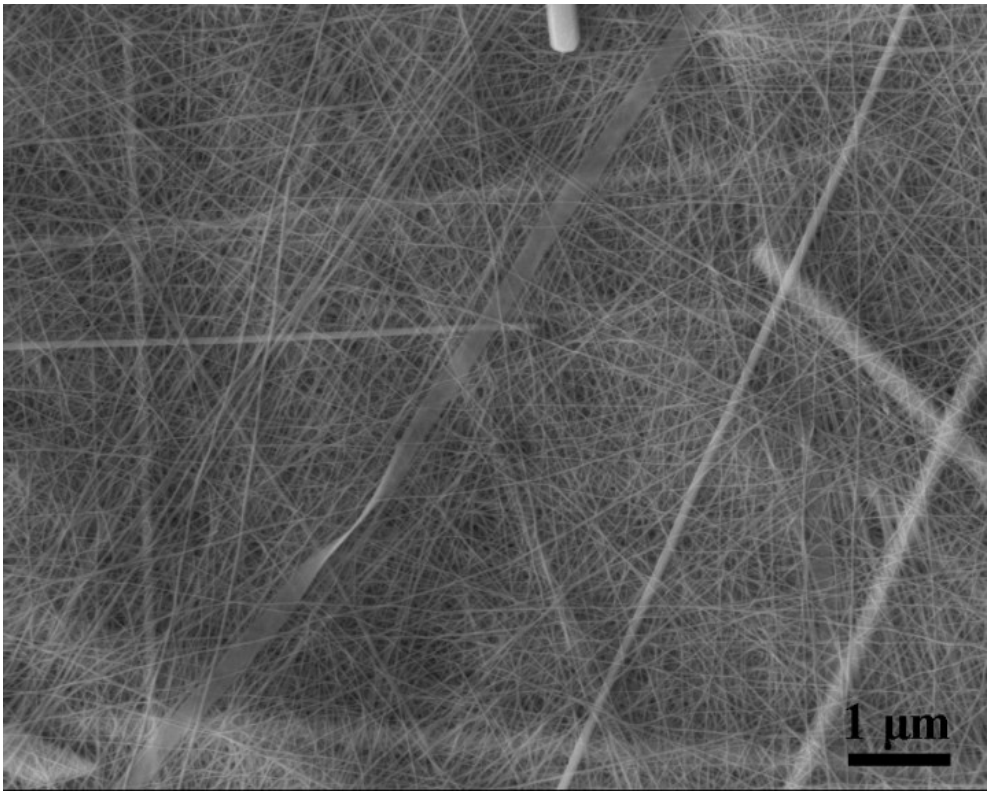


Fig. S2 SEM image of the as-synthesized Te NWs with $N_2H_4 \cdot H_2O$ as reductant.

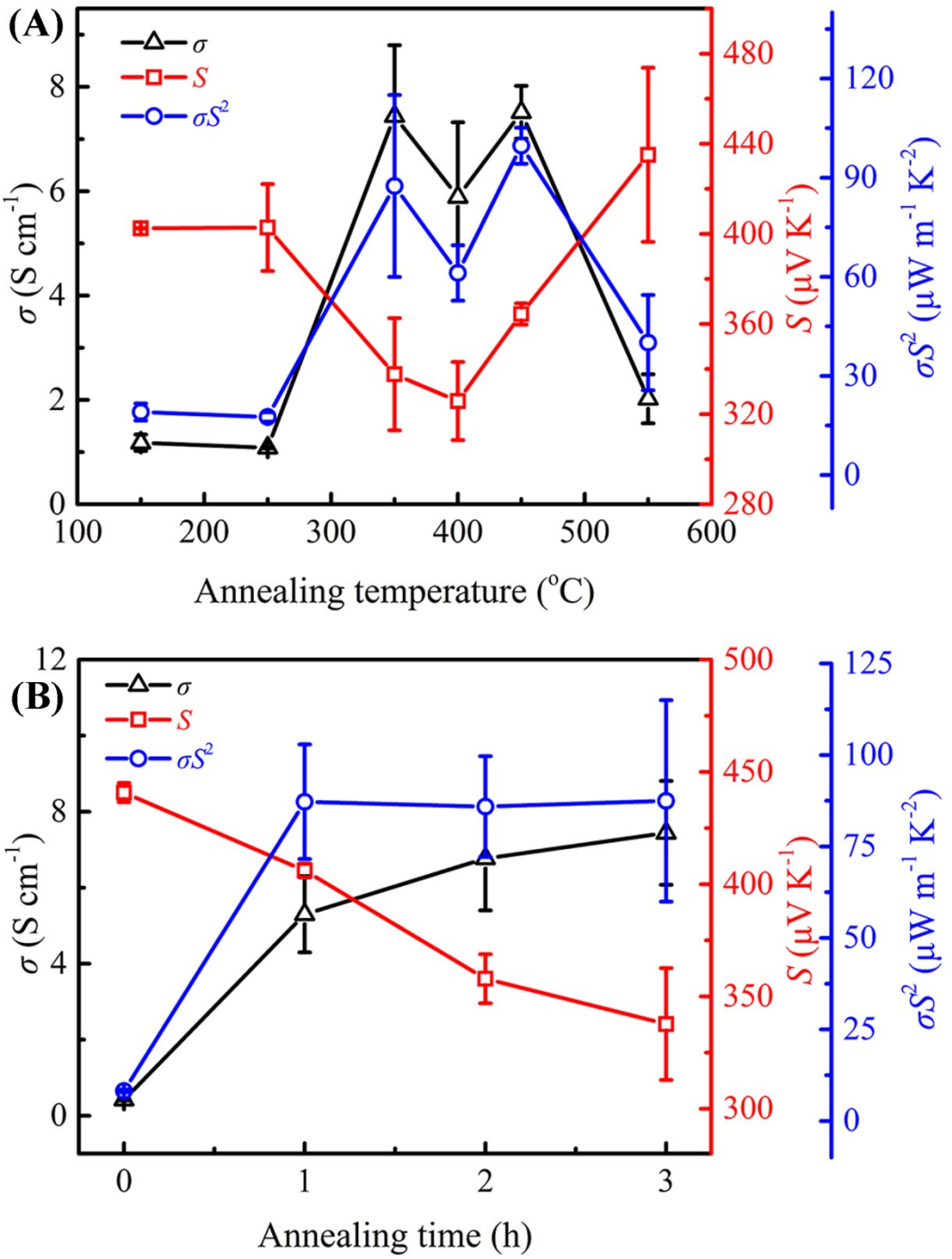


Fig. S3 The TE performance of the as-fabricated Te NWs thin piece versus different annealing temperature for 3 h (A) and different annealing time at 350 °C (B), where the Te NWs were synthesized with $N_2H_4 \cdot H_2O$.

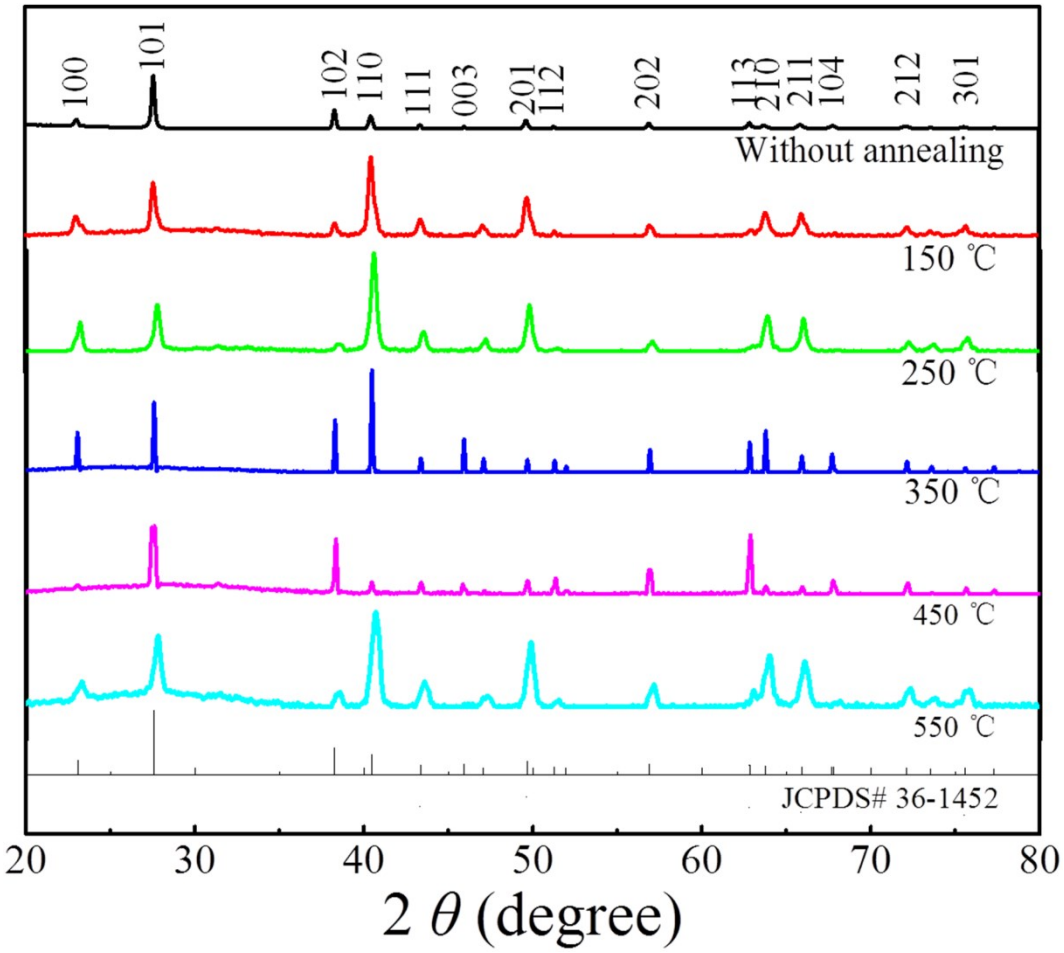


Fig. S4 XRD patterns of optimized Te NWs thin pieces with or without annealing at different temperature for 3 h.

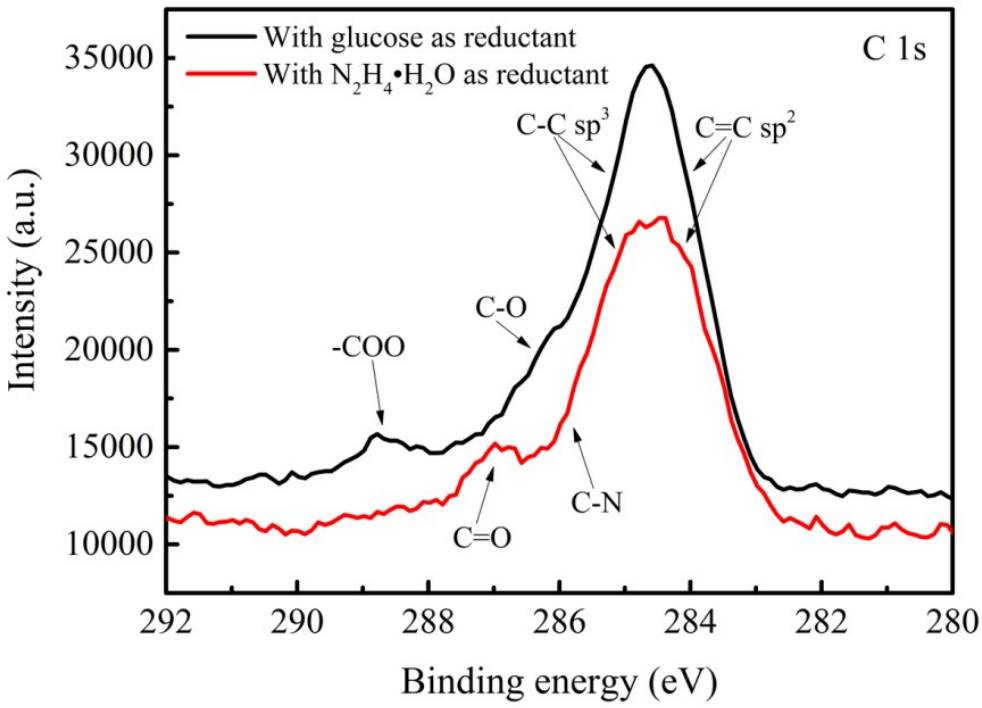


Fig. S5 C1s XPS spectra of the glucose (black line) and N_2H_4•H_2O (red line) synthesized fresh Te NWs, the glucose synthesized one was synthesized at 120 ^oC for 12 h.

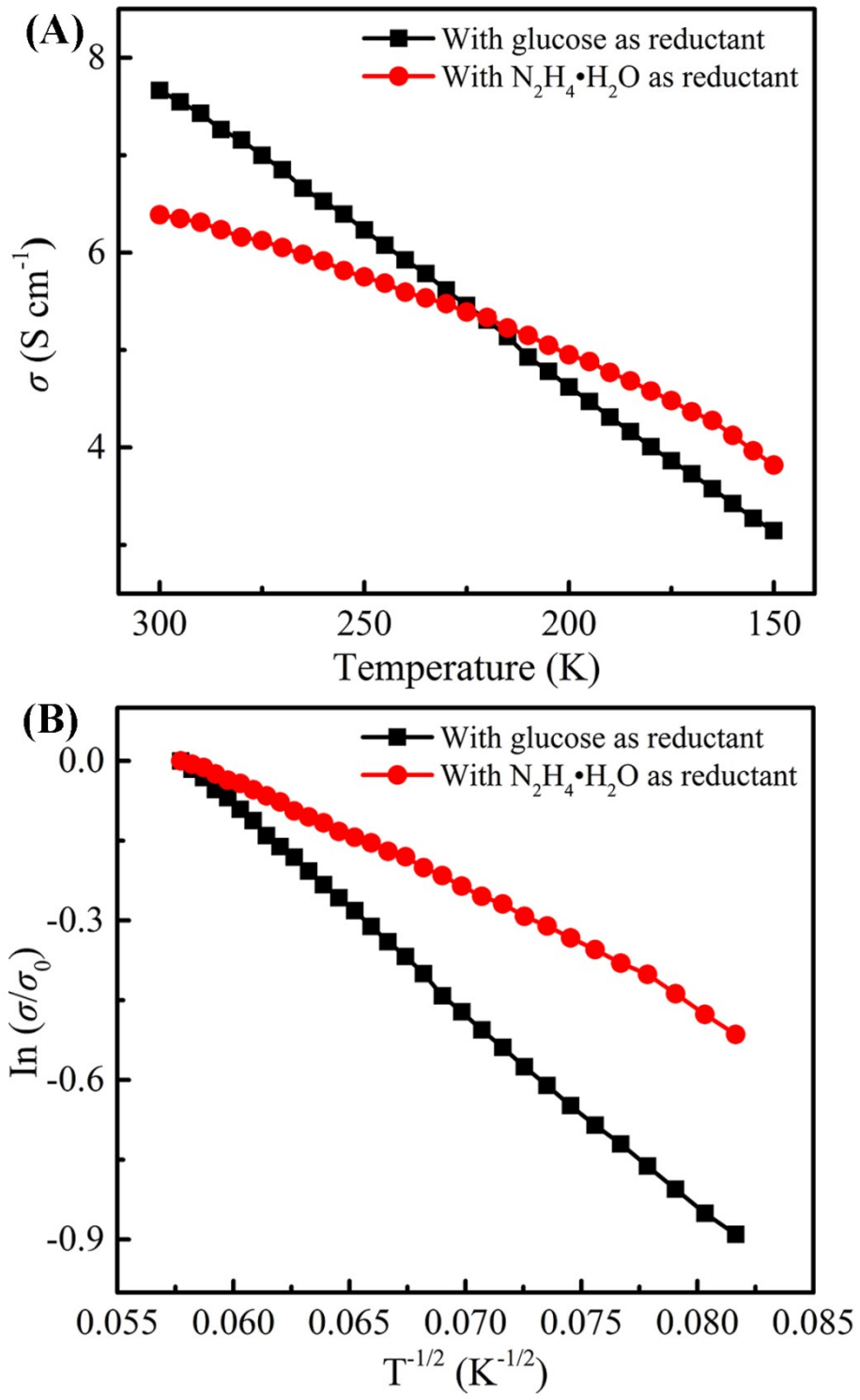


Fig. S6 Dependence of electrical conductivity on temperature (A) and analysis of the temperature-dependent of the electrical conductivity with the 1D VRH model (B) of the as-fabricated Te NWs thin piece after annealing at 350 °C for 3 h, where the Te NWs were synthesized with glucose (black line) at 120 °C for 12 h and N_2H_4•H_2O (red line) as reductant, respectively.

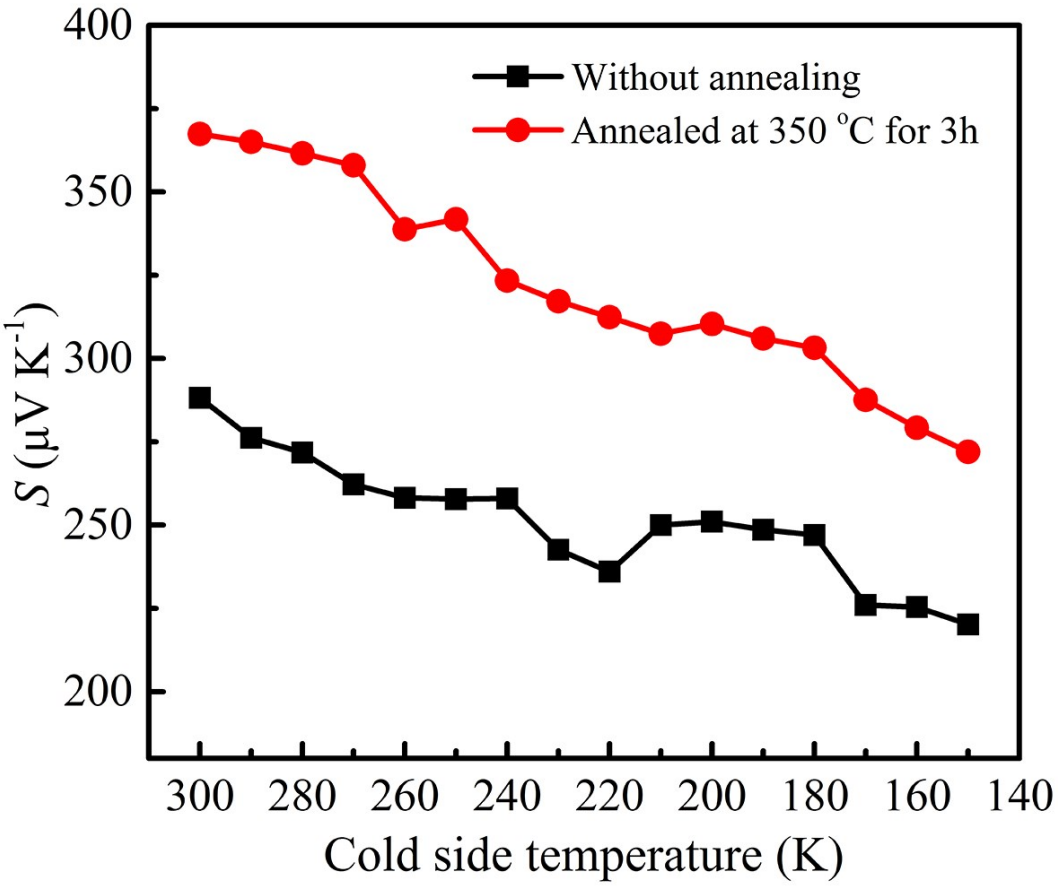


Fig. S7 Temperature-dependent Seebeck coefficient of the optimized Te NWs thin pieces with or without annealing at 350 °C for 3 h.

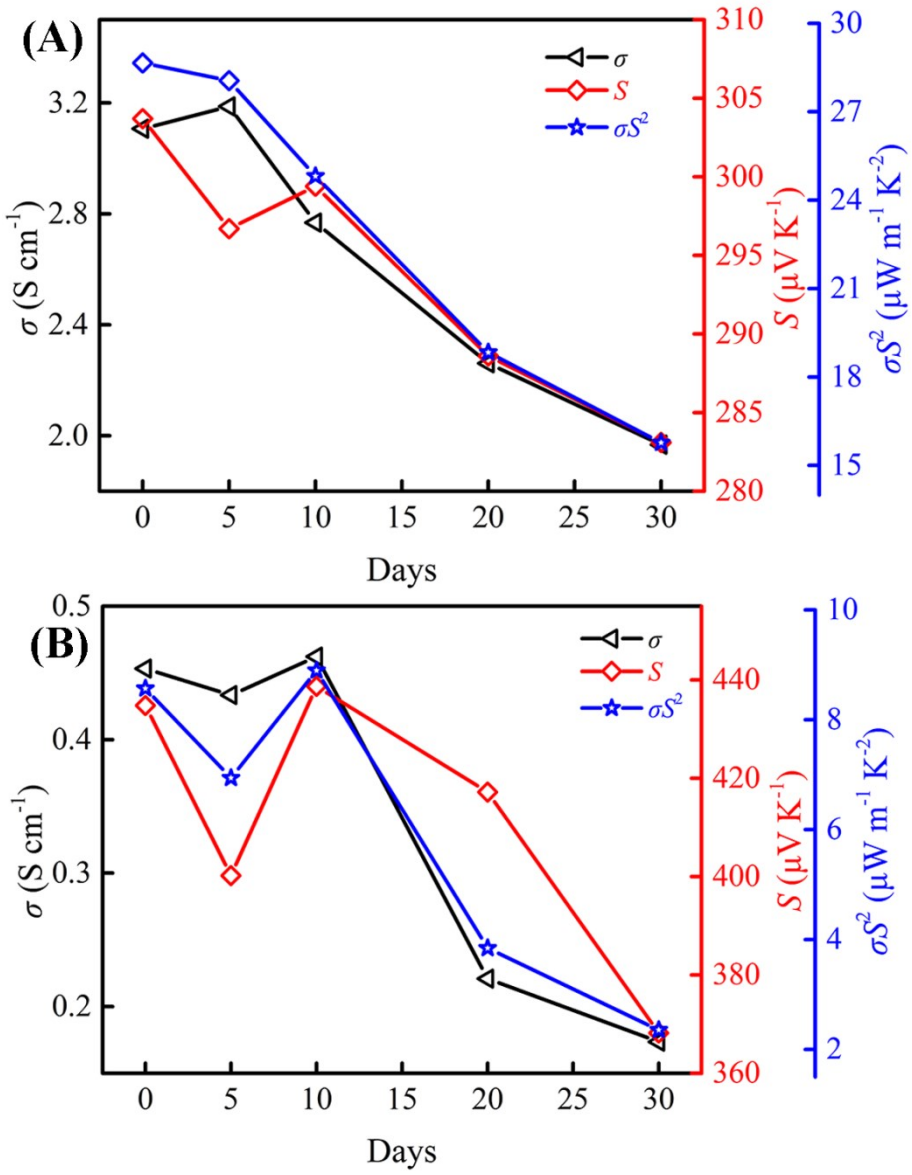


Fig. S8 Dependence of electrical conductivity, Seebeck coefficient, and power factor of the as-fabricated Te NWs thin piece on time (days), where the Te NWs were synthesized with glucose (A) at 120 °C for 12 h and N_2H_4•H_2O (B).

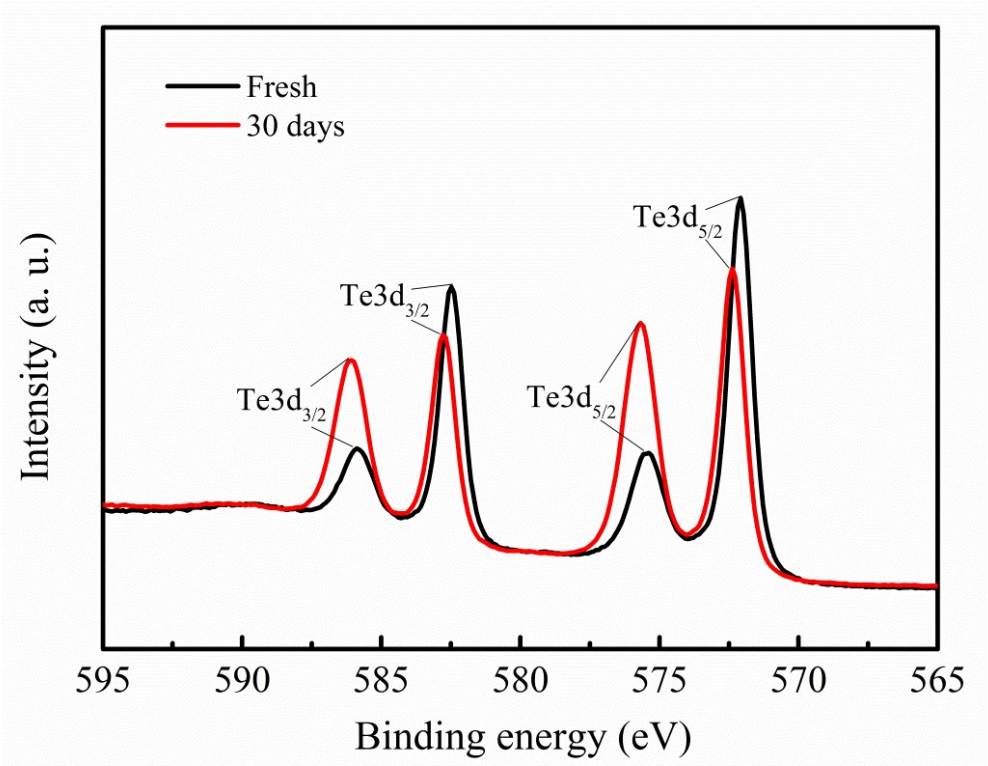


Fig. S9 Te3d XPS spectra of the fresh (red line) and keeping at ambience condition for 30 days (black line) of the N_2H_4•H_2O synthesized Te NWs.

Table S1. The content of C, atom ratio of C/O and crystallinity of optimized Te NWs thin pieces with or without annealing at different temperature for 3 h.

Items	Without annealing	Annealing temperature				
		150 °C	250 °C	350 °C	450 °C	550 °C
Content of C (wt%)	5.15	2.48	2.41	2.26	8.08	11.89
Atom ratio of C/O	2.01	1.55	1.98	2.01	4.84	8.30
Crystallinity (%)	95.1	92.0	93.4	94.2	88.7	83.4