Supplementary Information

Wholly Degradable Quasi-Solid-State Thermocells for Low-Grade Heat Harvest and Precise Thermal Sensing

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Fig. S1. Illustration of the preparing processes. (a) The preparation of the composite film electrodes. (b) The prepareation of the gelatin hydrogel electrolyte.



Fig. S2. XPS spectra for the PT 1-1 film. (a) Full survey. (b) The C 1s spectrum exhibits peaks at binding energies of 284.7 eV and 285.8 eV, attributed to the C–C and C–O bonds within PEDOT:PSS, respectively. (c) The O 1s spectrum shows peaks at binding energies of 531.6 eV and 532.9 eV, with the former attributed to the C–O bond on the thiophene ring of PEDOT and the latter to the S–OH bond on the sulfonic acid group of PSS. (d) The Ti 2p spectrum reveals a series of characteristic peaks in the binding energy range of 455–465 eV. The peaks at 459.3 eV and 464.8 eV are attributed to Ti–O bonds formed via surface oxidation of Ti₃C₂T_x; the peaks at 455 eV and 461.1 eV correspond to Ti–C bonds inherent to Ti₃C₂T_x; the peaks at 456.2 eV and 462.3 eV are assigned to characteristic peaks of Ti(II) $2p_{3/2}$ and Ti(II) $2p_{1/2}$, respectively.



Fig. S3. FITR spectra for the pure gelatin hydrogel and the gelatin-based hydrogel electrolyte.



Fig. S4. SEM images of the gelatin-based hydrogel electrolyte at various magnifications.



Fig. S5. Electrochemical impedance spectrum for the gelatin-based hydrogel electrolyte.



Fig. S6. Electrical conductivity of various film electrodes.



Fig. S7. Electrochemical impedance spectrum of the TEC using PT 1-1 electrodes.



Fig. S8. The (a) output voltage-load resistance and (b) output current-load resistance curves for the TECs using PT 1-5 electrodes under various ΔT s.



Fig. S9. The (a) output voltage-load resistance and (b) output current-load resistance curves for the TECs using PT 1-2 electrodes under various ΔT s.



Fig. S10. The (a) output voltage-load resistance and (b) output current-load resistance curves for the TECs using PT 1-1 electrodes under various ΔT s.



Fig. S11. Photos showing the degradation process of the whole TEC.



Fig. S12. Degradation time of TEC devices as a function of H_2O_2 concentration.



Fig. S13. Degradation time of TEC devices as a function of temperature.



Fig. S14. The set up of utilizing the TEC array to power an LED.



Fig. S15. The voltage responses of each TEC unit to the applied ΔT s of 3 K, 6 K, and 9 K.