Supplementary Information

A Facile One-Pot Synthesis of Advanced Te@Hydrothermal Carbon Nanocables with Broad-Spectrum Solar Absorption and High Light-to-Heat Conversion Performance

S1) Instruments and Characterization Methods

A detailed understanding of the phase compositions, morphological features, and optical properties of the materials were characterized through a series of analytical techniques, contributing to a thorough assessment of their potential applications. The surface morphology, particle size, and elemental composition of the products were investigated using scanning electron microscopy (SEM) with an energy–dispersive X–ray spectroscopy (EDS) analyzer, utilizing a Thermo Fisher Scientific electron microscope (model Prisma E) and the JEOL (JEM-2100F) high resolution transmission electron microscope (HRTEM). X–ray diffraction (XRD) analysis was conducted using a Bruker D8 ADVANCE diffractometer, employing a Cu–Kα radiation source with a wavelength of 1.54060 Å to obtain detailed information about the crystalline structure and phase composition of the materials. Additionally, the ultraviolet–visible–near–infrared (UV–Vis–NIR) reflectance and transmittance properties of the materials were measured using a Perkin Elmer (LAMBDA 750) spectrophotometer across a wide range of wavelengths (250–2500 nm). The surface chemical composition of the samples was further analyzed using X-ray photoelectron spectroscopy (XPS) data by the Ulvac-PHI (PHI GENESIS) spectroscope equipped with an Al anode X-ray target.

S2) Evaporation flux and efficiency calculations

The amount of water lost during the experiments were precisely measured by positioning the setup on an electronic balance. Changes in water mass during specific time intervals (Δm_t) were carefully documented. The resultant mass changes per unit area of the sponge ($\Delta m_t/A$) were plotted against the evaporation time. From the slope of the time-dependent mass-change curves, the corresponding evaporation flux ($\bar{m}$) was determined. The evaporation efficiency (Ƞ) was calculated according to the equation:

$$\eta = \bar{m} h_{Lv}/I$$

where I represents the power density of the incident light, and h_{Lv} is the total enthalpy of the liquid-vapor phase transition, including sensible heat and the phase change enthalpy. The total enthalpy was calculated by:

$$h_{Lv} = \lambda + C\Delta T$$

where λ is the latent heat of the phase transition, C is the specific heat capacity of water, and ΔT is the temperature rise of the water.

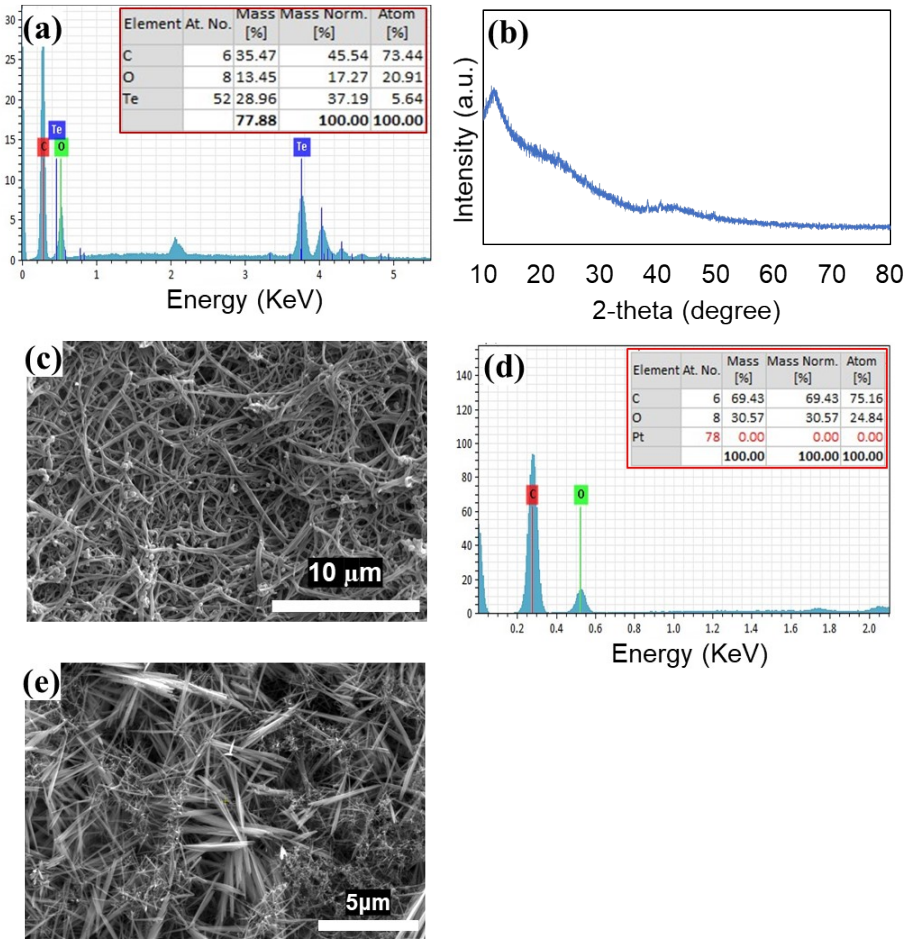

Fig. S1 (a) EDS spectra of NCs, (b) XRD pattern of NFs, (c) SEM image of NFs, (d) EDS spectra of NFs, (e) SEM image of NWs.

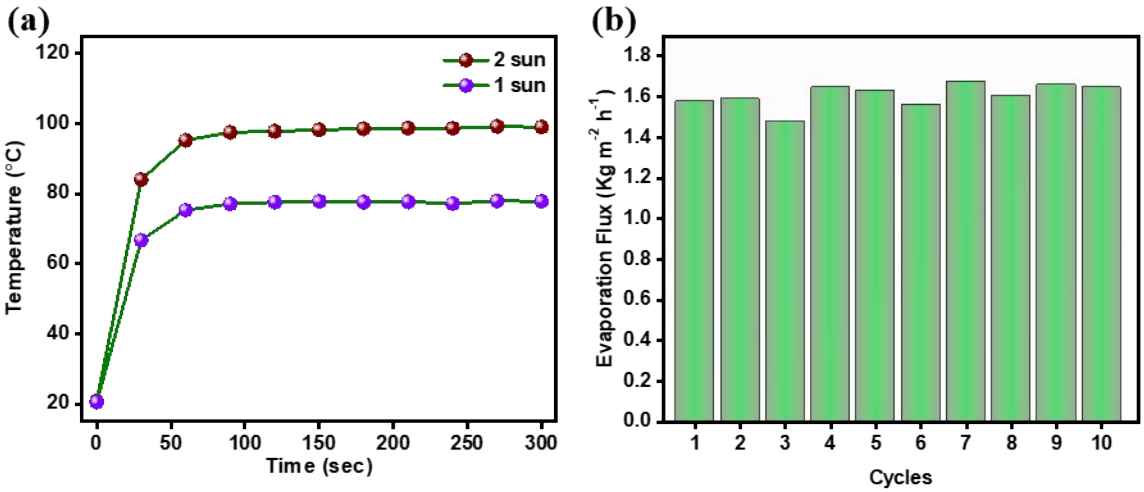

Fig. S2 (a) Time- based surface temperature changes of the NCs/MF under different illumination conditions. (b) Evaporation flux of NCs/MF for 10 cycles under 1 sun illumination.

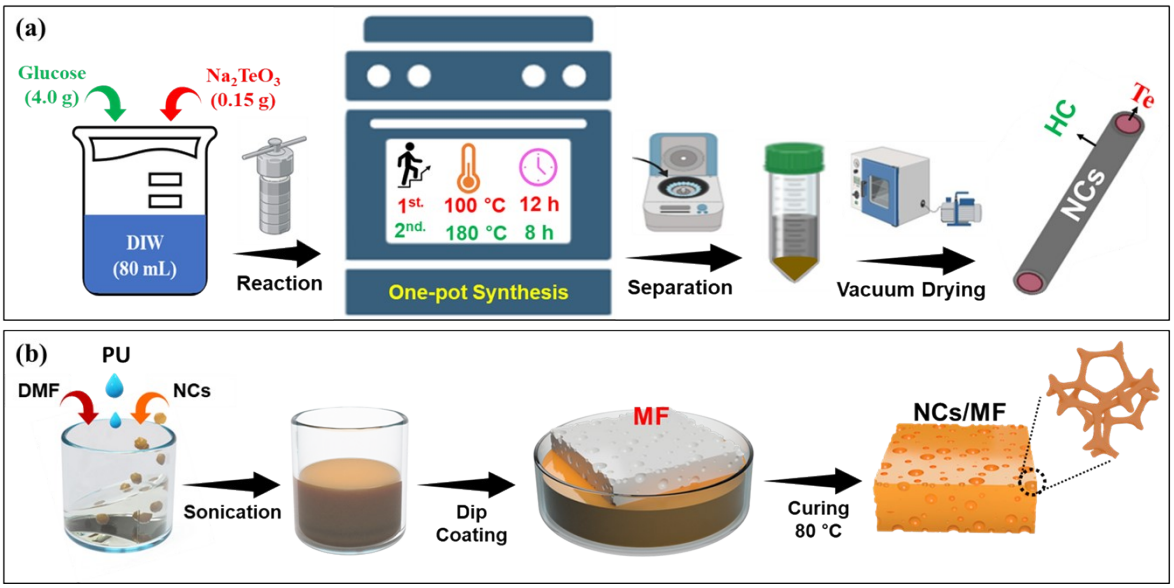

Fig. S3 Fabrication process of (a) NCs, and (b) NCs/MF photothermal sponges.

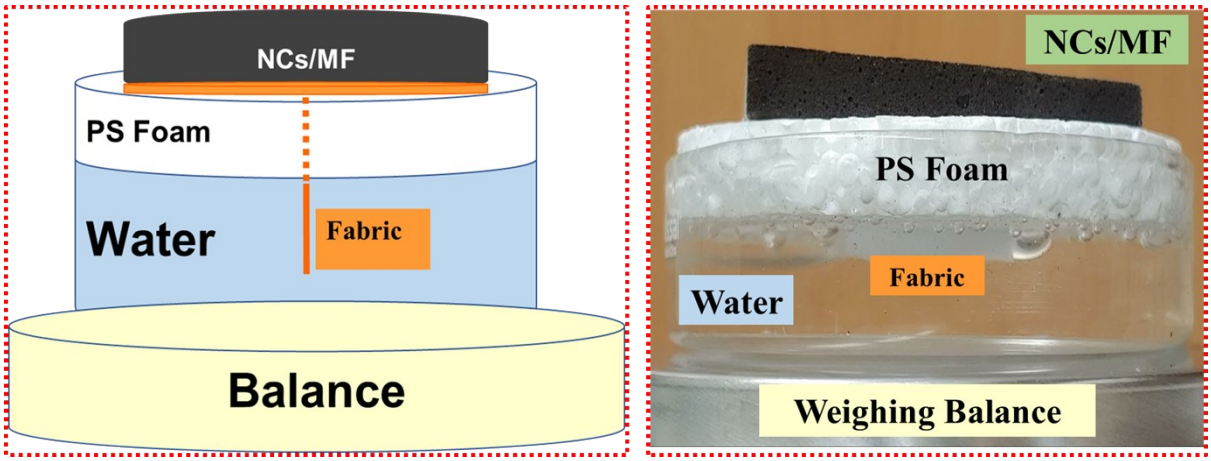

Fig. S4 Schematic depiction and optical image of real experimental setup for interfacial water evaporation experiments.