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Supporting Information

Roof Tile-Inspired 3D Arch Evaporator Based on $Ti_3C_2T_x/MoSe_2$ Photothermal Nanocomposite for Efficient Solar Desalination

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This supporting information contains the following:

1. The XRD patterns of Ti_3AlC_2 and $Ti_3C_2T_x$ and the XPS survey spectrum of $Ti_3C_2T_x/MoSe_2$-100.

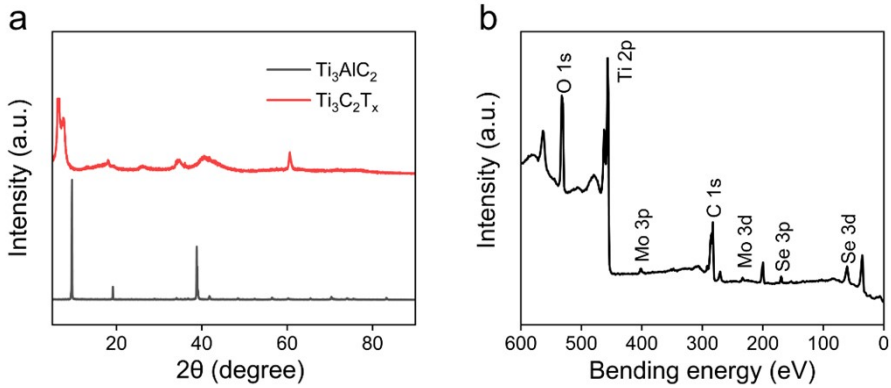

Fig. S1. (a) The XRD patterns of Ti_3AlC_2 and $Ti_3C_2T_x$. (b) The XPS survey spectrum of $Ti_3C_2T_x/MoSe_2$-100.

2. SEM images of Ti_3AlC_2, $Ti_3C_2T_x/MoSe_2$-50 and $Ti_3C_2T_x/MoSe_2$-150.

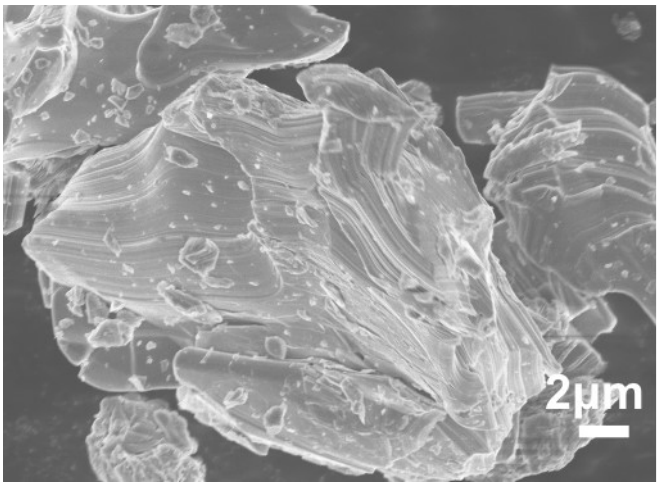

Fig. S2. SEM image of Ti_3AlC_2.

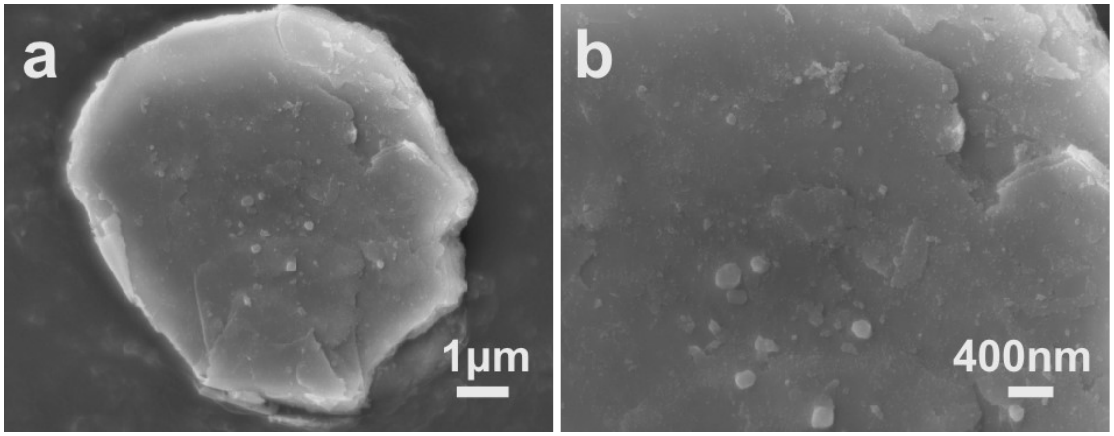

Fig. S3. SEM images of $Ti_3C_2T_x/MoSe_2$-50.

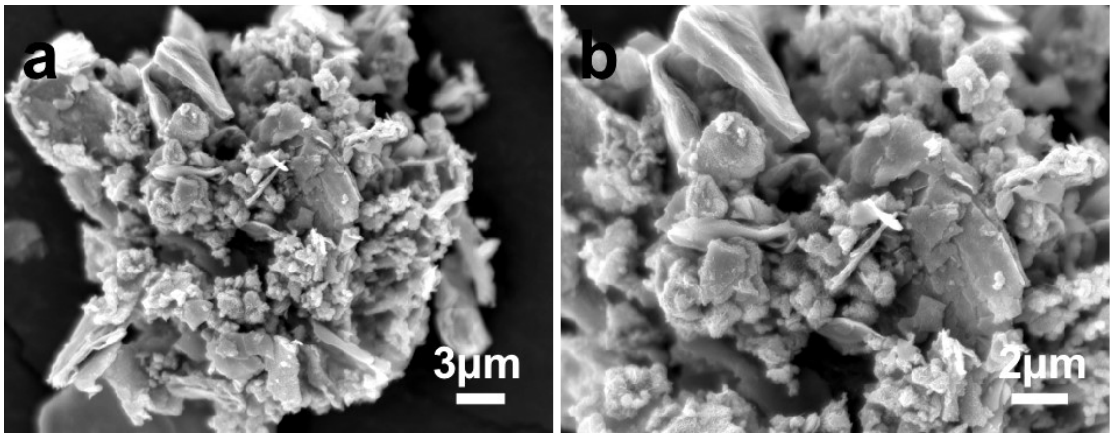

Fig. S4. SEM images of $Ti_3C_2T_x/MoSe_2$-150.

3. EDS results of $Ti_3C_2T_x/MoSe_2$-100.

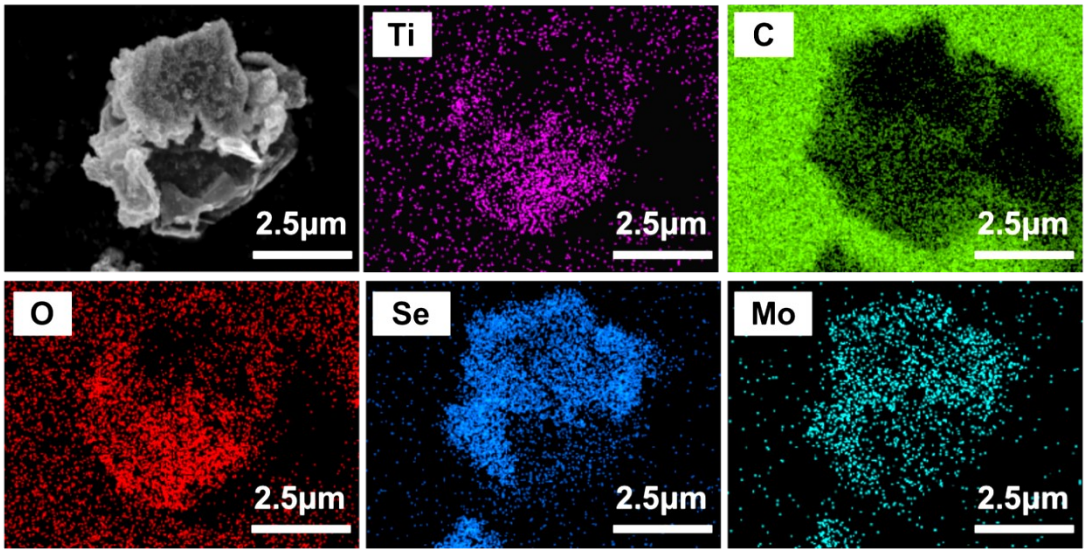

Fig. S5. EDS results of $Ti_3C_2T_x/MoSe_2$-100.

4. Digital photos of CC-T/M-100 in water before and after ultrasound and large-size CC-T/M-100 digital photos.

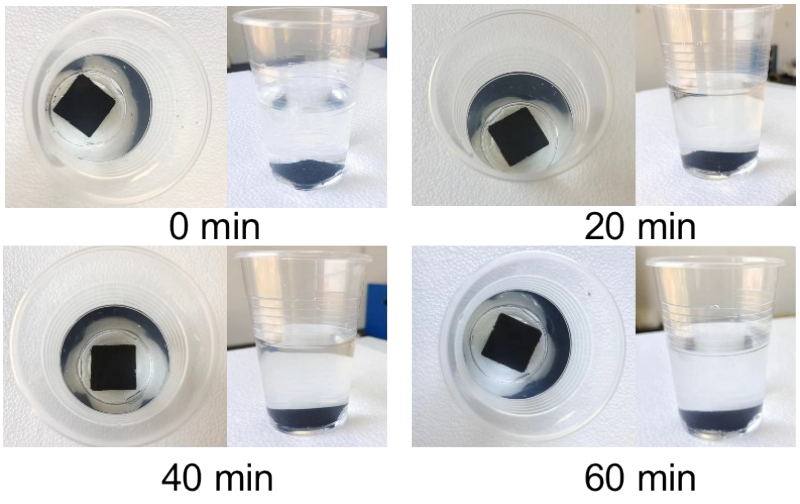

Fig. S6. Digital photographs of CC-T/M-100 in water before and after ultrasound.

Fig. S7. Large-size CC-T/M-100.

5. UV-vis-NIR reflection and transmission spectra of carbon cloth, CC-$Ti_3C_2T_x$, and CC-T/M-100.

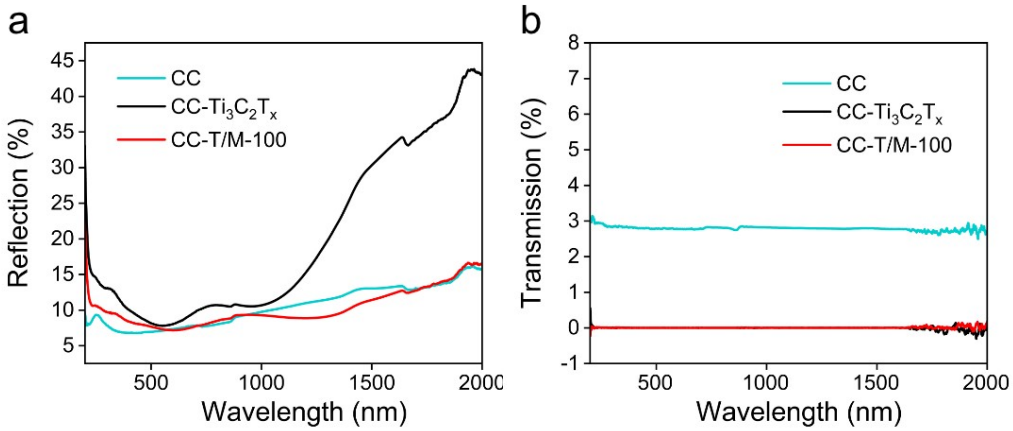

Fig. S8. UV–vis–NIR spectra of carbon cloth, CC-$Ti_3C_2T_x$, and CC-T/M-100 in the mode of (a) reflection and (b) transmission.

6. The calculation of absorption and evaporation rate.

a) Absorption:

$$A = 100 - T - R$$

where A (%) is the absorption, T (%) is the transmission, and R (%) is the reflection.

b) Evaporation rate:

The formula for calculating the seawater evaporation rate is

$$m = \Delta m \div A$$

where m (kg m^{-2} h^{-1}) is the evaporation rate, Δm (kg) is the mass loss measured for 1 h, and A is the projected area of the evaporator (m^2).

7. Infrared images of evaporators under one sun illumination.

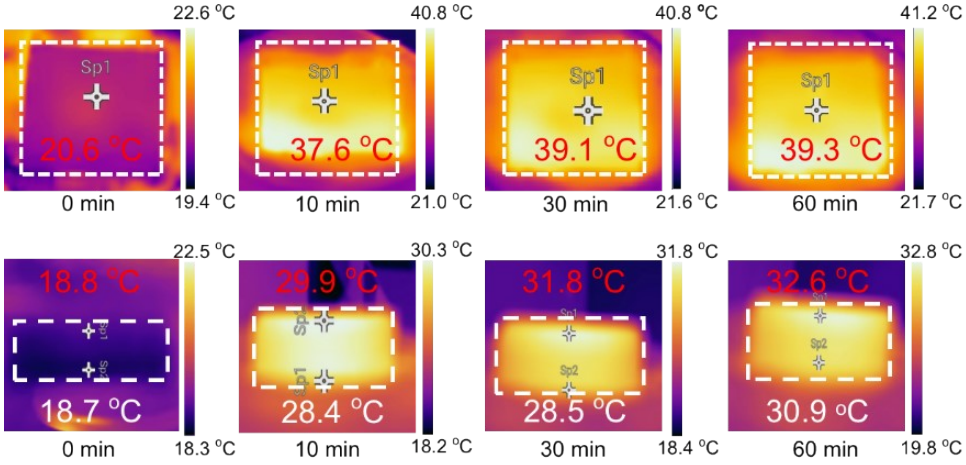

Fig. S9. Infrared images of 2D and 3D evaporators constructed by CC-T/M-100 under one solar illumination.

8.The calculation of the heat loss including radiation, convection, and conduction

a) Radiation loss:

The radiation loss is calculated by the Stefan-Boltzmann equation.

$$\emptyset = \varepsilon A \sigma (T_1^{\,4} - T_2^{\,4})$$

Φ is heat flux (W), ε is the emissivity (0.96), A is the projected area of the evaporator (m^2), σ is the Stefan-Boltzmann constant (5.67×10^{-8} W m^{-2} K^{-4}), T_1 is the surface temperature of the 3D evaporator under one-sun illumination after 1 h (K), and T_2 is the ambient temperature around our evaporator (K). Therefore, based on the Equation, we can calculate the radiation heat loss.

b) Convection loss:

The convective heat loss is defined by Newton's law of cooling.

$$Q = hA\Delta T$$

Q is the heat energy, h is the convection heat transfer coefficient (5 W m^{-2} K^{-1}), A

represents projected area of the evaporator (m^2), and ΔT (K) is the difference value between the surface temperature and steam temperature of 3D evaporator.

c) Conduction loss:

The heat loss of convection was calculated according to the following Equation.

$$Q = Cm\Delta T$$

Q is the heat energy, C is the specific heat capacity of pure water (4.2 kJ $^{\circ}C^{-1}$ kg^{-1}), m is the weight of bulk seawater (0.05 kg), and ΔT ($^{\circ}C$) is the temperature difference value of bulk seawater between before and after solar illumination.

9. Calculation of the heat loss.

Table S1. Heat loss calculation results.

Bending interval (cm)	3	2	1	0.5
Evaporator projection area (cm^2)	9	6	3	1.5
The bottom temperature rises ($^{\circ}C$)	0.8	0.5	0.2	0.1
Evaporator surface temperature ($^{\circ}C$)	39.3	34.2	34.2	32.8
Temperature around the evaporator ($^{\circ}C$)	33.0	30.7	30.4	30.4
Radiation loss (kJ)	0.131	0.046	0.025	7.974×10^-3
Convection loss (kJ)	0.102	0.038	0.024	0.006
Conduction loss (kJ)	0.168	0.105	0.042	0.021

10. Contact angle measurement of carbon cloth and hydrophilic modified carbon cloth.

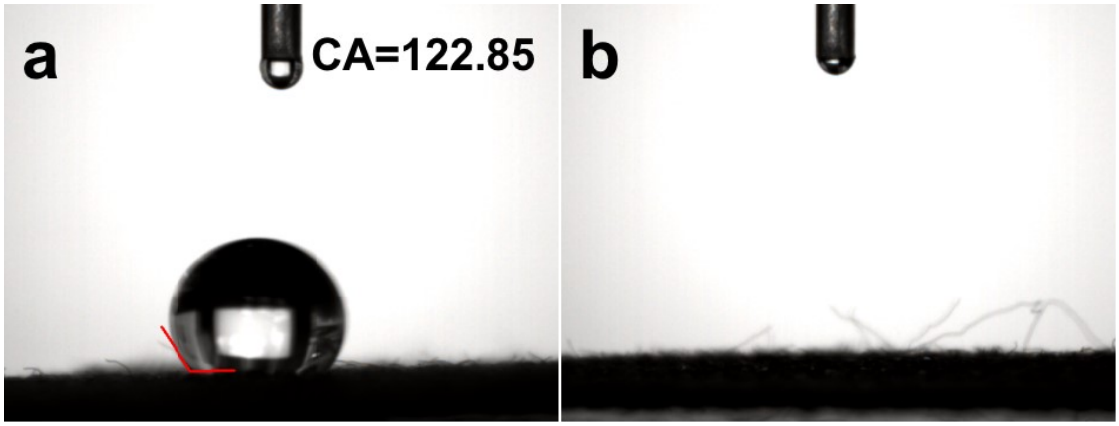

Fig. S10. (a) Contact angle measurement of carbon cloth and (b) hydrophilic modified

carbon cloth.

11. Experimental conditions for the preparation of all samples.

Table S2. Detailed ratio of solvothermal reaction materials.

Samples	Materials for solvothermal reaction			
	Se (mg)	CH_3BNNa (mg)	$Na_2MoO_4 \cdot 2H_2O$ (mg)	$Ti_3C_2T_x$ (mg)
T/M-50	107.04	42.73	164.5	300
T/M-100	107.04	42.73	164.5	150
T/M-150	160.56	64.10	246.75	150
$MoSe_2$	160.56	64.10	246.75	—