Supplementary Material

Fabrication of low-cost porous carbon polypropylene composite sheets with high photothermal conversion performance for solar steam generation

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Note S1. Calculation of solar-vapor conversion efficiency.

The solar-vapor conversion efficiency can be calculated by the following equations [1].

$$\eta_{SV} = \dot{m}(H_{LV} + Q)/E_{in} \quad (1)$$

$$\dot{m} = m_{actual} - m_{dark} \quad (2)$$

$$H_{LV} = 1.91846 * 10^6 * [T_{fin}/(T_{fin} - 33.91)]^2 \quad (3)$$

$$Q = c * (T_{fin} - T_{in}) \quad (4)$$

where η_{sv} represents the evaporation efficiency, $\dot{m}$ is defined as the evaporation rate under irradiation minus the evaporation rate in the dark (Fig. S3), H_{LV} is the latent heat required to vaporize water (J/kg), Q is the heat required to raise the water temperature, E_{in} is the incident light energy input (kJ/m2h), m_{actual} is the evaporation rate under irradiation, m_{dark} is the evaporation rate under dark condition, T_{in} is the initial sample surface temperature, T_{fin} is the average sample surface temperature during evaporation, and c represents the specific heat capacity of water (4.2 J/gK).

For the P-CPCS-40 evaporator under 1 sun irradiation, m_{actual}= 1.81 kg m-2 h-1, m_{dark}= 0.3372 kg m-2 h-1 (Fig. S3), T_{fin}=320.35 K, T_{in}=300.85 K, and E_{in}= 360000 kJ/m2h. Based on the above equations, η_{SV} can be calculated to be 98.2%.

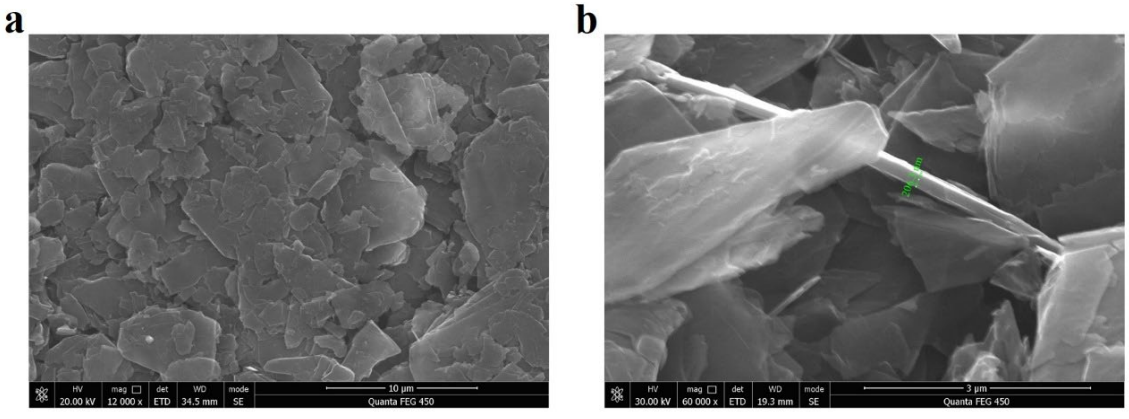


Figure S1. SEM images of carbon flakes.

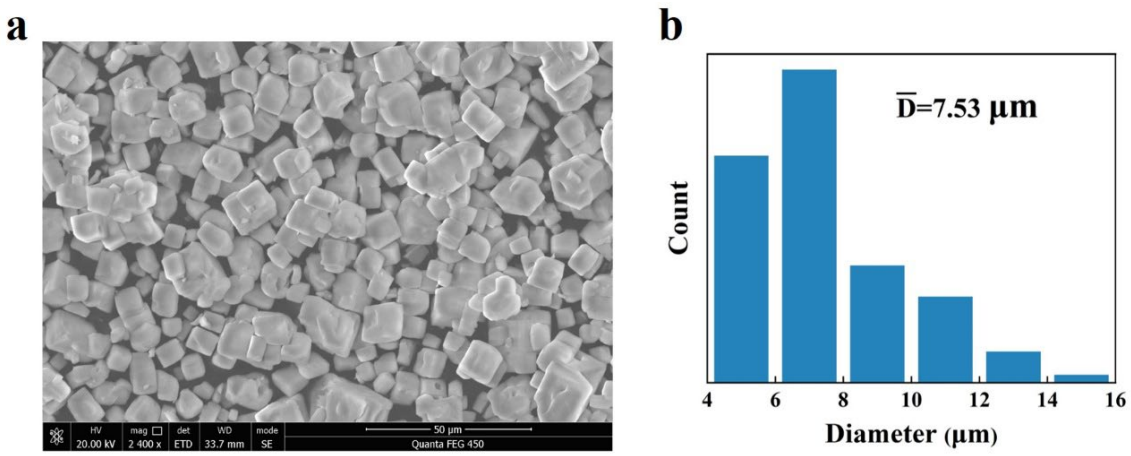


Figure S2. (a) SEM image of NaCl powder. (b) Particle size analysis image of NaCl powder.

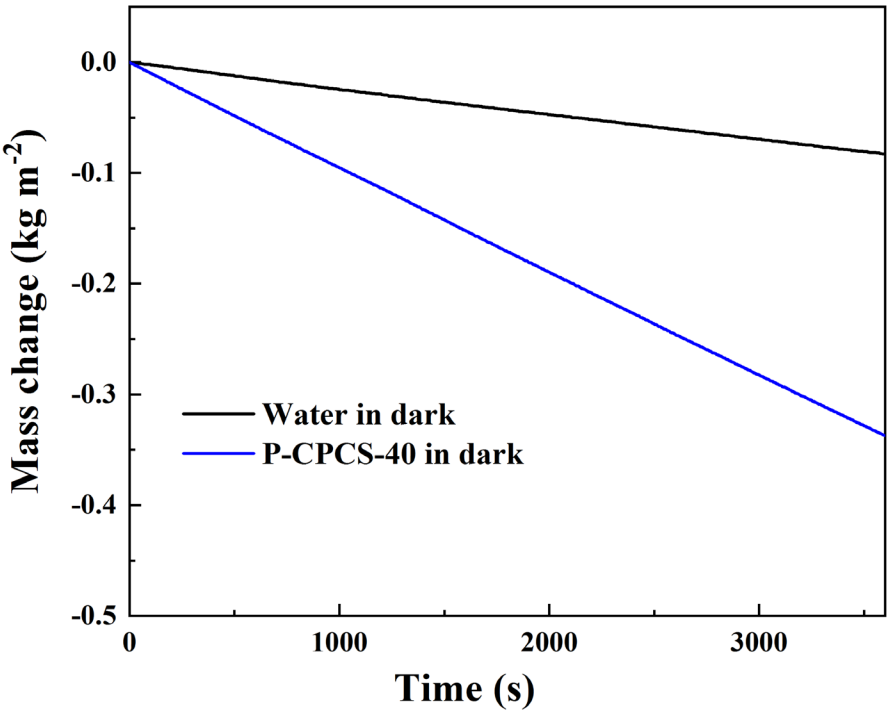


Figure S3. Mass change of water for P-CPCS-40 in the dark condition.

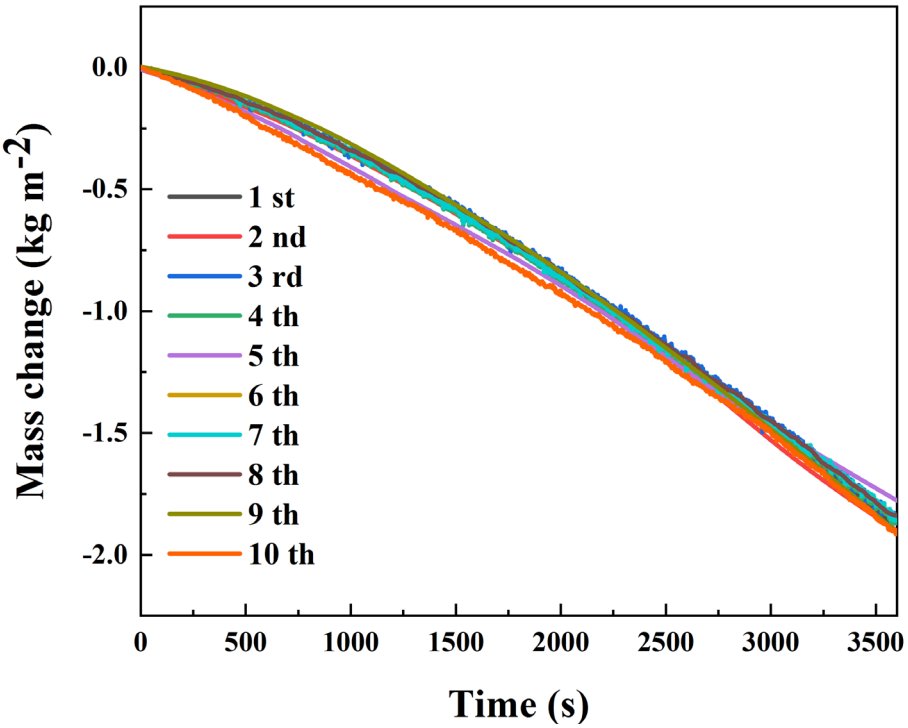


Figure S4. Mass changes of water for P-CPCS-40 evaporator under 1 kWm−2 solar irradiation from 1 to 10 cycles.

Table S1. Water evaporation performance of other reported absorbers in previous studies.

Materials	T_{max} in air (℃)	Heating rate in air (℃/s)	T_{max} in water (℃)	Heating rate in water (℃/s)	Evaporation rate (kg $m^{-2}h^{-1}$)	Evaporation efficiency (%)	Reference
P-CPC-40	79.6	0.1764	47.2	0.078	1.81	98.2	This work
HP-MG	41.3	0.0118	35.3	0.0143	1.72	94.2	[2]
LC@LCG	39	0.01			1.84	86.5	[3]
50-CB@EM	60	0.125	-	-	2.34	93.29	[4]
P-Ag-P@CFs	41.1	0.087	-	-	1.378	90.2	[5]
Carbonized mushrooms	38	0.0270	-	-	1.475	78	[6]
Cu@PPy NW	78	1.16	-	-	2.09	97.6	[7]
Janus PMX20	72.1	0.2589	46.5	0.1472	1.41±0.04	86.4	[8]
RGO-SA-CNT	-	-	40	0.0042	1.622	83	[9]
Cu@C–Ns	73.5	0.0539	-	-	1.94	89.4	[10]
CS25	-	-	47	0.225	1.31	85	[11]
MoS_2-Mo_5N_6/MF	103	0.6667	51	0.1556	2.31	106.6	[12]
G_1 MXene	62.8	0.1227	-	-	1.37	90.1	[13]
B/Z4-P	45.3	-	-	-	2.7	86	[14]
Fe-MOF-74/Cu textile	52.7	0.4776	40.4	0.1533	1.659	83.81	[15]

Materials	T_{max} in air (℃)	Heating rate in air (℃/s)	T_{max} in water (℃)	Heating rate in water (℃/s)	Evaporation rate (kg $m^{-2}h^{-1}$)	Evaporation efficiency (%)	Reference
ACC-5	32	0.0233	-	-	3.82	85.2	[16]
CBC-500-PDMS	76	0.46	-	-	1.97	113.4	[17]
PPy-coated SS meshes	55	3.3	39	0.0023	0.92	58	[18]
PANI/HNTs@PU	-	-	38	0.0111	1.61	94.7	[19]
B-SPH	-	-	30.3	0.0057	3.45	95	[20]
Bi-MOF + GNs	94.9	0.783			2.16	87.5	[21]
NPG-6	37	0.0394	-	-	1.51	94.5	[22]
CMPCA-1	37.5	0.0158	-	-	1.4406	86.8	[23]
MRGA-12	75.9	0.2733	-	-	1.86	83.28	[24]
3DMA-5	80	0.31	39	0.025	1.309	82.4	[25]
Co-CNS/M foam	69.8	0.73	33.2	0.0567	1.393	93.39	[26]
3D-CG/GN	36.5	0.055	-	-	1.25	85.6	[27]
VA-GSM	-	-	-	-	1.62	86.5	[28]
NCM	59	0.1	-	-	1.2	81.8	[29]
HSE3	-	-	45.5	0.0057	1.77	92	[30]
Blended-fiber-based evaporator	44.5	0.0694	-	-	1.53	90.57	[31]
N950	100	0.2533	40	0.0533	1.5	80	[32]
CNT layer/2.4 μm	72	0.1733	-	-	1.31	82	[33]
LIG/LIG-O	-	-	29.4	0.0056	1.191	76.5	[34]
HN/CNT paper	80	0.4167	37	0.02	1.09	83.2	[35]
LMN	66.2	0.0117	-	-	1.41	95	[36]
Single component foam	46.7	0.0063	30.6	0.0018	1.1687	80.5	[37]
PMoS_2-CC	-	-	43.2	0.0513	1.3	80.1	[38]
PU+CR-TPET	77	0.0867	43	0.0056	1.272	87.2	[39]
SWNT/AuNR films	-	-	-	-	1.85	82	[40]
Co-CAT	106.6	0.118	-	-	2.13	91.1	[41]
SMoS_2-PH	-	-	37.7	0.0074	3.297	93.4	[42]
NiO-NSP	37.7	0.0275	-	-	1.78	84.7	[43]
Au/h nanoturf membrane	48.4	0.61	-	-	1.334±0.045	91	[44]
SWNT–MoS_2 film	-	-	-	-	-	81	[45]
FTCS-PDA/BNC	78	5.4	33	0.015	-	-	[46]
SG3	-	-	42.6	0.004	2.21	-	[47]
SSA	91	0.1725	-	-	-	-	[48]
R-NFAs	65	0.75	40.2	0.0169	1.31	-	[49]
NVGQF	80.7	0.3713	-	-	-	-	[50]
TPAD-COF-BF_2	58	0.165	41.5	0.0103	1.19	-	[51]

Note: All data in the table were obtained under 1 sun irradiation.

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