

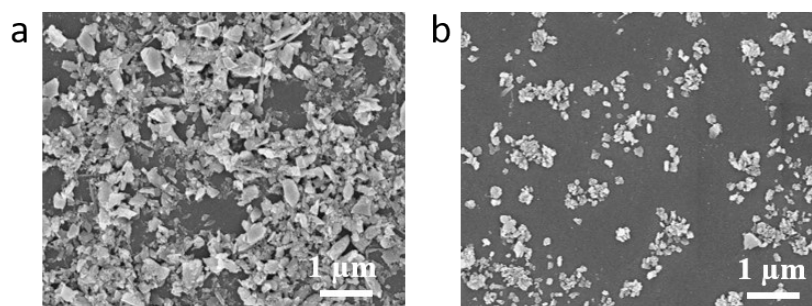
## Facile Synthesis of Hierarchical SnSe Nanosheets-Hydrogel Evaporators for Sustainable Solar-powered Desalination

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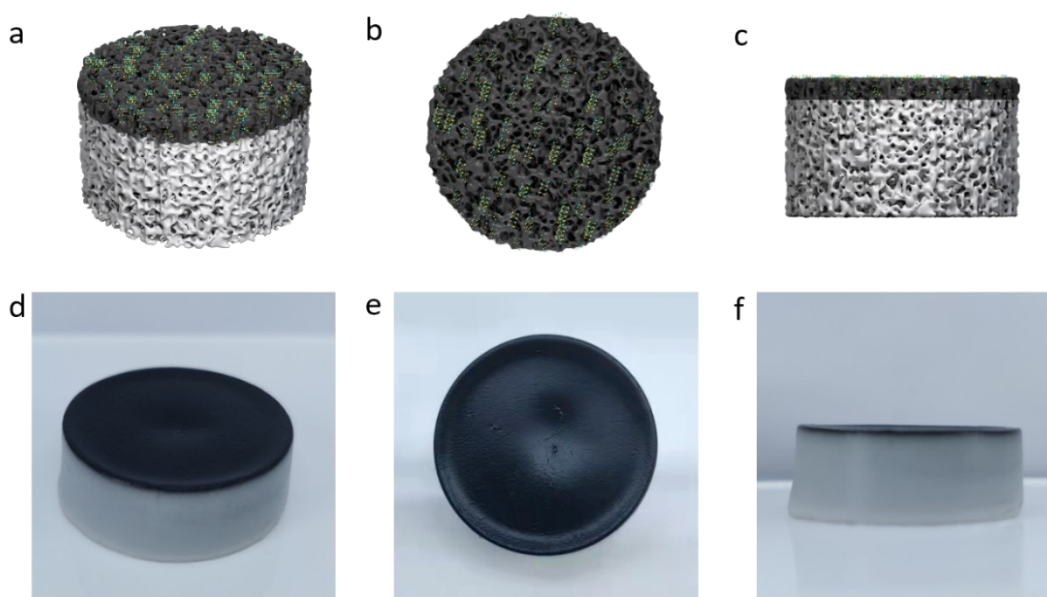
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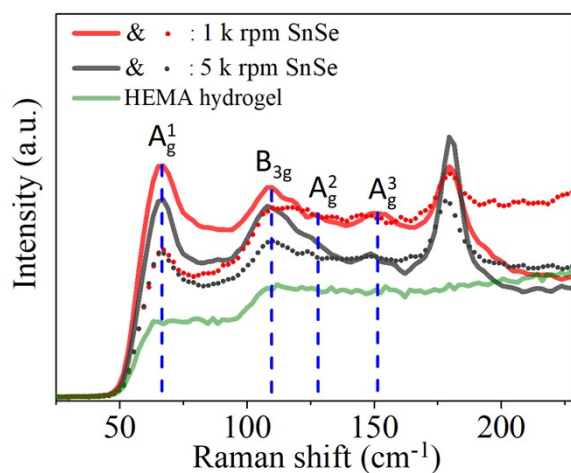


**Fig. S1** SEM image of (a) 1k rpm and (b) 5k centrifugation SnSe NSs.

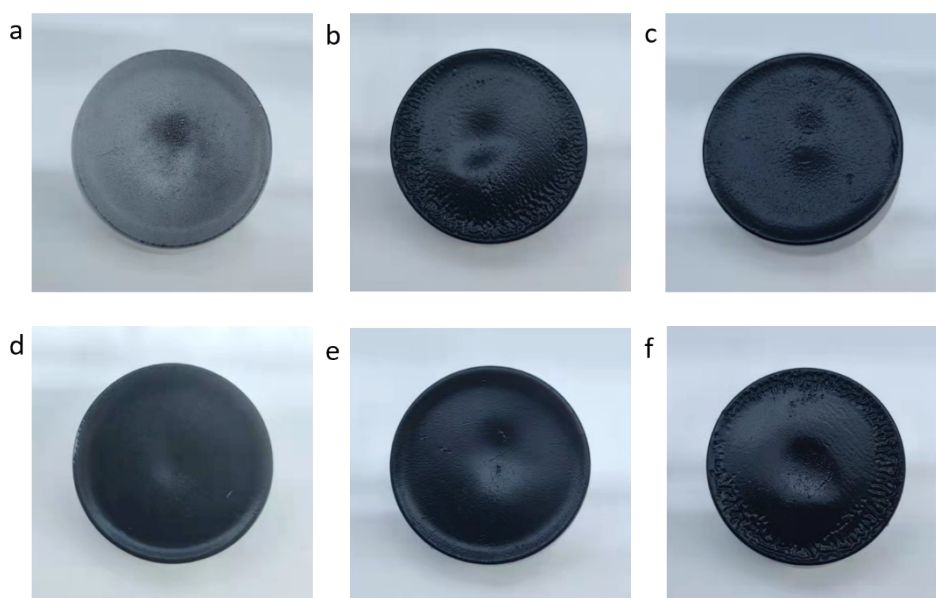


**Fig. S2** (a-c) Analog images and (d-f) corresponding pictures of a hierarchical SnSe-

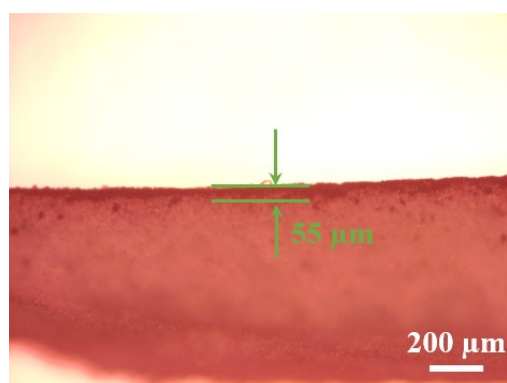
hydrogel evaporator from different perspective, the diameter of the fabricated sample is about 2.4 cm.



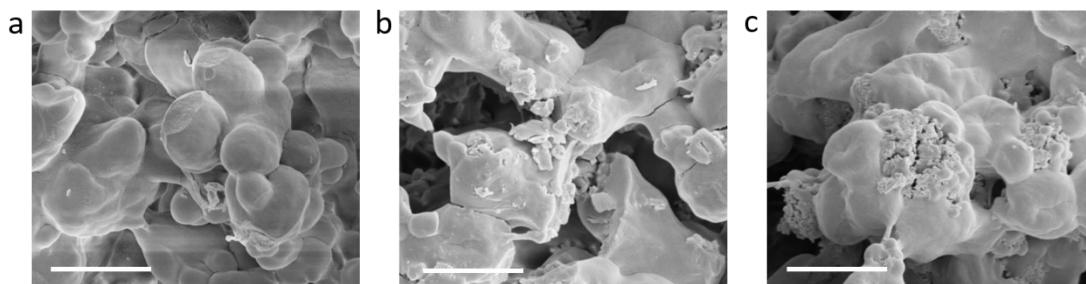
**Fig. S3** Raman spectra of SnSe NSs (solid line), white HEMA hydrogel (green line) and black surface of SnSe-hydrogel (dotted line).



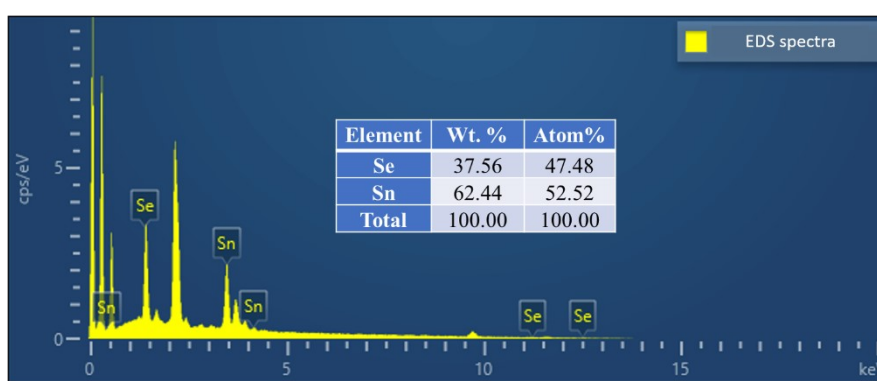
**Fig. S4** Effect of the size and concentrations of SnSe nanosheets on the complex surface of the evaporator. (a) Grinding, 2mg/mL SnSe, (b) 1k rpm, 2mg/mL SnSe, (c) 5k rpm, 2mg/mL SnSe, (d) 1k rpm, 0.5mg/mL SnSe, (e) 1k rpm, 1mg/mL SnSe, (f) 1k rpm, 3mg/mL SnSe.



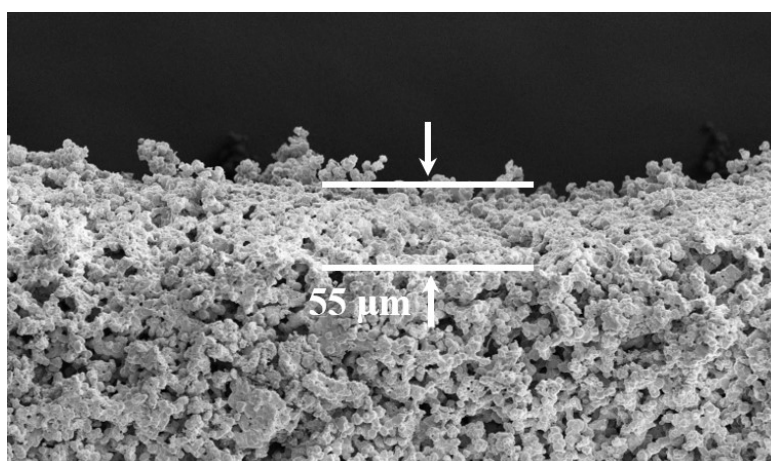
**Fig. S5** Optical image of the cross-section of the 1k rpm, 2mg/mL SnSe based evaporator.



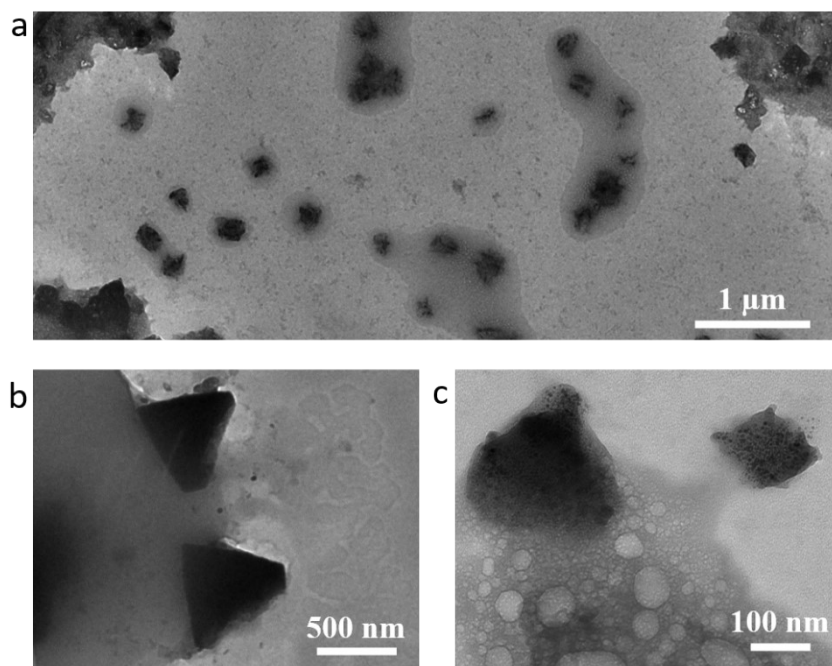
**Fig. S6** High magnification SEM image of the top surface of the evaporator, (a) without SnSe, with (b) 1k rpm SnSe and (c) 5k rpm SnSe, the scale bar is 5  $\mu\text{m}$ .



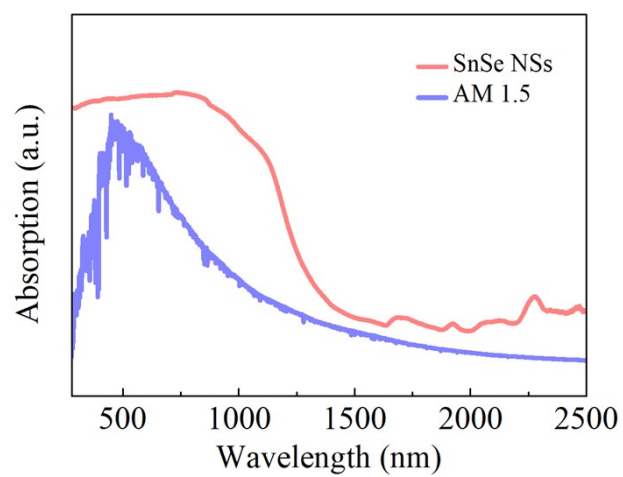
**Fig. S7** The EDS spectra of the evaporator with 1mg/mL, 1k rpm SnSe NSs, the insert table showing the content of Sn and Se element.



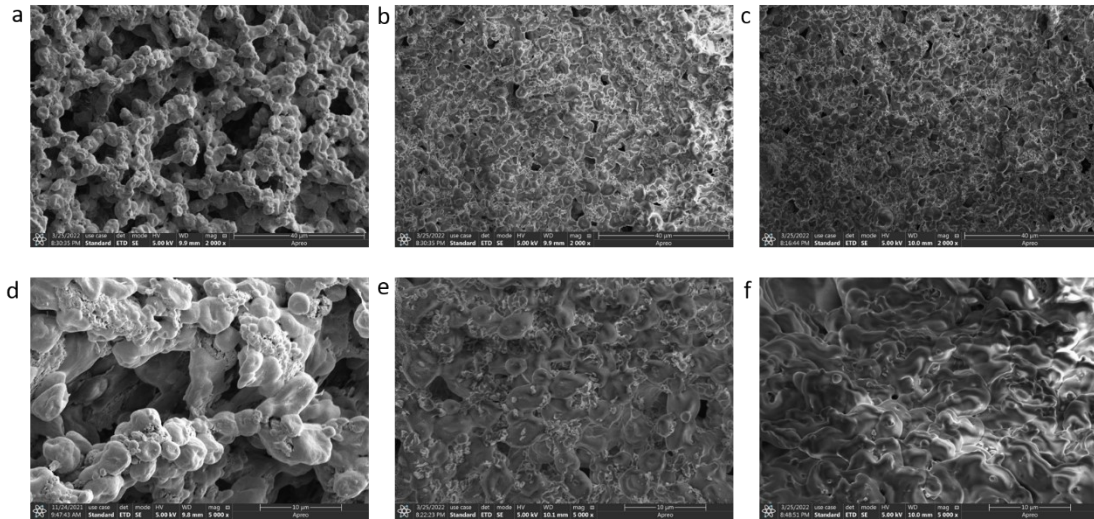
**Fig. S8** SEM image of the cross-section of a hydrogel evaporator with 1mg/mL, 1k rpm SnSe NSs.



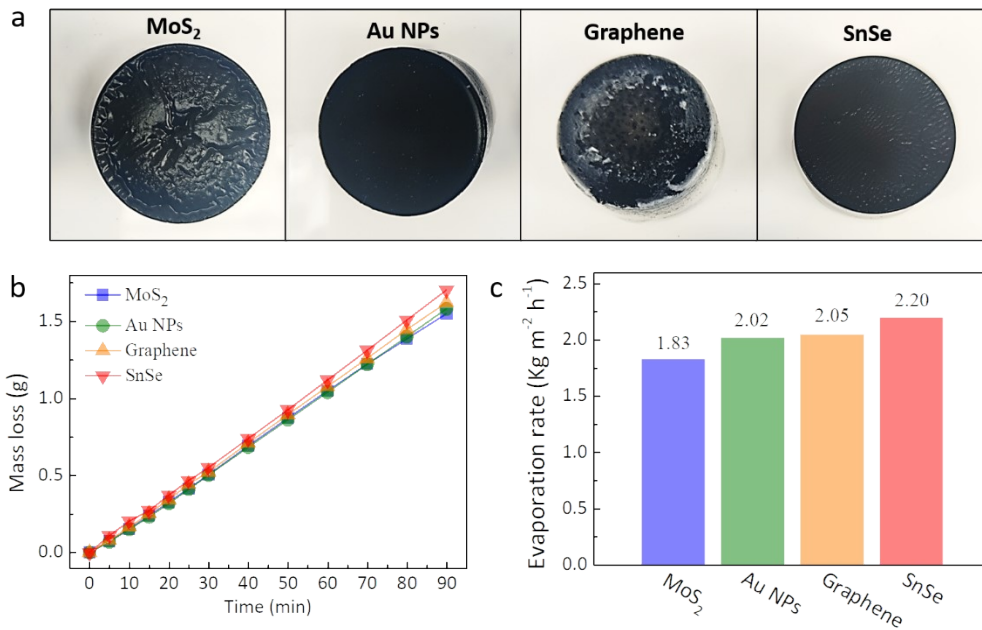
**Fig. S9** TEM image of the SnSe NSs with pHEMA hydrogel.



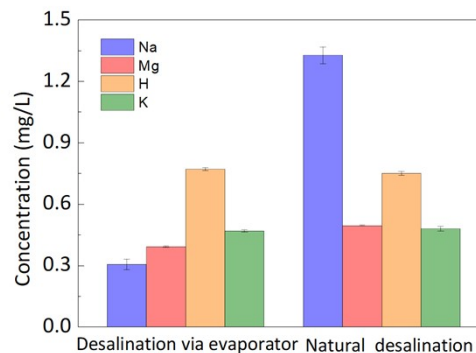
**Fig. S10** UV-vis-NIR spectra of SnSe NSs and the normalized spectral solar irradiance density of air mass 1.5 global (AM 1.5 G) tilt solar spectrum.



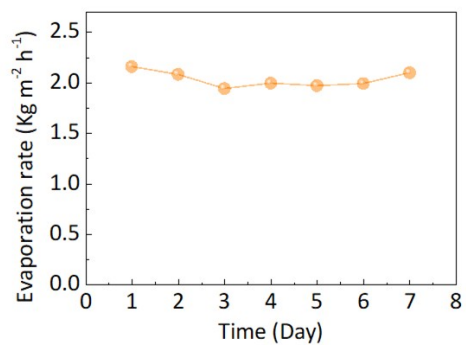
**Fig. S11** SEM image of the top surface of the evaporator with (a, d) 1mg/mL, (b, e) 2mg/mL, and (c,f) 3mg/mL SnSe NSs.



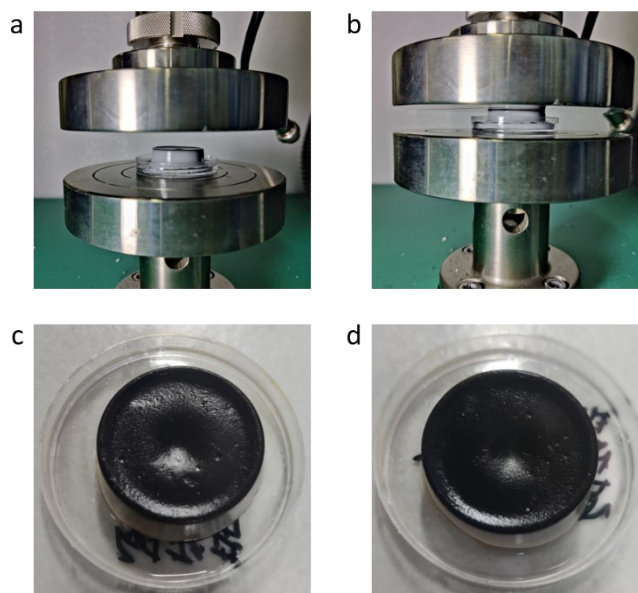
**Fig. S12** (a) Top view of the hierarchical MoS<sub>2</sub>-hydrogel, Au NPs-hydrogel, Graphene-hydrogel, and SnSe-hydrogel evaporators. (g) The time-dependent water mass loss curves and (h) corresponding evaporation rates histogram.



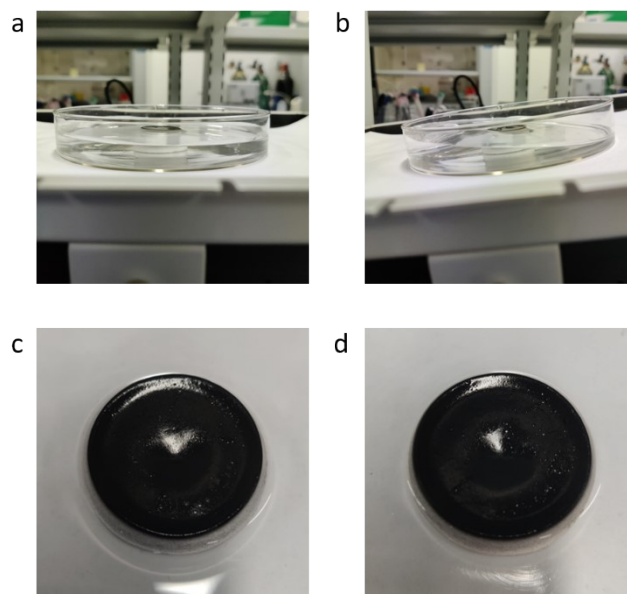
**Fig. S13** Concentrations of four primary ions of desalinated seawater via evaporator and without evaporator.



**Fig. S14** The average evaporation rates of the SnSe-hydrogel evaporator in a 7-dyas test.



**Fig. S15** (a, b) The pictures of the compressive cycle test. The surface picture of the SnSe-hydrogel evaporator (c) before and (d) after 1000 compression cycles.



**Fig. S16** (a, b) Picture of wave washing simulation test on a shaker. The surface picture of the SnSe-hydrogel evaporator before (c) and after 24 h wave wash test.

**Table S1** The solar evaporation of the evaporators fabricated with different sizes and concentrations of SnSe NSs and other nanomaterials.

Materials	Size	Concentration	Evaporation rate/kg m <sup>-2</sup> h <sup>-1</sup>
SnSe	Gring	2 mg/mL	1.61
SnSe	1K rpm selected	2 mg/mL	1.99
SnSe	5K rpm selected	2 mg/mL	1.79
SnSe	1K rpm selected	0.5 mg/mL	2.07
SnSe	1K rpm selected	1 mg/mL	2.20
SnSe	1K rpm selected	3 mg/mL	2.01
MoS <sub>2</sub>	5K rpm selected	2 mg/mL	1.94
Graphene	Few layer	1 mg/mL	2.05
Au NPs	15 nm	2 mg/mL	2.02

**Table S2** The ion concentrations of the seawater before and after solar desalination by the SnSe-hydrogel evaporator

Ions	Seawater Concentration (mg/L)	Purified water Concentration (mg/L)	Rejection rate
Na <sup>+</sup>	9449.70	0.30	99.997
Mg <sup>2+</sup>	1242.16	0.39	99.960
K <sup>+</sup>	525.16	0.77	99.857
Ca <sup>2+</sup>	415.13	0.57	99.885