

Supporting Information

Plasmonic Heating from In NPs on a Floating Microporous Membrane for Enhanced Solar Seawater Desalination

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Experimental Section

Fabrication of the In NP/MPM devices. The indium-based In NP/MPM devices were prepared by thermal evaporation (Elite Engineering, Singapore) of indium source with different thicknesses on MPM substrates (Sigma-Aldrich) at a base pressure of 3×10^{-7} Torr. The evaporation rate was 0.5 Å/s.

Characterizations. SEM images were acquired on a scanning electron microscopy (SEM; JEOL JSM-7001F). Absorption spectra were measured by using a UV/VIS/IR PerkinElmer LAMBDA 950 spectrophotometer equipped with integration sphere. IR images were taken by an IR Camera (FLIR T420). XPS were performed on a VG ESCALAB 220i-XL system using a monochromatic Al K α source. X-ray diffraction (XRD) patterns were obtained from a high resolution Phillips PANalytical X'Pert Pro diffractometer using Cu K α radiation (1.5406 Å). The element concentrations of seawater were measured on a PerkinElmer Optima2000 ICP-OES spectrometer. Contact angle measurement was conducted on a DataPhysics OCA contact angle system.

Experimental setup for solar evaporation. The water evaporation experiments were conducted in a 100 mL breaker with an internal diameter of ~5 cm. To monitor the in-situ weight change of the water during the evaporation process, the breaker with 100 mL water was placed on a 4 decimal electronic precision balance (Sartorius) equipped with a 2-door glass chamber under a solar simulator (Sun 2000, 280 to 2500 nm light source, ABET technologies). The chamber could avoid the strong air flow from the cooling fan of the solar simulator which will induce vibrations. A piece of In NP/MPM (Φ ~4.8 cm) was floating on the surface of water. To maximize the transmittance of sunlight from solar simulator, the top side glass cover of the chamber was replaced by quartz glass. For each cycle, the illumination time was 30 min and the weight of water in the container was recorded every 5 minutes. After each cycle, the In NP/MPM device was picked up from the breaker, rinsed with DI water, and dried naturally for next run. The surrounding temperature and humidity in our lab were 23.2 Celsius and 55.4%, respectively.

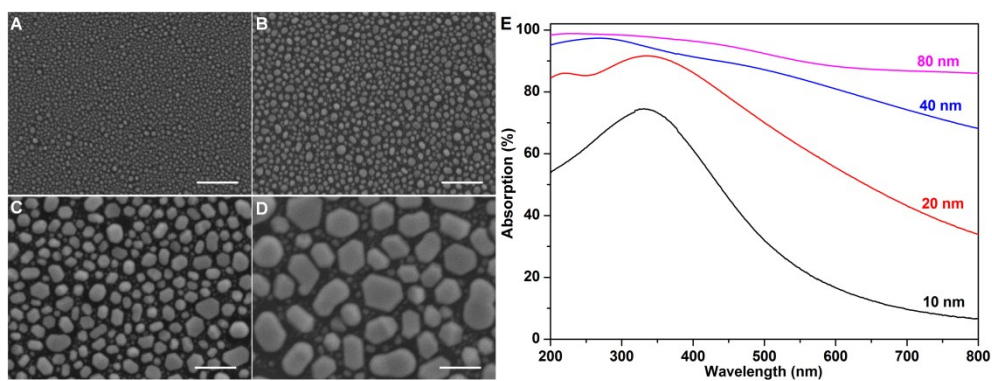


Figure S1. (A-D) SEM images of In NPs coated quartz substrates prepared through thermal evaporation of indium source in vacuum with deposition thicknesses of 10, 20, 40, and 80 nm, respectively. The scale bars are 500 nm. (E) Absorption spectra of the as formed In NPs on quartz substrates.

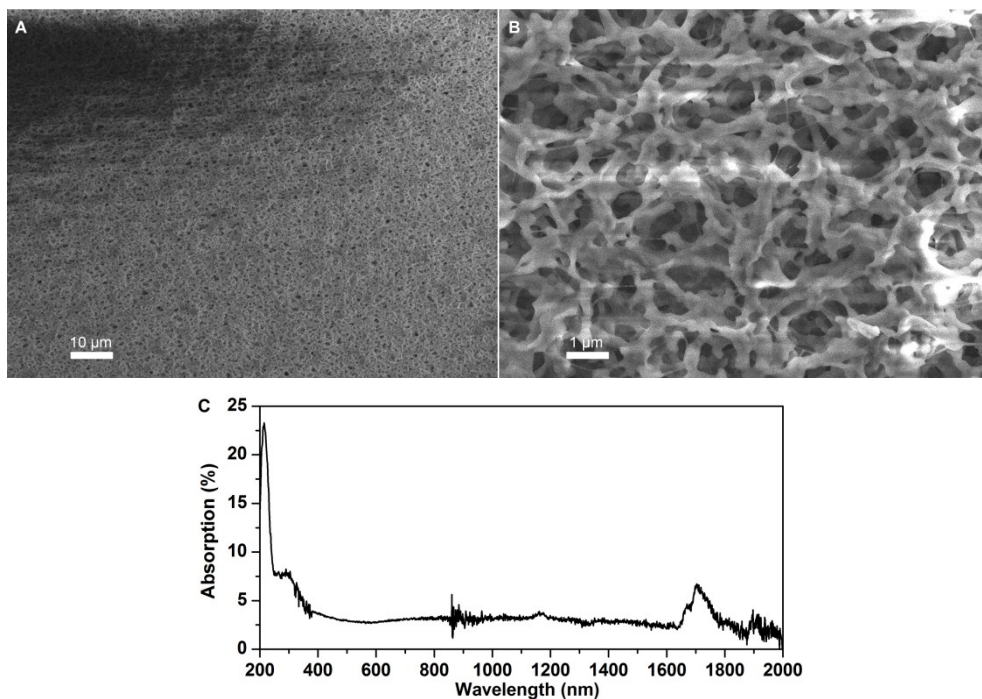


Figure S2. (A, B) SEM images of bare MPM substrate, showing the highly porous structure. (C) Absorption spectrum of the bare MPM substrate.

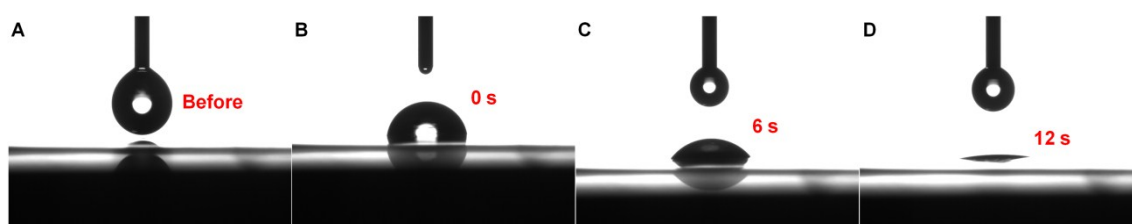


Figure S3. Contact angle measurement of a water drop on the In NP/MPM device. The water drop on the device surface could disperse quickly in a short time, showing the hydrophilicity of the device.

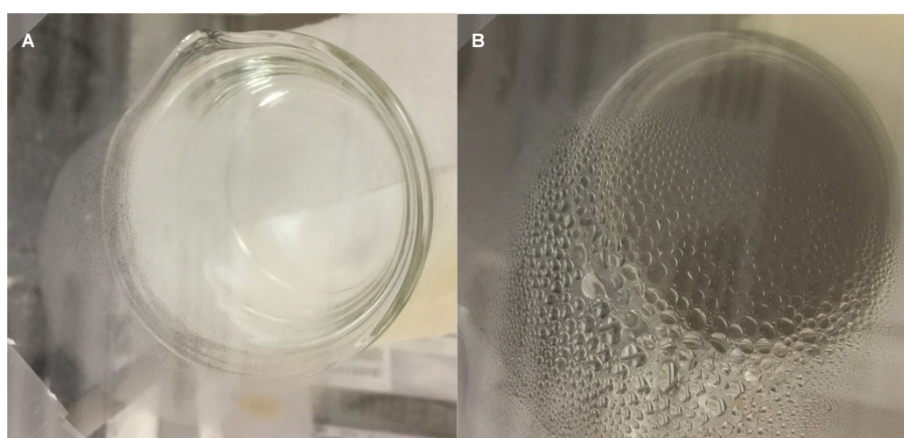


Figure S4. Optical photos of water condensed on the quartz cover after 30 minutes without (A) and with (B) In NP/MPM plasmonic device under 3 sun.

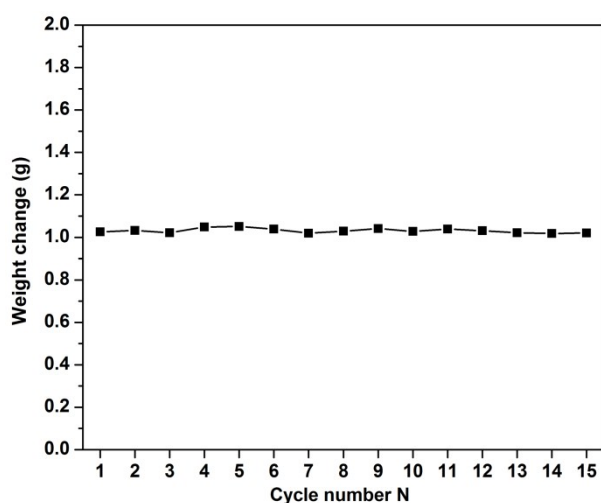


Figure S5. The cycle performances of In NP/MPM device in solar evaporation under fixed optical illumination (3 sun).

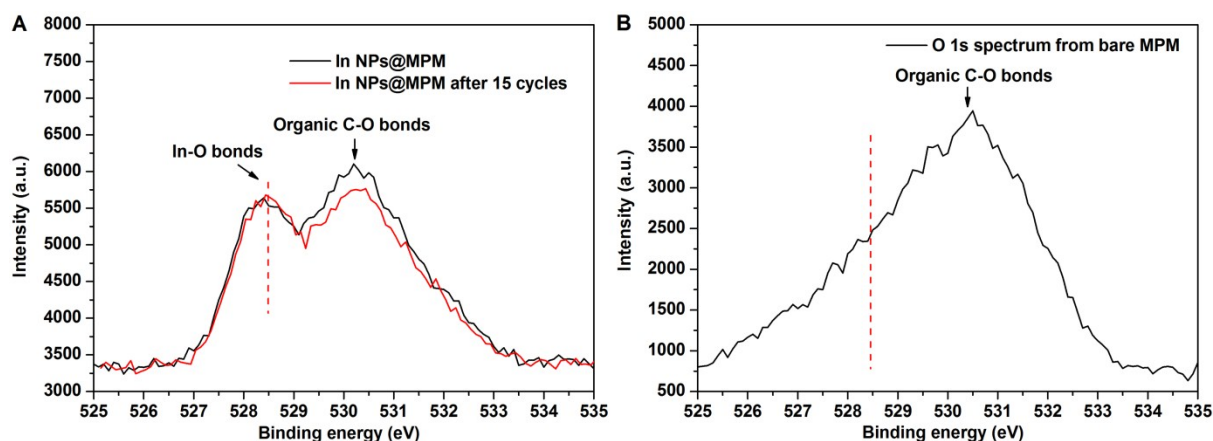


Figure S6. (A) XPS spectra of O 1s of In NP/MPM before and after desalination processes. (B) O 1s spectrum from bare MPM.

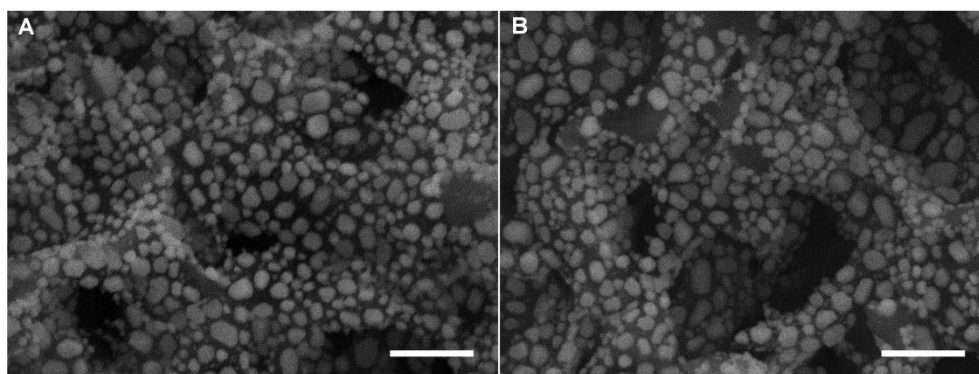


Figure S7. SEM images of In NP/MPM device before (A) and after (B) desalination processes. The scale bars are 500 nm.

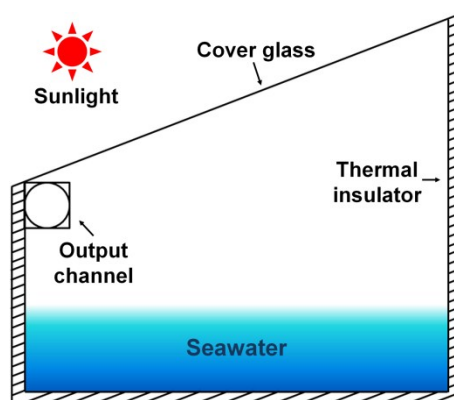


Figure S8. The schematic illustration of a basin solar still illuminated under sunlight.¹

References

1 M. Ali Samee, U. K. Mirza , T. Majeed, N. Ahmad, *Renewable Sustainable Energy Rev.* 2007, **11**, 543.