Journal Name

ARTICLE

Improved light-harvesting and thermal management for efficient solar-driven water evaporation using 3D photothermal cone

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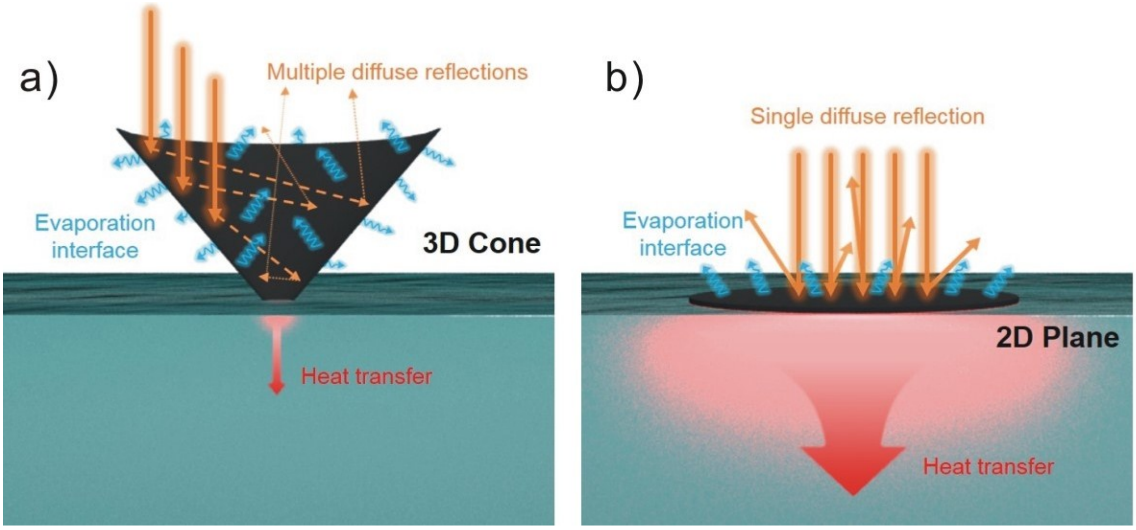

Fig. S1. Schematic illustration for the comparison on a) 3D photothermal cone and b) 2D common plane material. There are three advantages of the 3D cone in water evaporation: i) Multiple diffuse reflections inside the cone leads to improvement on ligh harvesting. ii) Heat transfer to bulk water can be lowered by minimizing the contact area between cone and water without any extra thermal blocker. iii) Larger evaporation interface may be provided by 3D cone than 2D plane as the same water surface area.

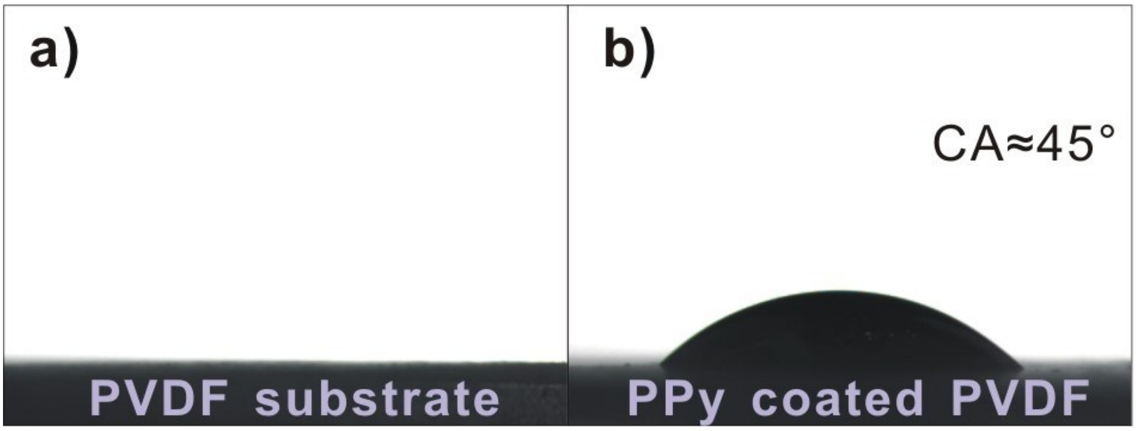

Fig. S2. Water contact angles of a) commercial PVDF membrane with alleged 0.45 μm of pores, and b) PPy coated PVDF formed by CVDP process. The image and CA result show a hydrophilic surface of PPy coated PVDF.

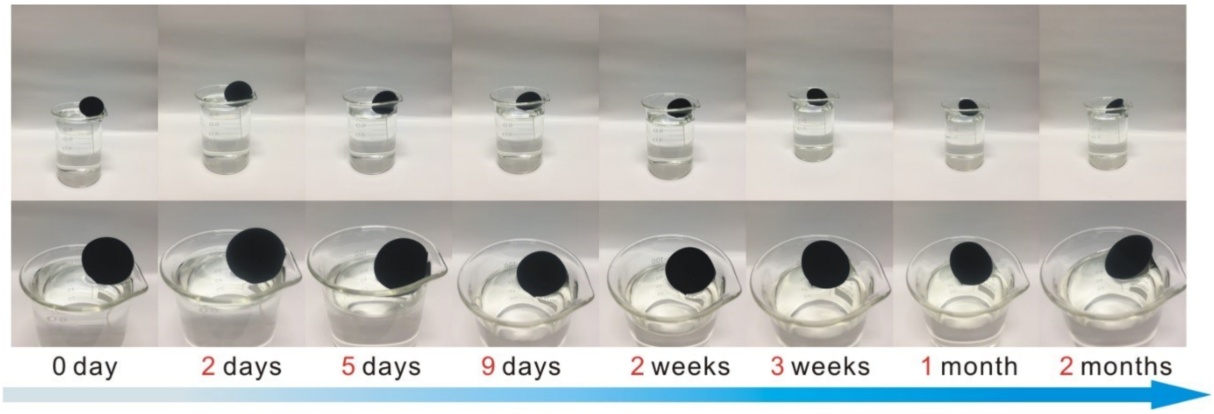

Fig. S3. Time course digital photographs of the as-prepared photothermal cone self-floating on the water surface. Water has been added in beaker every week to avoid evaporation to dryness.

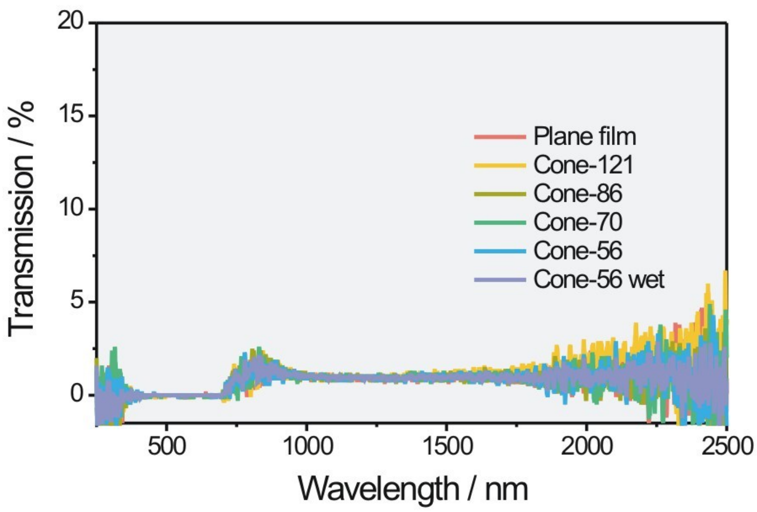

Fig. S4. UV-Vis-NIR transmission spectra of the PPy coated plane film and photothermal cones in the wavelength range of 250 nm to 2500 nm. With the PPy coating layer, the photothermal samples almost prevent all light passing through.

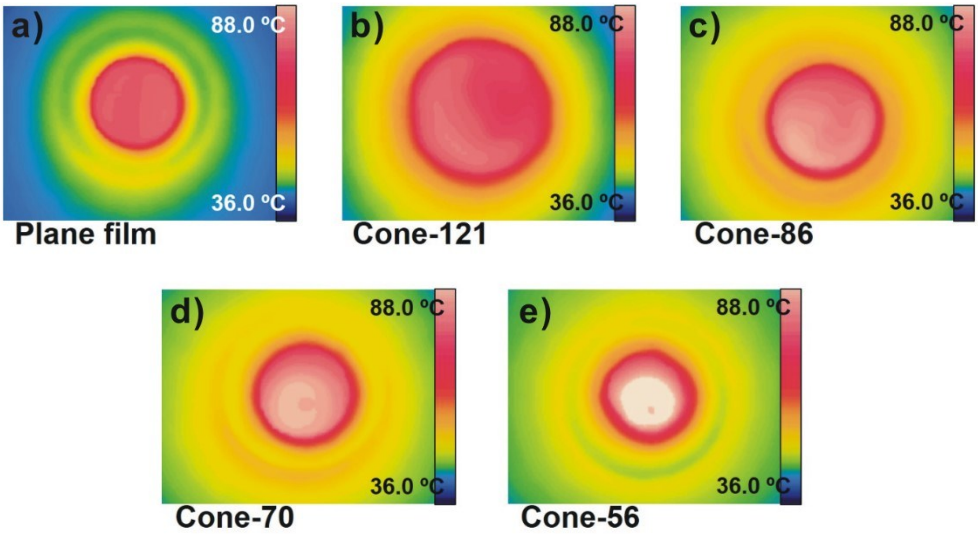

Fig. S5. IR thermal images of PPy coated photothermal samples including a) plane film and b-e) 3D cones in air under one-sun irradiation for 30 min.

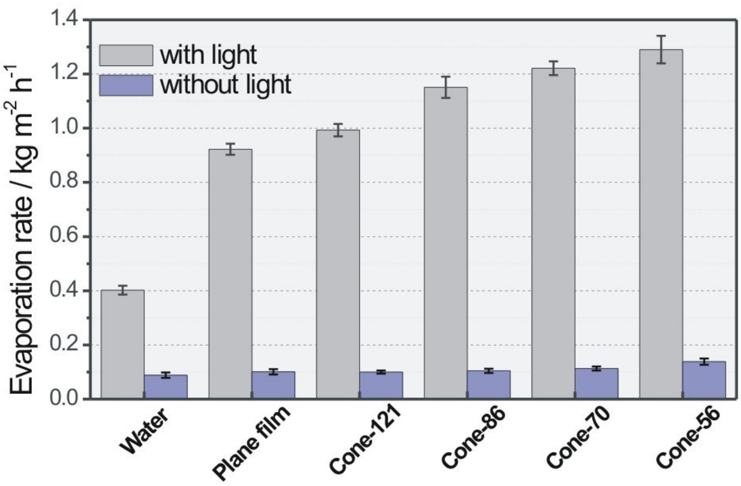

Fig. S6. Water evaporation rates at equilibrium of pure water and as-prepared photothermal samples with (gray) and without light (purple).

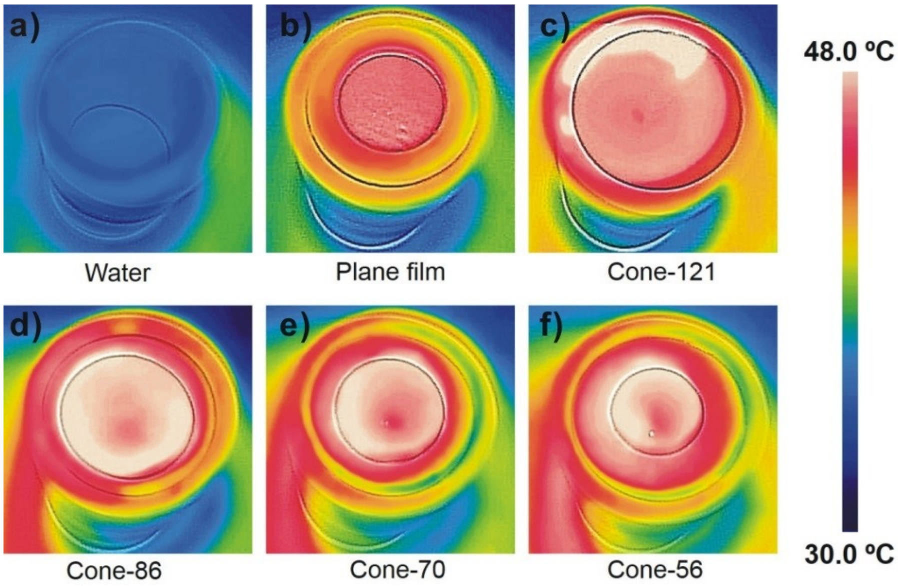

Fig. S7. IR thermal images of a) pure water and photothermal samples including b) plane film and c-f) 3D cones under one-sun irradiation for 120 min.

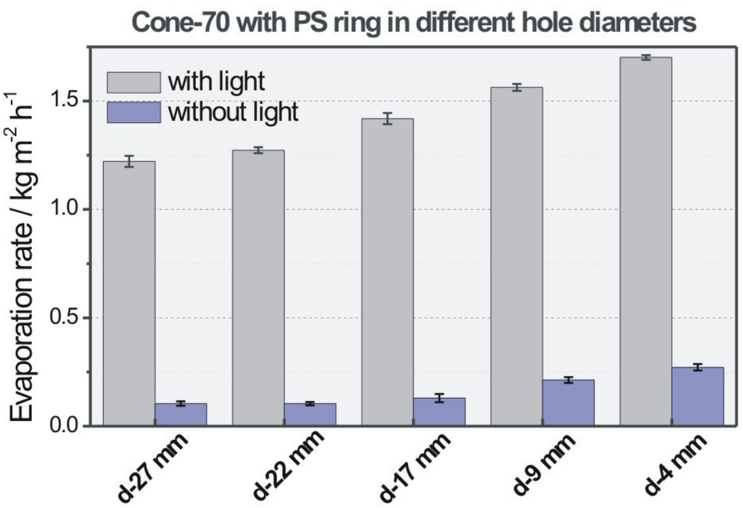

Fig. S8. Water evaporation rates at equilibrium of Cone-70 held by PS ring in different hole diameters with (gray) and without light (purple). A narrower hole can result in a larger actual evaporation area and smaller contact area with water.

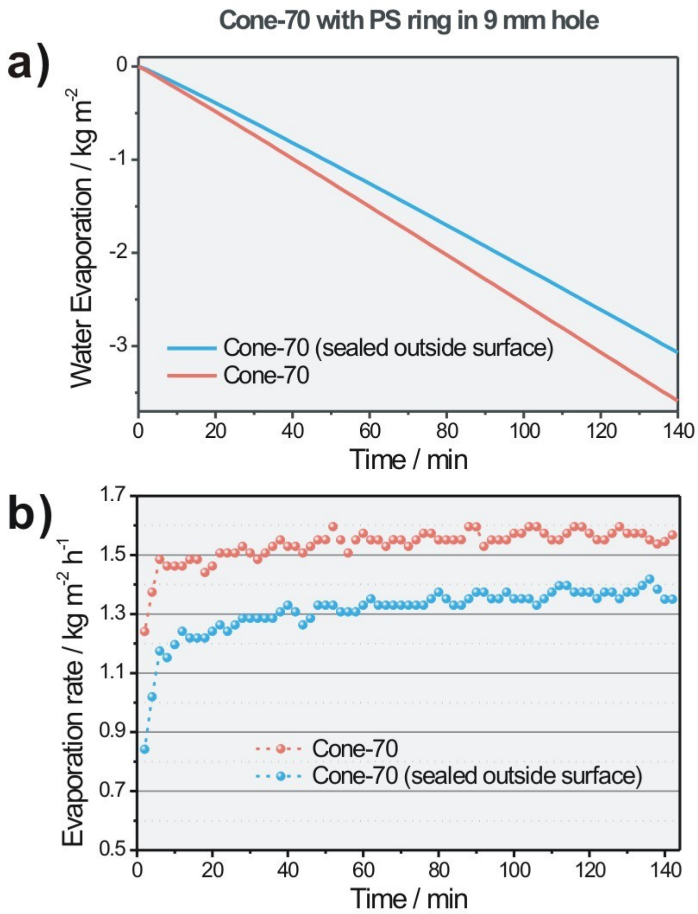

Fig. S9. a) Time course of water evaporation performance of Cone-70 with sealed outside surface under one-sun irradiation. The pristine Cone-70 is shown as a contrast. b) The corresponding water evaporation rates under irradiation in the intensity of 1 kW m^{-2}.

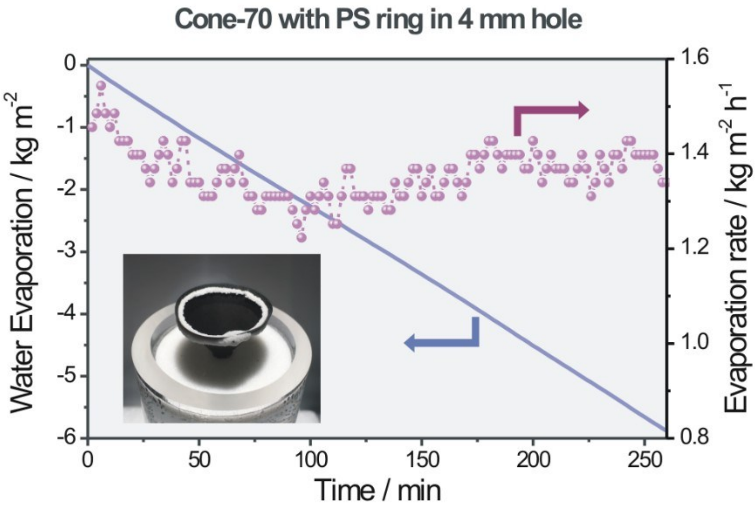

Fig. S10. Time course of simulated seawater evaporation performance and the corresponding water evaporation rate of Cone-70 elevated by the PS ring with 4 mm hole under one-sun irradiation. Inset shows the digital photograph of Cone-70 after 250 min irradiation. A salt ring was observed on Cone-70 after 250 min irradiation.

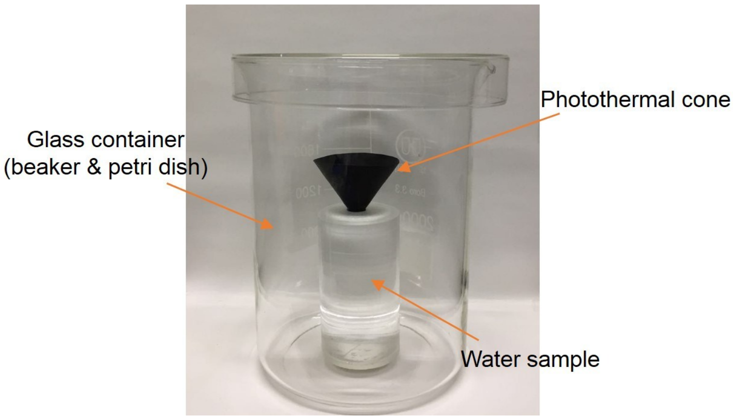

Fig. S11. The digital photograph of the device for fresh water collection. The PMMA container with water sample was located inside a large glass container, which was composed of a beaker (2000 mL) and a petri dish. A a scaled up photothermal cone (about 21 cm^{-2} in projected area) was fixed on the water. Water samples used here were sailne water and seawater.

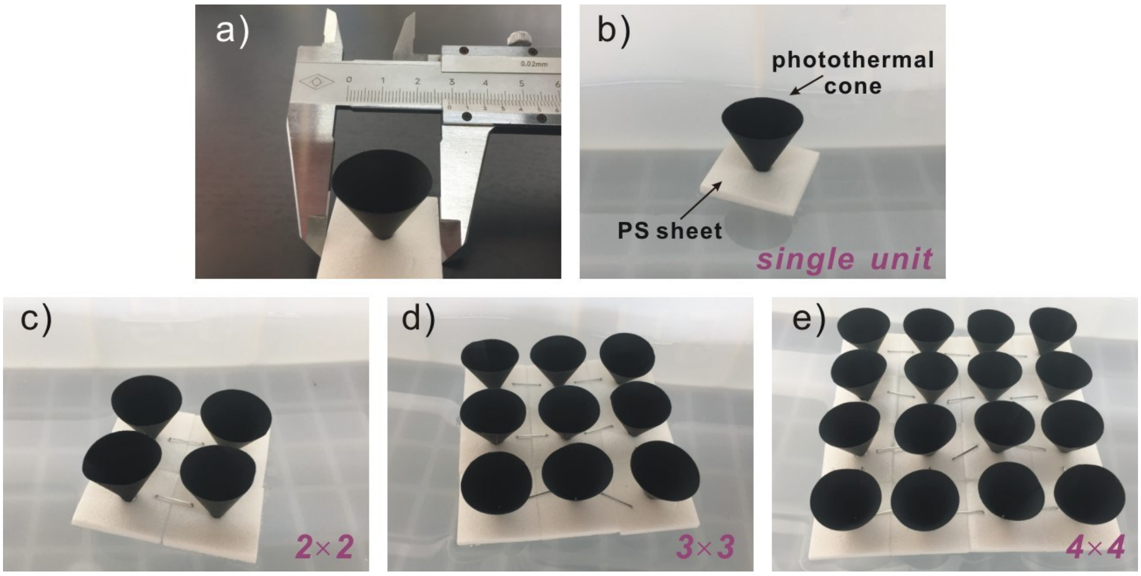

Fig. S12. a) The digital photograph of single photothermal unit in centimeter-scale. b) A single unit for water evaporation consists of photothermal cone (Cone-70 in figure) and PS sheet, which is used to fix the cone's position on the water surface. The as-prepared photothermal units can be connected together facilely to form the desirable arrays, such as c) 2×2, d) 3×3, and e) 4×4. As the larger cone can be fabricated, there is enormous potential for photothermal cone to be used in practical application on fresh water generation.