Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supplementary Information

A hierarchical origami moisture collector with laser-textured microchannel array for a plug-and-play irrigation system

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This file contains ***4*** supporting figures, ***2*** table and ***5*** movies.

Supporting Figures:

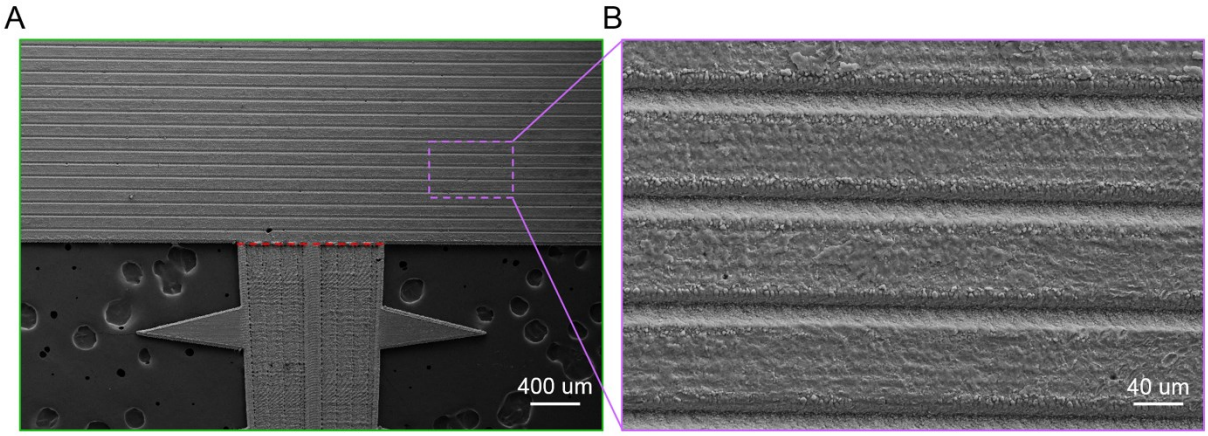

Figure S1 The SEM images of the HOMC. **A**) The joint of the STGC and SGI. The red line dotted line represents the fold line. **B**) The microstructure on SGI.

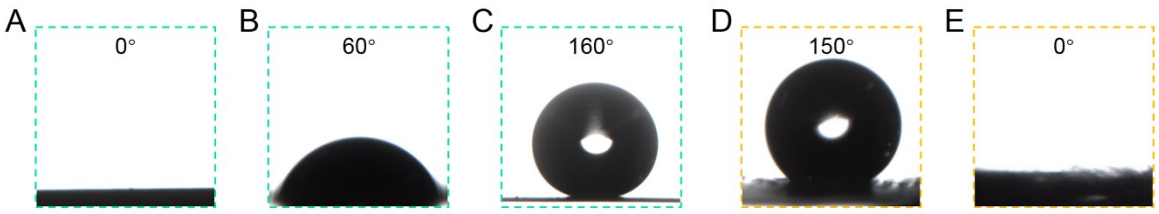

Figure S2. The water contact angle of (**A**) the laser-treated Al surfaces (including the main structure of the STGC, STC, SGC, SC, SGI, SGS and SS), (**B**) the original Al surface, (**C**) the chemically modified Al surface, (**D**) the outside surface of the leaf sheath, and (**E**) the trichomes array on the sheath.

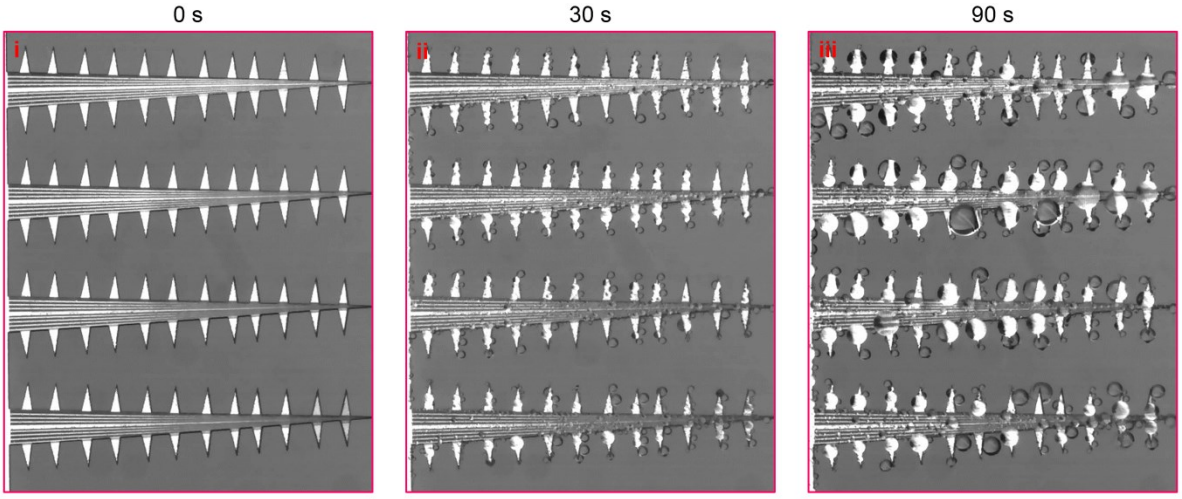

Figure S3. The optical images of whole fog harvesting process on the superhydrophobic STGC samples. **i-iii**) the fogdrop captured on the surface agglomerate into spherical shape and merge continuously, blocking the path for transportation.

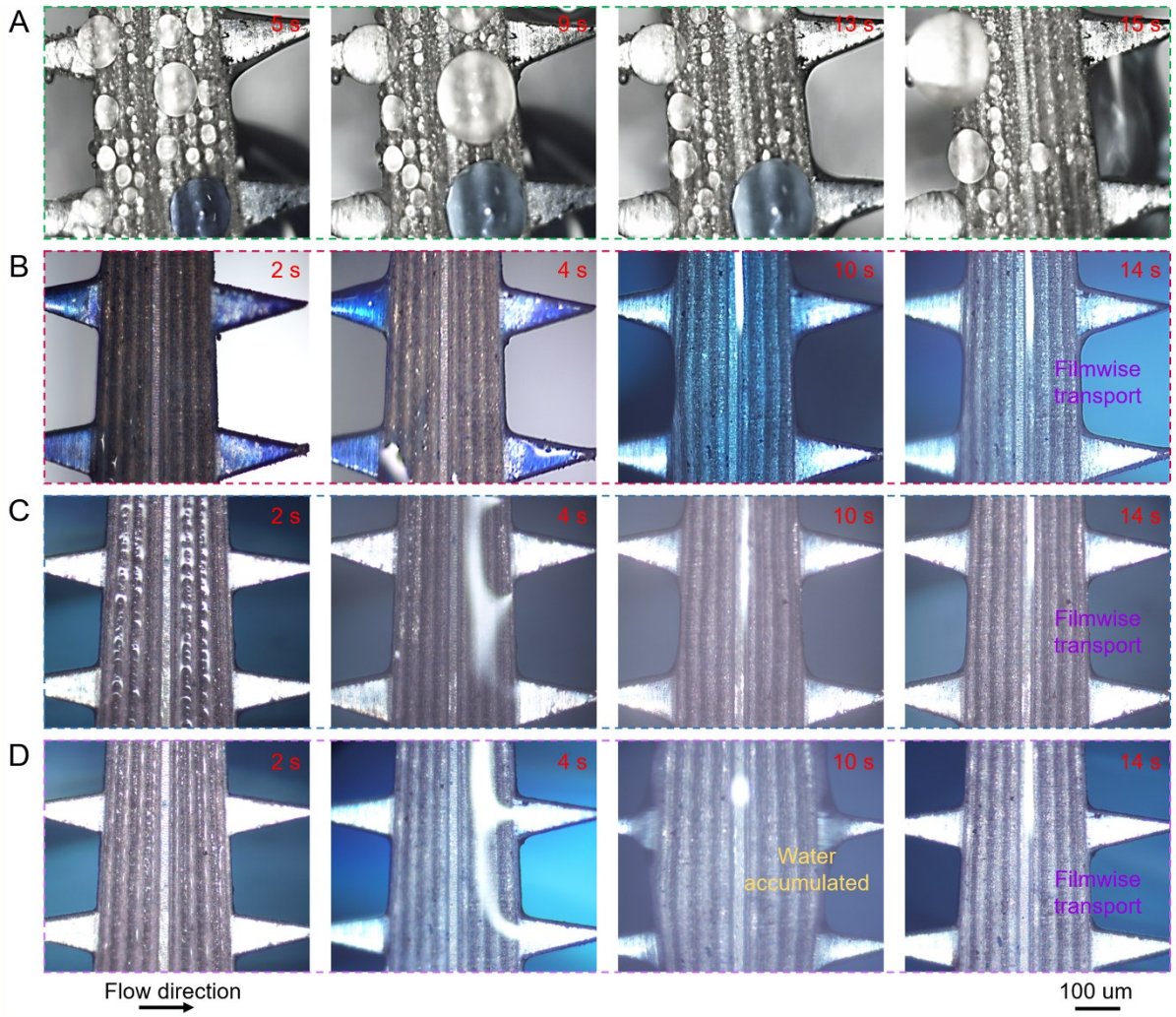

Figure S4. The optical images of SFHC with different fog flow velocity. **A**) the hydrophobic SFHC in 1 m/s flow velocity. **B**) the SFHC in 0.45 m/s fog flow velocity. **C**) the SFHC in 1 m/s fog flow velocity. **D**) the SFHC in 2 m/s fog flow velocity.

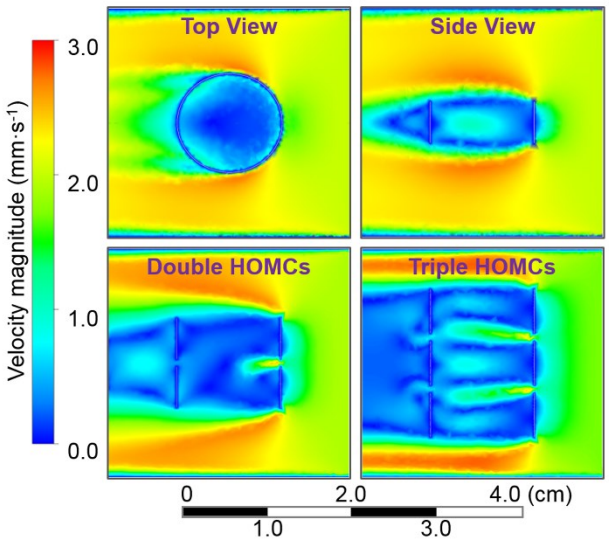

Figure S5. The simulation of wind fields inside the HOMC from the assembled collector from single HOMC and triple HOMCs. The wind field distribution image was simulated by Ansys Fluent software. The initial wind speed was set at 2.5 m/s which is same as the normal natural environment wind.

Table S1. Detailed geometric parameters of HOMC.

Ls	*Lt*	*H*	*h*	*w*	*D*	*d*	*s*	H_w	*α*	*β*	*δ*	*γ*
13 mm	0.7 mm	50 μm	25 μm	55 μm	13 mm	40 μm	60 μm	5 mm	6°	22.5°	18°	90°

The detailed geometric parameters of the HOMC are listed in Table S1. Both the spine and thorns are in the wedge shape. The apex angles of the spine (*α*) and thron (*β*) are 6° and 22.5°, respectively. Twelve thorns were orderly distributed on two sides of spine. The length of spine (*Ls*) and thorns (*Lt*) are 13 mm and 0.7 mm, respectively. Gradient microchannels with high and low ribs are aligned along spine on top surface of the STGC. Inclined angle of the channels (*δ*) and the grooves on the SGI is 18°. These channels formed by two neighboring high ribs are named as the major channel and the minor channels formed with any low ribs.Totally 2 major channels and 8 minor channels formed by 3 high ribs and 6 low ribs. The width and height of channels along the spine gradually decrease from the tip to the base. The heights of high ribs (*H*) and low ribs (*h*) at the end of spine are approximately 50 μm and 25 μm, respectively. The width of each minor channels (*w*) at the base is approximately 55 μm. The angle between thorn and spine (*γ)* is approximately 90°. Diameter (*D*) of the crown are 13 mm. The depth (*d*) of grooves on the SGI is 40 μm The space (*s*) between each grooves is 60 μm. The height of annular thin-wall (H_w) of the HOMC are 5 mm.

Fog-collecting system	Main methods	Mechanism	Flow velocity (cm/s)	Ambient temperature (T)	Humidity (rh)	Collection efficiency (g/cm^2·h)	Ref.
Wheat awn-like system	3D printing	Shape gradient	40	25 °C	95%	≈5.90	1
Star-shaped wettability patterned surfaces	Spin-coating	Wettability gradient	N/A	Room temperature	95%	≈2.78	2
Superwettable patterned surfaces	Pulsed laser deposition	Wettability gradient	N/A	Room temperature	95%	≈5.30	3
Hybrid wettability surface	Femtosecond-laser	Wettability gradient	10	20 °C	95%	≈0.2	4
Hydrophobic/hydrophilic cooperative Janus system	Chemical modification	Janus system	70	Room temperature	95%	≈0.93	5
Superhydrophilic/hydrophobic Janus foam	Femtosecond-laser	Janus system	50	Room temperature	95%	≈3.7	6
Nanocone-decorated 3D fiber network	Nanocone decoration	Shape gradient	75	0 °C	95%	≈3.6	7
Hydrophilic/superhydrophobic patterned surface	Thermal pressing procedure	Wettability gradient	12	22 °C	95%	≈0.16	8
HOMC combination	Femtosecond-laser and origami	Wettability and shape gradient	45	25 °C	95%	≈8.4	This work

Table S2. Comparison of the fog-collecting systems with other works.

References in the table are shown below.

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Supplementary movies:

Movie S1: The wetting and membrane formation processes on the STGC-1 and STGC-2

Movie S2: The water transport process on completely wetted STGC

Movie S3: The water evaporation process on the SGI.

Movie S4: The fogdrop collection process of the HOMC.

Movie S5: The fog harvesting process of the assembled collcector from the HOMCs (top view and side view).