Electronic Supplementary Information for

Floating, Highly Efficient, and Scalable Graphene Membranes for Seawater

Desalination using Solar Energy

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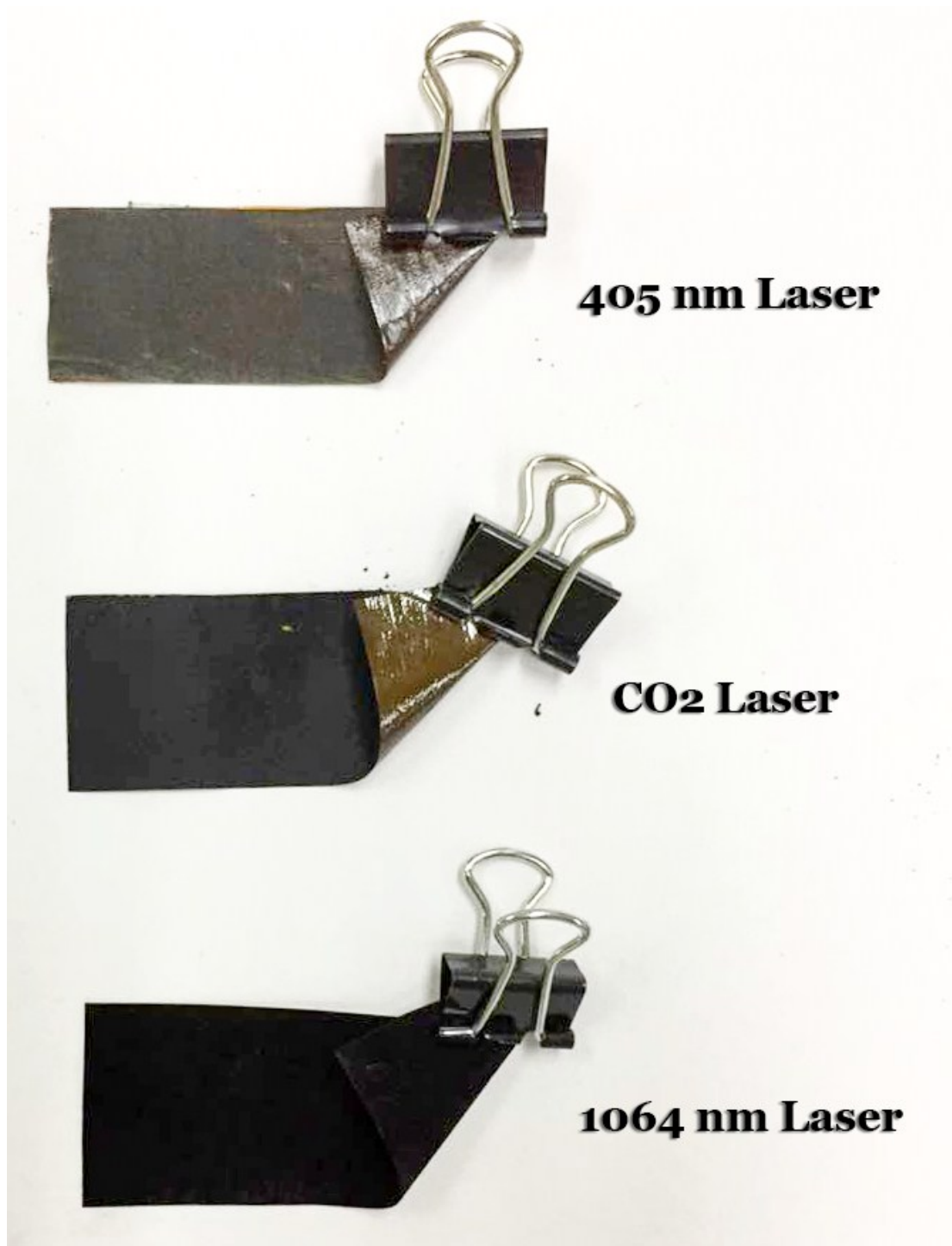Hong Kong Polytechnic University, Hong Kong
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Figure S1. Optical photo of scribed polyimide using 405 nm, CO2 laser and 1064 nm laser, respectively. Only the 1064 nm laser can carbonize the bottom of polyimide.

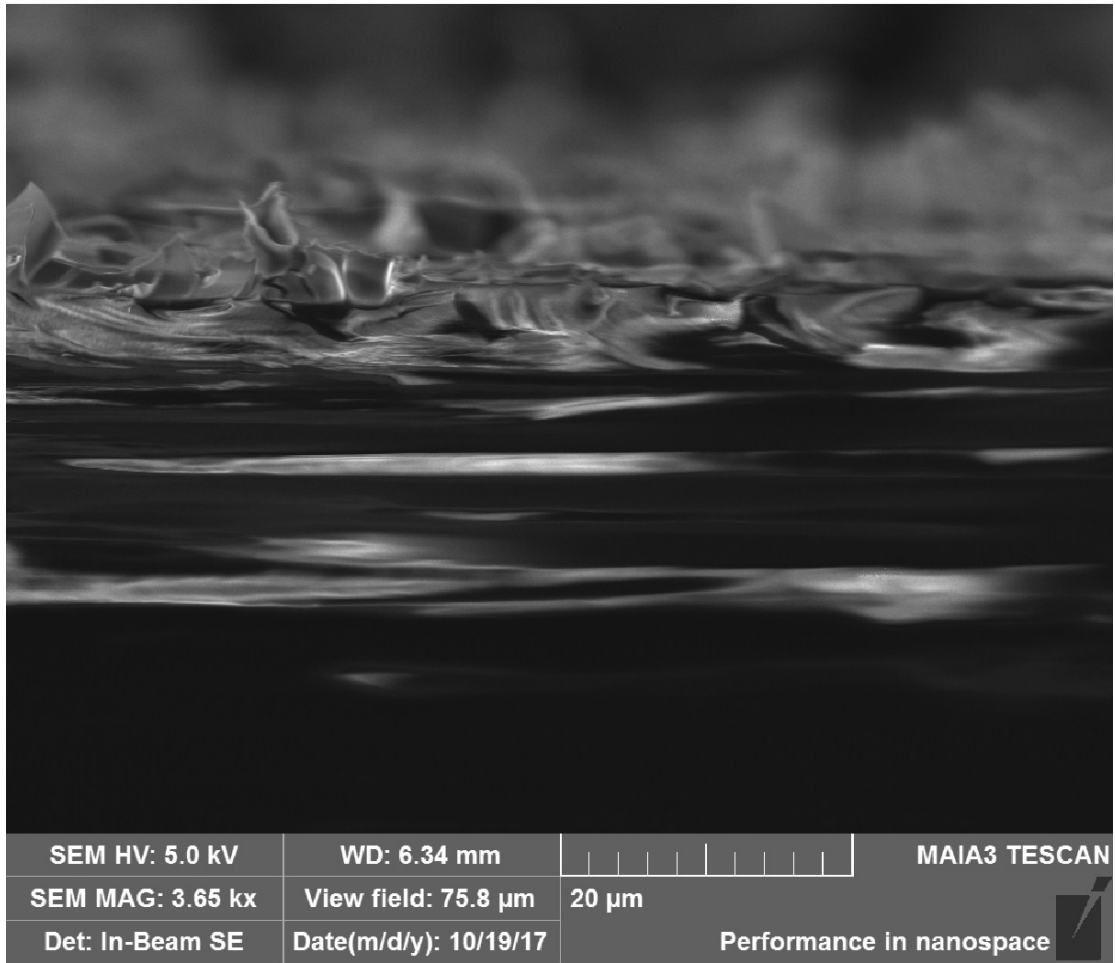| SEM HV: 5.0 kV | WD: 6.34 mm | | MAIA3 TESCAN |
| SEM MAG: 3.65 kx | View field: 75.8 µm | 20 µm | |
| Det: In-Beam SE | Date(m/d/y): 10/19/17 | | Performance in nanospace |

Figure S2. Cross-sectional SEM image of the polyimide after 405 nm laser treatment.
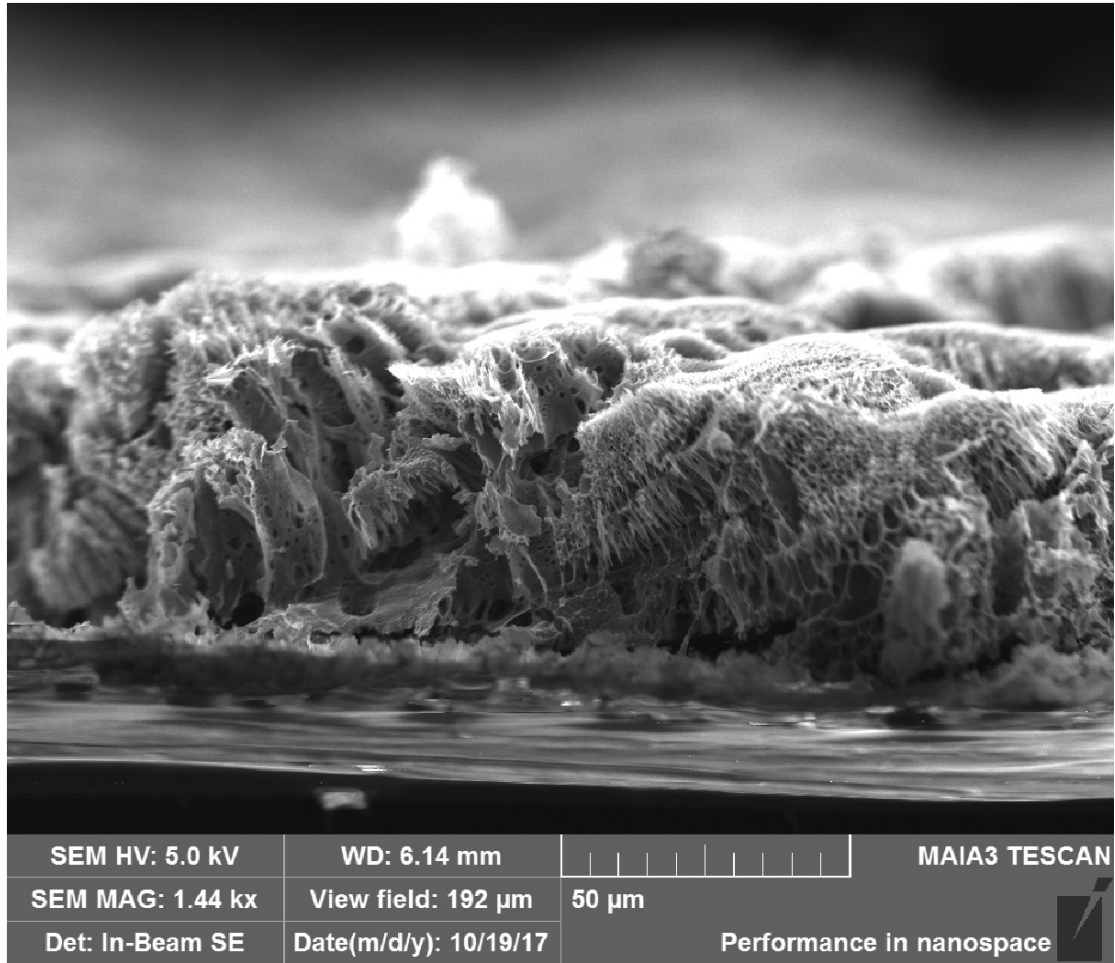
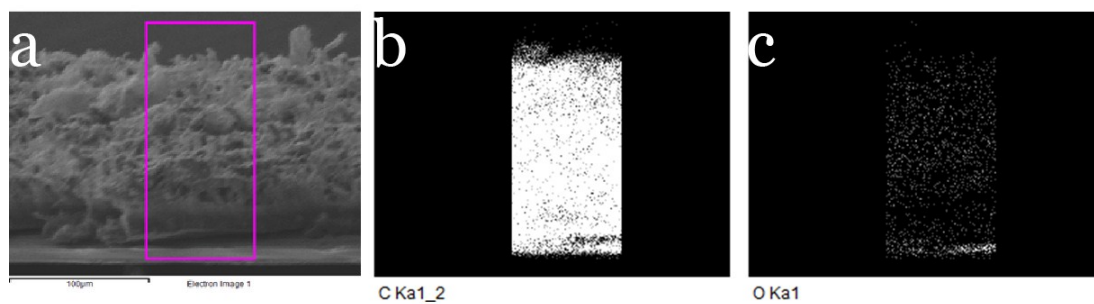Figure S3 Cross-sectional SEM image of the polyimide after 10,600 nm (CO_2) laser treatment.

Figure S4. Cross-sectional SEM (a) and EDX mapping of (b) Carbon and (c) Oxygen elements for Janus membranes.
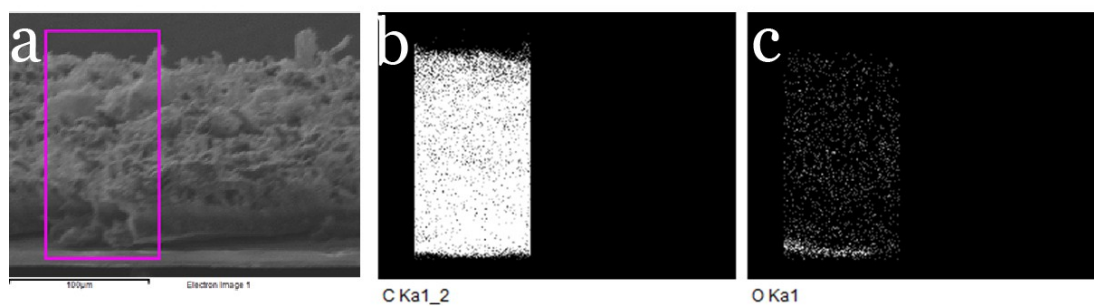

Figure S5. Another cross-sectional SEM (a) and EDX mapping of (b) Carbon and (c) Oxygen elements for Janus membranes at different locations.

Element	Weight%	Atomic%
C K	98.57	98.92
O K	1.43	1.08
Totals	100.00	
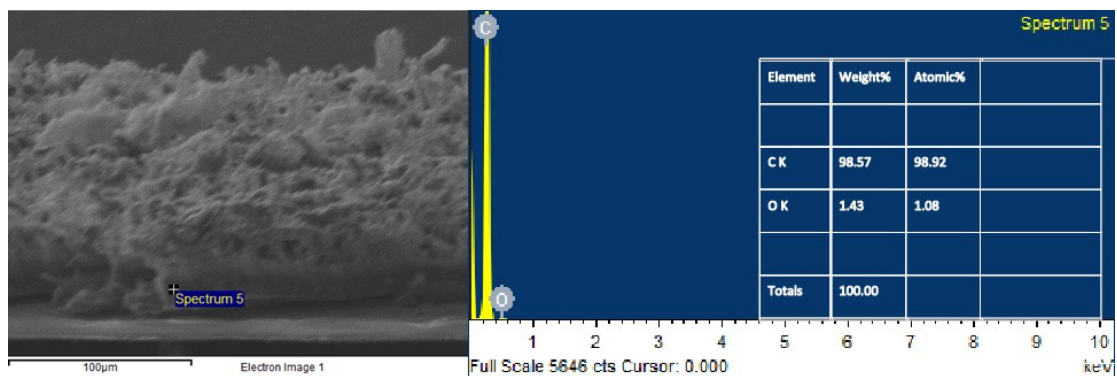
Figure S6. Cross-sectional SEM (a) and EDX (b) of the superhydrophilic part of the Janus membranes.

Element	Weight%	Atomic%
C K	97.74	98.29
O K	2.26	1.71
Totals	100.00	
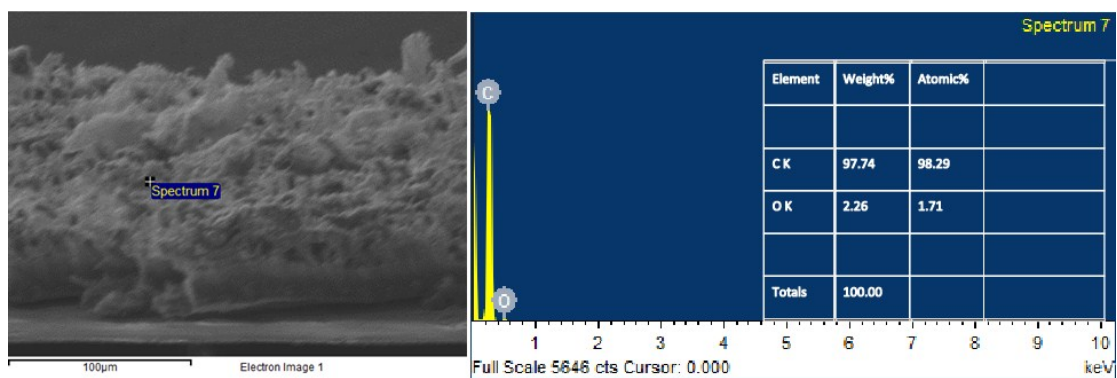
Figure S7. Cross-sectional SEM (a) and EDX (b) of the middle part of the Janus membranes.

Element	Weight%	Atomic%
C K	96.10	97.04
O K	3.90	2.96
Totals	100.00	

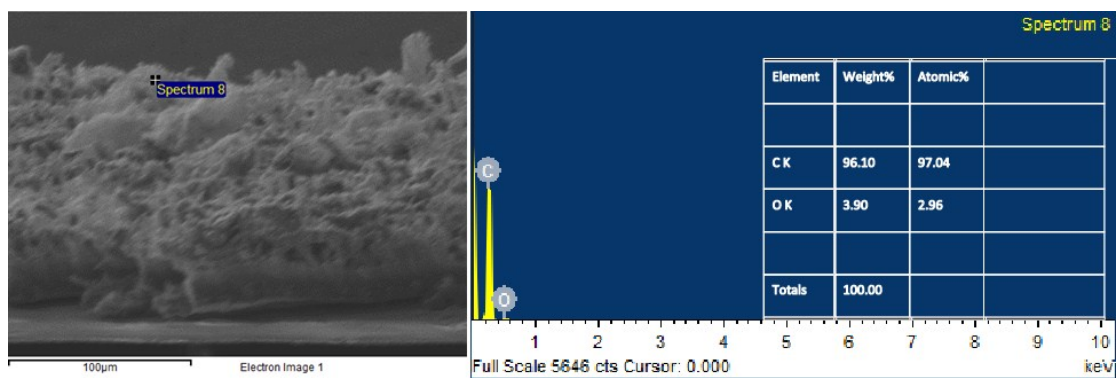Figure S8. Cross-sectional SEM (a) and EDX (b) of the superhydrophobic part of the Janus membranes.

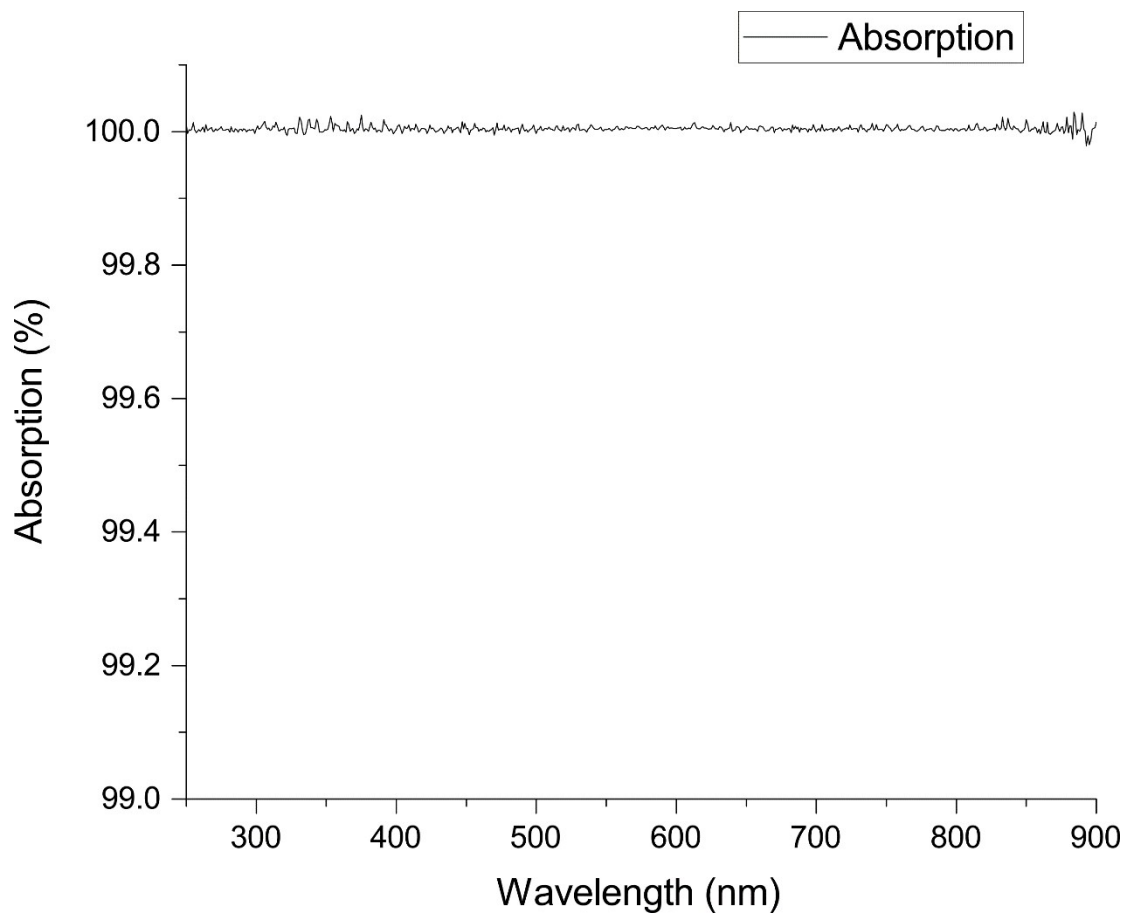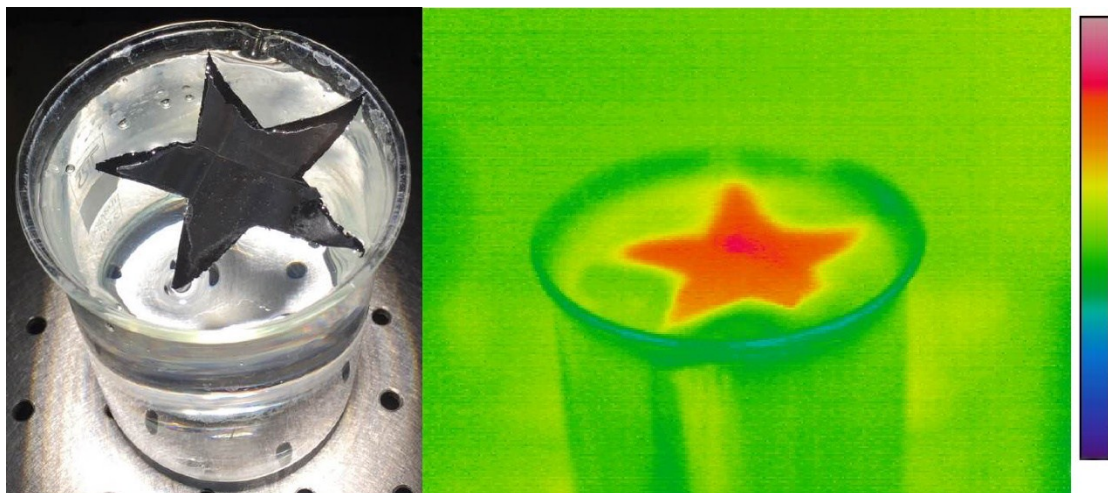Figure S9. FTIR of the Janus membranes.

Figure S10. Optical and IR image of a star shape generator under 1 sun illumination.

Table S1 Green indexes of different solar steam generators.

Type	Involving organic solvent?	Involving metal?	Involving halogen?	Involving acid or alkaline?	Solid or liquid waste?	Amount of raw materials end up in product?
Current work	X	X	X	X	X	High
Double layer carbon[1]	X	O	X	O	O	Low
thin-film black gold membranes[2]	X	O	O	O	O	Low
Porous graphene with N doping[3]	O	O	O	O	O	Low
Airlaid-paper-based AuNP film[4]	X	O	O	O	O	Low
Polypyrrole coated stainless steel mesh[5]	X	O	O	O	O	Low
GO films with 2D water path[6]	X	X	O	O	O	High
Gold-deposited nanoporous template[7]	X	O	X	X	X	High
3D Al NPs plasmonic on AAO[8]	X	O	O	O	O	High
Flexible wood membrane/CNT[9]	O	X	X	O	O	High
GO aerogels[10]	O	X	X	O	O	High
MXene Ti_3C_2[11]	O	O	O	O	O	Low
3D printed CNT/GO/NFC[12]	X	O	O	O	O	Low
CVD graphene foam on Ni foam[13]	X	O	X	X	X	High
Narrow-Bandgap Ti_2O_3[14]	X	O	X	X	O	High
Mushroom[15]	X	X	X	X	X	High
Functional hydrophilic reduced graphene oxide[16]	X	X	X	O	O	High
Black TiO_x NPs on stainless steel[17]	X	O	O	O	O	Low
Carbonized wood[18]	X	X	X	X	X	High

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