Supplementary Materials

Photothermal-driven water-gliding microrobots based on fully integrated flexible sensors with heterogeneous wettability

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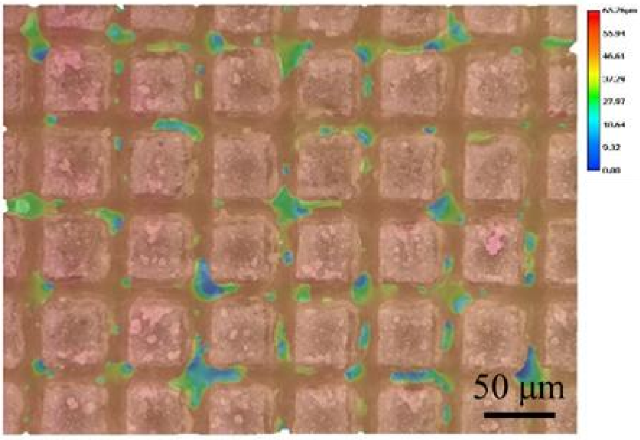
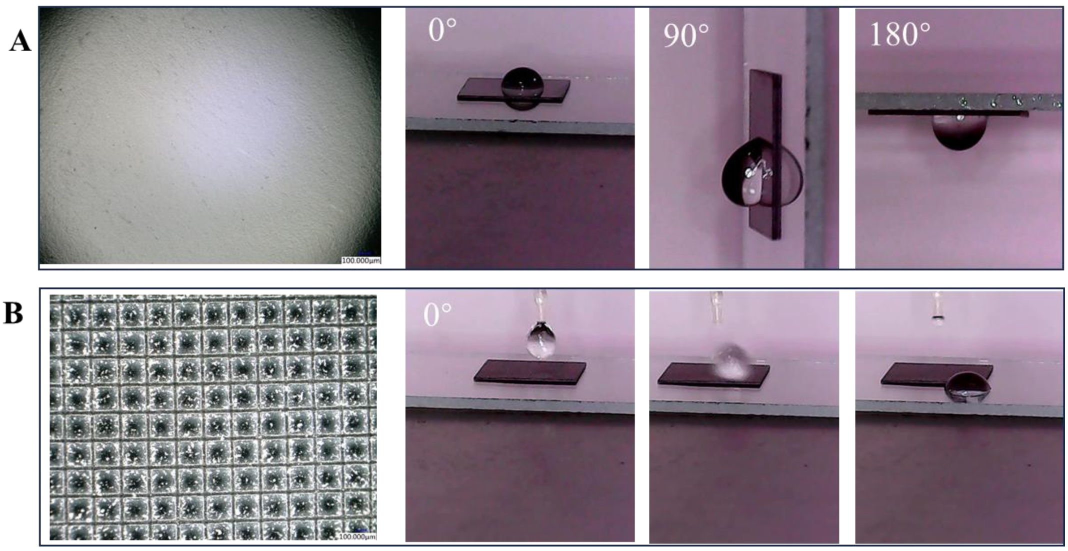
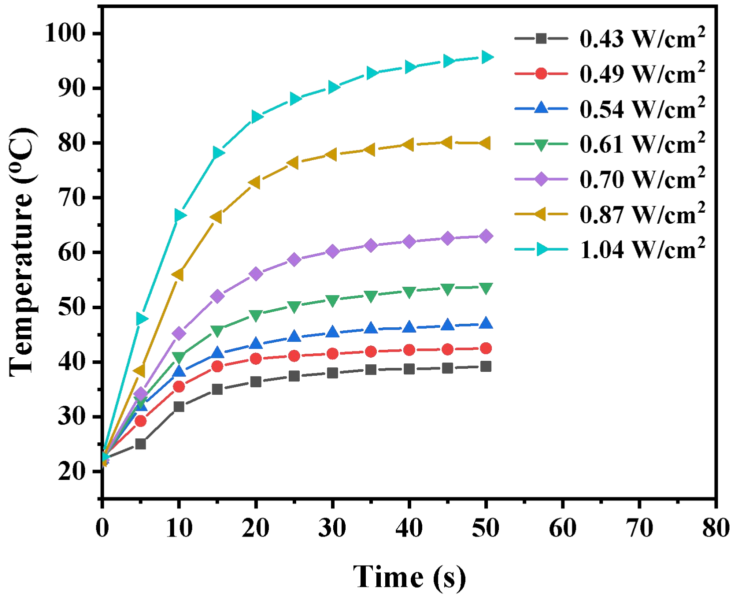


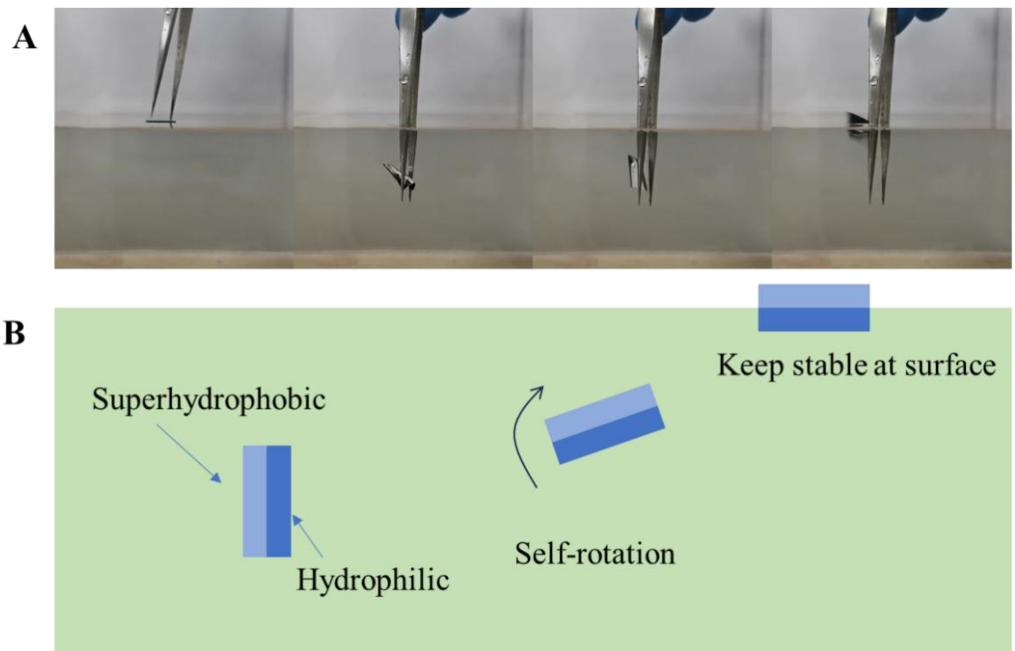
Supplementary Figure 1. 3D optical photograph of the surface of a rough sample sculpted by a laser.



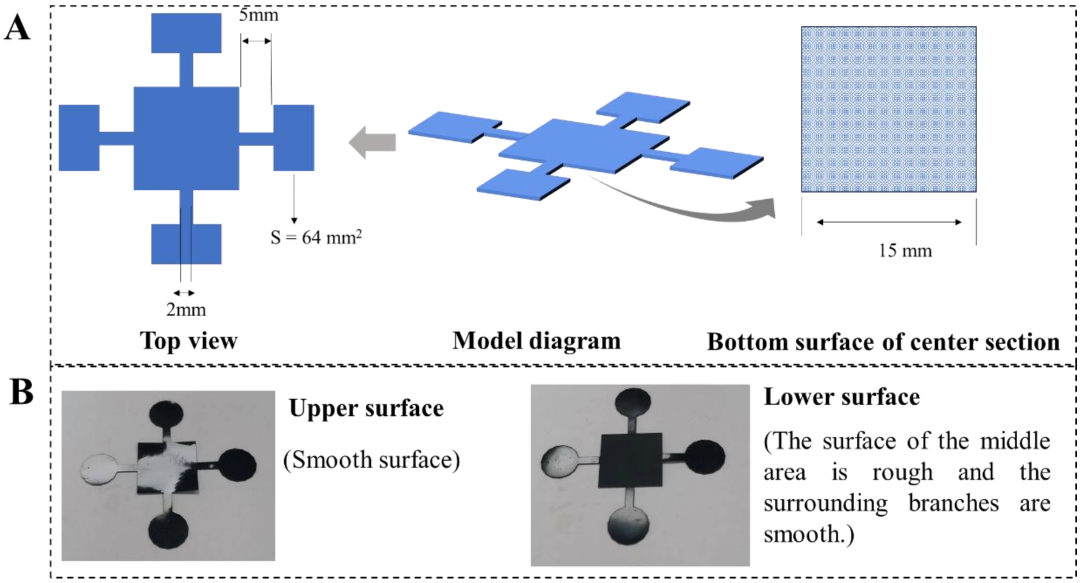
Supplementary Figure 2. (A) Optical microscope photograph of the untreated PDMS/CNT sample and the adhesion of water droplets in the sample at different tilt angles. (B) Optical microscope photograph of the carved sample and the state of water falling on a flat sample. The volume of the drop is 20 µL.



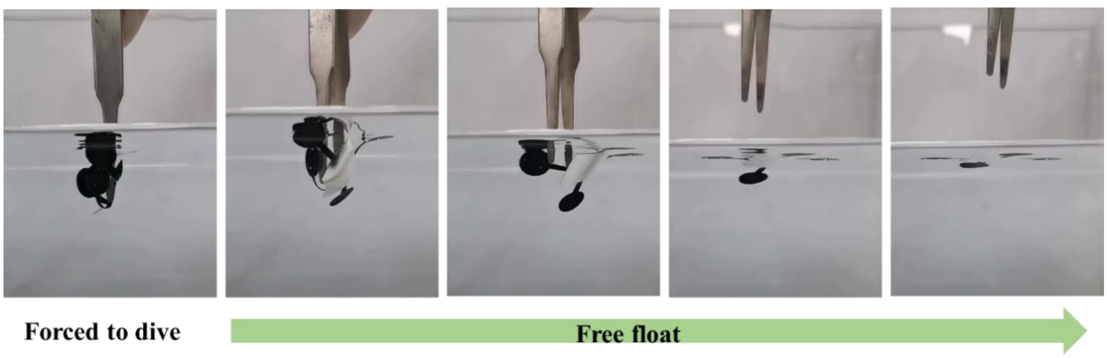
Supplementary Figure 3. Photothermal conversion effect of PDMS/CNTs. The relationship between temperature and irradiation time under different illumination conditions.



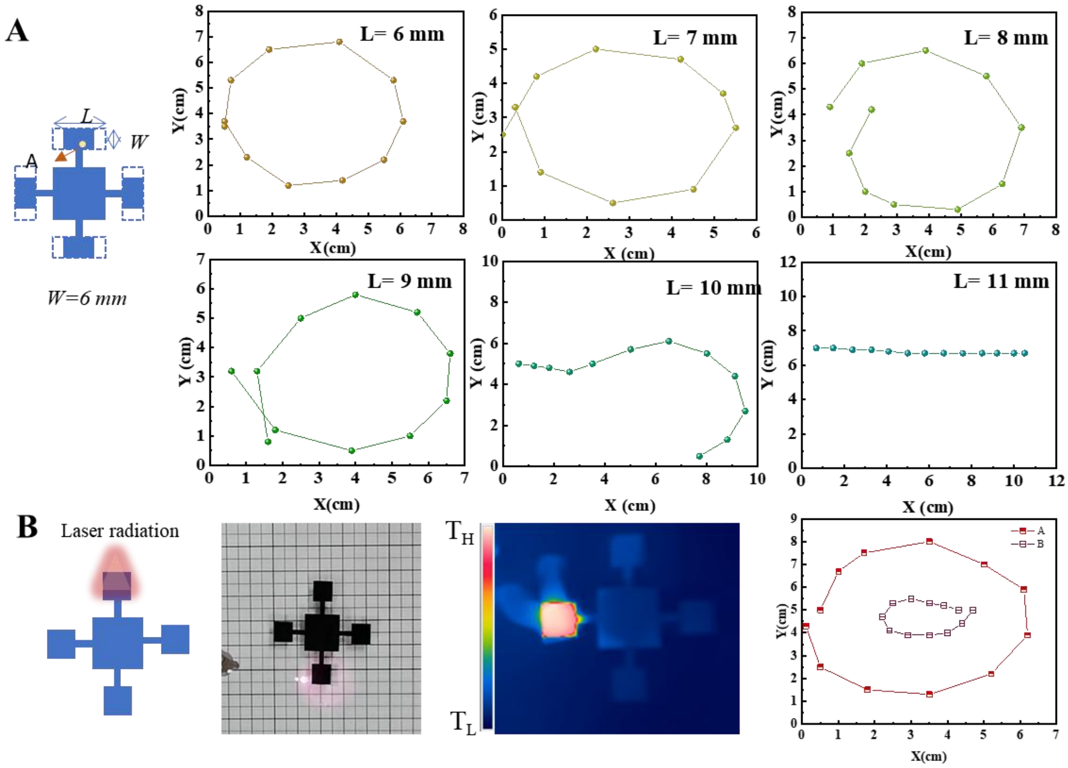
Supplementary Figure 4. (A) The underwater floating process of the square Janus sample including its self-rotation, upward floating, and penetration through the water surface. (B) Schematic diagram of the floating behavior of the square Janus sample.



Supplementary Figure 5. (A) Detailed structural parameters of the floating actuator with custom shapes. (B) Physical photographs of the sample actuator with circular irradiated zone.



Supplementary Figure 6. The underwater floating process of the actuator with custom shape, showing that the superhydrophobic surface (with typical silver mirror phenomenon) of the actuator is always located at the solid-liquid interface.



Supplementary Figure 7. (A) Schematic and motion trajectory of the actuator with adjustable length with the constant width of rectangular irradiated region. (B) Structure diagram, thermal imaging and trajectory of actuators with square irradiated region.

Supplementary Table 1. A comparison of structural parameters and properties between well-known BWSRs and this work

Propulsive mode	**Size**	**Weight (g)**	**Max. velocity (mm/s)**	**Intergation (Y/N)**	**Ref.**
Piezoelectric effect	>10 cm	0.67	23	N	[1]
DC motor	>21 cm	6	200	N	[2]
DC motor	>27 cm	7.85	90	N	[3]
DC motor	>14 cm	6.1	87	N	[4]
DC motor	>20 cm	21.7	71.5	N	[5]
Thermal-induced Deformation	>11 cm	0.07	2	N	[6]
DC motor	15 cm	3.88	150	N	[7]
DC motor	>12 cm	3.9	160	N	[8]
Steering engine	19 cm	27.9	--	N	[9]
DC motor	39.4×33×7 cm	137	243	N	[10]
DC motor	11×10.7×3.4 cm	20.9	73.7	Y	[11]
Marangoni effect	6.5×5 cm	1.98	20	Y	This work

Supplementary References:

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