Supplementary Information

Conformable superoleophobic surface with multi-scale structures on polymer substrate

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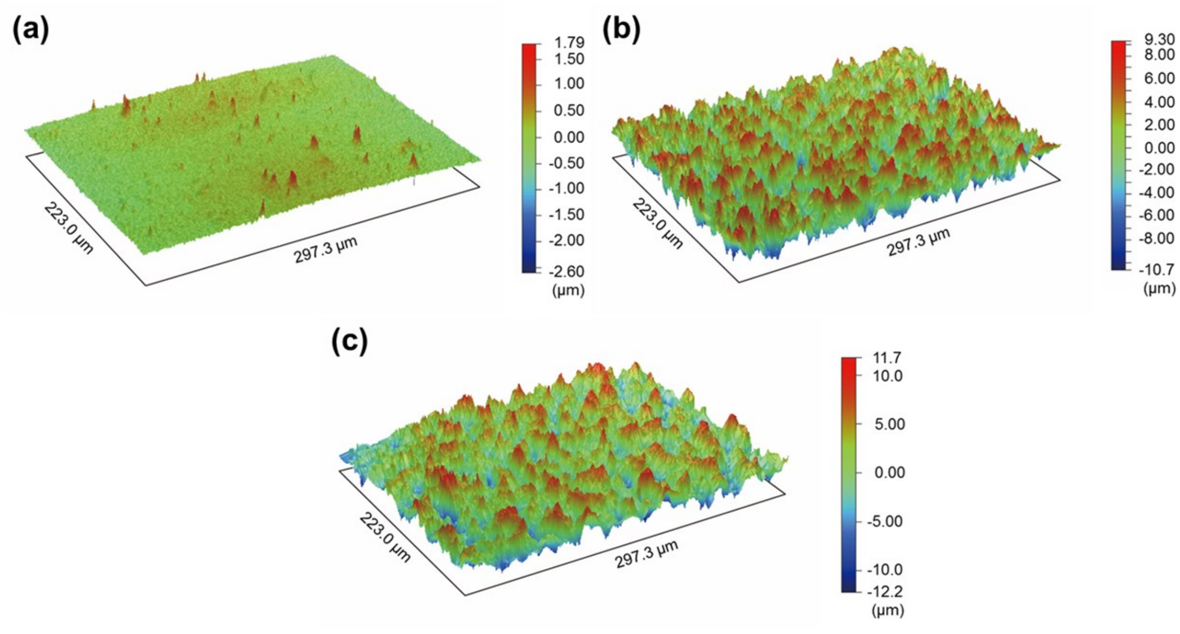

Fig. S1 3D profiler images of the pristine PP film, chemically etched film, and PD-coated and etched film.

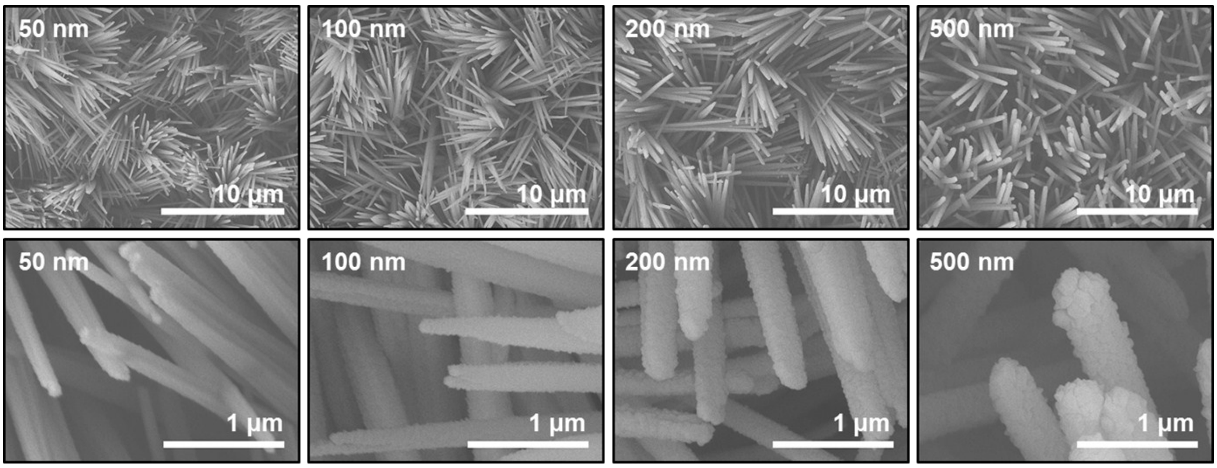

Fig. S2 SEM images of $Cu(OH)_2$ NWs with Al deposition thicknesses of 50 nm, 100 nm, 200 nm, and 500 nm.

Table S1. Change in the diameter at the tip of the NWs after Al deposition.

	Nominal Al deposition thickness [nm]				
	0	50	100	200	500
Diameter [nm]	100-200	100-200	150-250	250-350	450-550

Table S2. Change in the diameter at the tip of the NWs with NFs after boiling.

	Nominal Al deposition thickness [nm]			
	50	100	200	500
Diameter [nm]	250-350	450-550	700-800	1100-1300

Table S3. CA and SA values for liquids with various surface tensions on the fluoroalkylsilane coated surfaces.

Liquids	Nominal Al deposition thickness									
	0 nm		50 nm		100 nm		200 nm		500 nm	
	CA [°]	SA [°]	CA [°]	SA [°]	CA [°]	SA [°]	CA [°]	SA [°]	CA [°]	SA [°]
water	168.5 ± 2.0	1.5 ± 0.2	168.7 ± 2.5	2.0 ± 0.5	165.8 ± 0.3	1.7 ± 0.2	174.3 ± 2.0	1.3 ± 0.6	169.1 ± 2.2	2.1 ± 0.4
glycerol	164.7 ± 3.0	3.5 ± 0.6	166.7 ± 2.6	2.8 ± 1.1	164.1 ± 2.6	5.4 ± 1.1	167.0 ± 3.9	1.9 ± 0.8	166.7 ± 3.0	3.5 ± 0.9
ethylene glycol	160.3 ± 0.8	17.1 ± 4.0	166.2 ± 2.9	5.4 ± 1.4	163.6 ± 3.0	4.8 ± 0.6	167.8 ± 2.8	3.4 ± 0.7	162.8 ± 3.2	4.9 ± 0.6
rapeseed oil	152.5 ± 1.7	38.4 ± 5.0	156.2 ± 3.5	19.0 ± 2.9	155.2 ± 2.2	7.7 ± 5.2	164.7 ± 2.5	4.0 ± 1.0	161.2 ± 3.6	8.5 ± 1.1
hexadecane	149.1 ± 0.5	-	156.7 ± 4.2	24.5 ± 3.0	155.4 ± 2.1	14.7 ± 3.5	165.0 ± 1.8	7.5 ± 3.3	160.4 ± 3.0	6.4 ± 2.1
dodecane	136.4 ± 6.1	-	143.3 ± 5.6	30.2 ± 4.9	157.1 ± 4.1	23.4 ± 3.6	161.4 ± 3.4	12.1 ± 0.3	159.0 ± 6.0	10.8 ± 2.0
decane	121.2 ± 6.3	-	135.2 ± 6.1	35.7 ± 5.8	151.4 ± 4.6	35.5 ± 11.1	161.4 ± 1.8	11.4 ± 1.5	151.7 ± 2.3	12.5 ± 0.6

Table S4. Surface tensions of various liquids at 20°C.[1,2]

Liquid	Surface tension, γ [mN m^{-1}]
decane	23.8
dodecane	25.3
light crude oil	25.6
hexadecane	27.0
rapeseed oil	35.5
ethylene glycol	48.1
glycerol	60.3
water	72.4

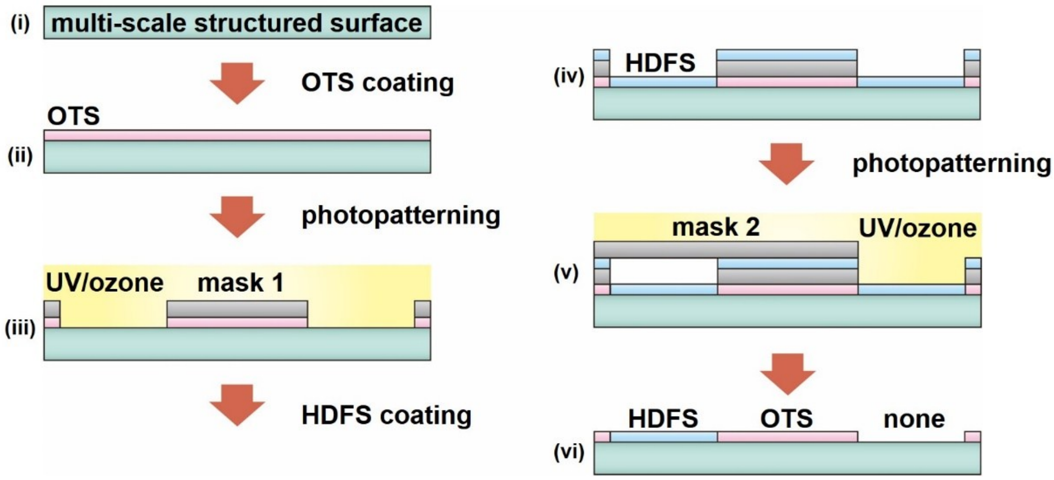

Fig. S3 Schematic of the procedure used to produce a wettability-pattern surface with heterogeneous surface energy.

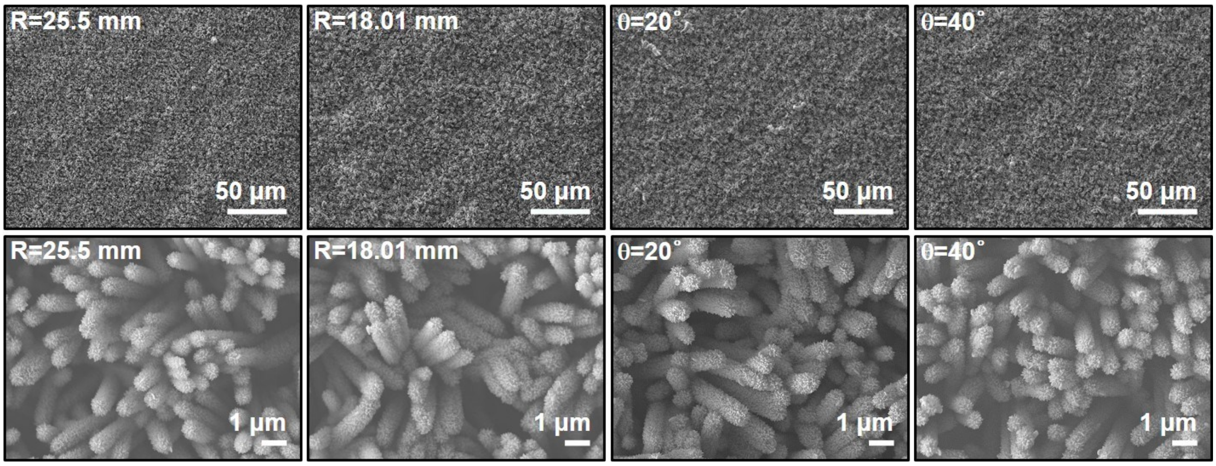

Fig. S4 SEM images of the prepared surface after 10,000 cycles of bending and twisting.

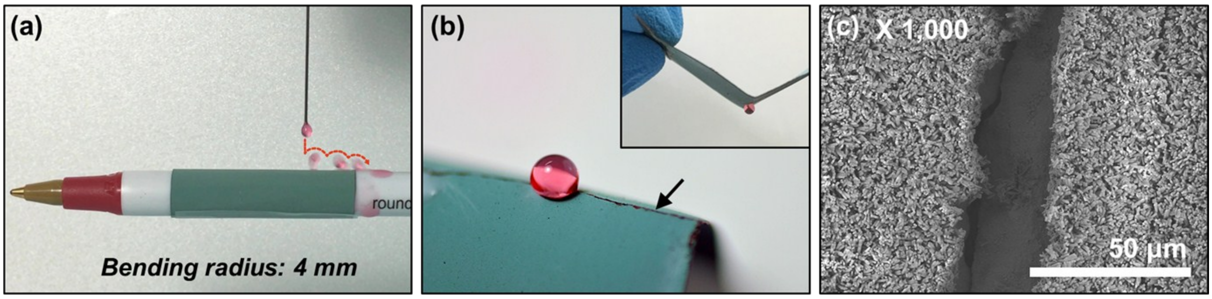

Fig. S5 (a) Photograph of the superoleophobic surface wrapped around a ballpoint pen (radius of 4 mm). (b) A hexadecane drop on the surface after the sample was folded in half. The inset shows the droplet hanging on the upside down surface. (c) SEM image of the cracked area indicated by the arrow in (b).

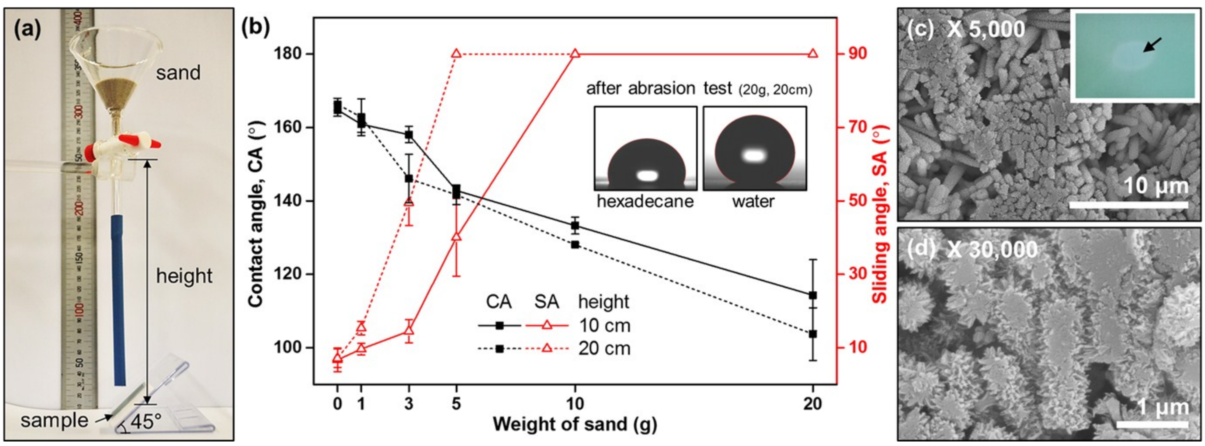

Fig. S6 (a) The experimental setup of the sand abrasion test. (b) Changes in CA and SA of hexadecane after the abrasion test. (c, d) SEM images of the superoleophobic surface after 20 g of sand abrasion from a height of 20 cm. The black arrow in the inset shows an optical image of the abraded area.

References

1 T.-S. Wong, S. H. Kang, S. K. Y. Tang, E. J. Smythe, B. D. Hatton, A. Grinthal and J. Aizenberg, *Nature*, 2011, **477**, 443.
2 S. Pechook, N. Kornblum and B. Pokroy, *Adv. Funct. Mater.*, 2013, **23**, 4572.