Supporting information for

Synthesis and characterization of omniphobic surfaces with thermal, mechanical and chemical stability

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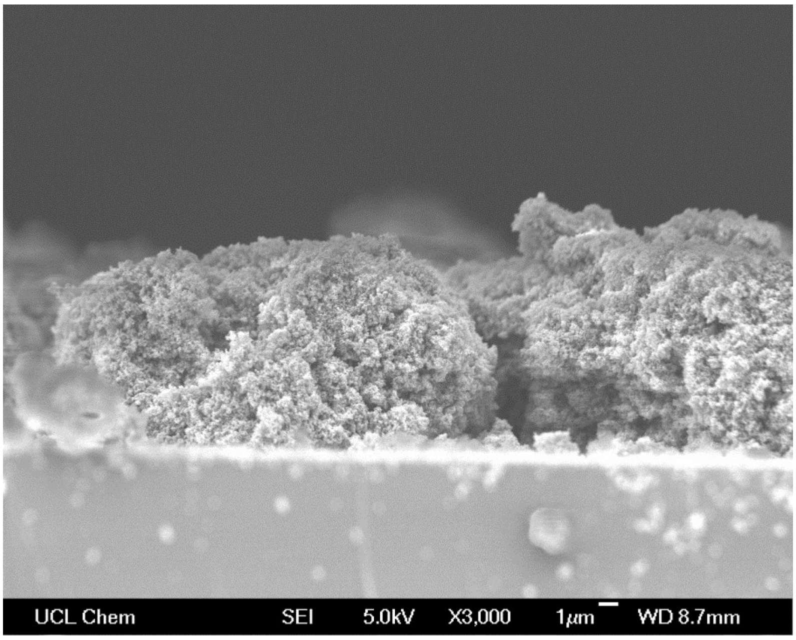
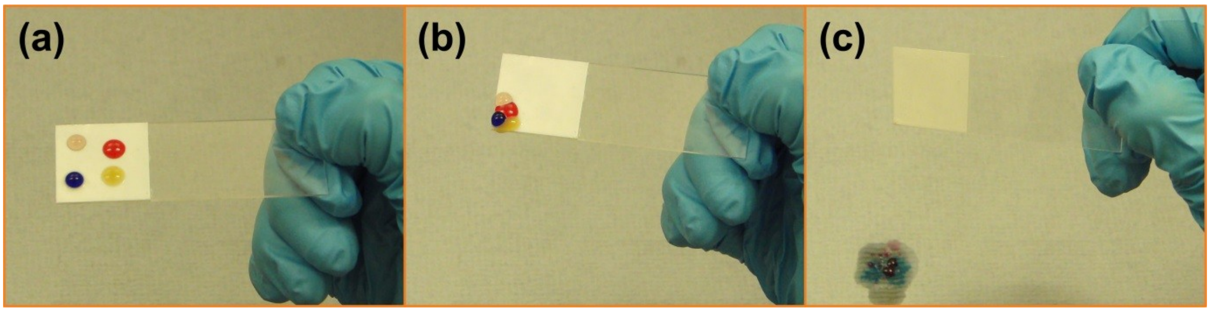
Supporting Tables and Figures

Supplementary Table S1. Viscosities (cST) of lubricants at different temperatures and boiling points (1 atm) and estimated useful range (UR, based on pour point and where evaporation is approximately 10%) are according to the respective product information[1,2]. The densities of lubricants at room temperature (~20 °C) were calculated by weighing the mass of a 1 ml volume of the lubricants using an analytical balance Ohaus; δ = 0.01 mg.

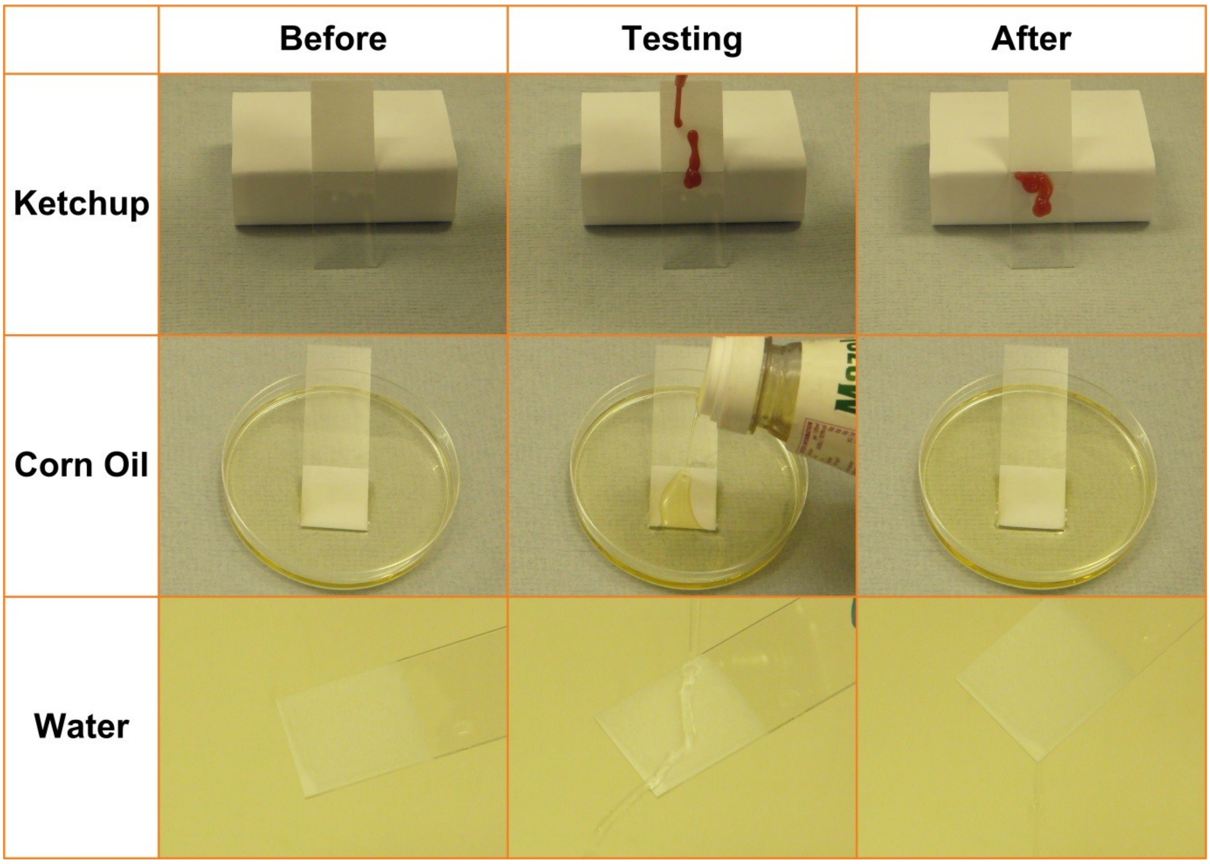
Temperature (°C)	Fluorinert FC-70	Krytox 100B	Krytox 104A
20	~ 18	12.4	177
40	~ 5.6	5.5	60
100	~ 1.03	—	8.4
Boiling points/UR (°C)	215	-70 — 66	-51 — 179
Density at room temperature (g/cm^3)	2.01042	1.84292	1.85270



Supplementary Fig. S1. Cross-sectional SEM image of the SH paint treated glass substrate. The thickness of the SH coating was ~14 ± 1 μm.



Supplementary Fig. S2. Four liquids contaminating tests on a SLIPS glass surface, the liquids are hexadecane (red), red wine (light red), coffee (yellow) and water (blue), respectively. (a) Liquids were staying on the surface and moving slowly. (b) Liquids got together and tended to slide off. (c) Liquids slid off leaving the surface clean.



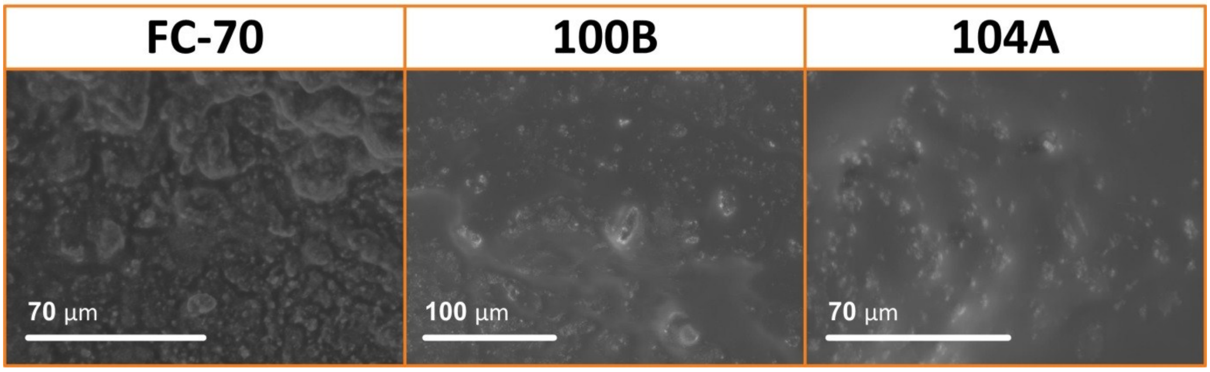
Supplementary Fig. S3. Contamination-repellent tests on the SLIPS surfaces using ketchup, running corn oil and tapped water.

Supplementary Table S2. CA of water, weight of samples and the thickness of the FC-70 lubricating layer in the multi-cycle reversible transition tests (the treated surface area is 25 mm x 28 mm).

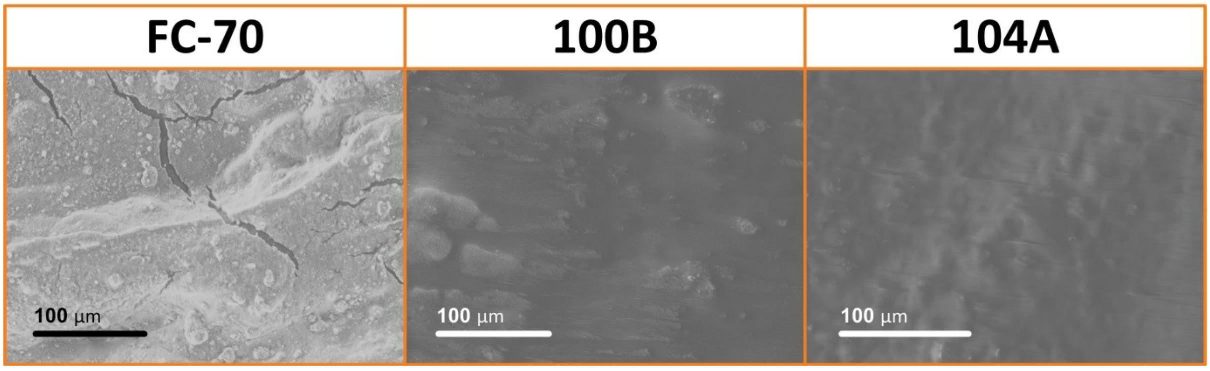
Cycles \ Data	CA (°)	Weight (g)	Thickness (μm)
0	157.8	4.7392	0
0.5	101.7	4.8686	91.950
1	160.0	4.7386	0
1.5	101.2	4.8789	99.695
2	157.7	4.7387	0
2.5	104.3	4.8526	80.935
3	160.2	4.7390	0
3.5	105.5	4.8357	68.713
4	158.6	4.7383	0
4.5	105.0	4.8593	85.981
5	157.3	4.7372	0
5.5	105.6	4.8622	88.823
6	159.7	4.7385	0
6.5	103.1	4.8722	95.005
7	159.4	4.7388	0
7.5	105.2	4.8692	92.660
8	159.0	4.7389	0
8.5	108.0	4.8932	109.643
9	155.9	4.7384	0
9.5	108.1	4.8681	92.163
10	159.4	4.7387	0
10.5	100.3	4.8931	109.714

Supplementary Table S3. Mass (g) of the Fluorinert FC-70, Krytox 100B and Krytox 104A lubricated samples and the corresponding average thickness (μm) of the lubricating layers as the increase of the heating time (the treated surface area is 25 mm x 25 mm).

Sample / Time	Fluorinert FC-70 Weight/Thickness	Krytox 100B Weight/Thickness	Krytox 104A Weight/Thickness
Before lubricants	4.5423/0	4.5575/0	4.5239/0
After lubricants	4.6522/87.464	4.6619/90.639	4.7543/198.974
After 5 min	4.5421/0	4.5571/0	4.6659/122.632
After 10 min	____	____	4.6314/92.837
After 15 min	____	____	4.5908/57.775
After 20 min	____	____	4.5862/53.803
After 25 min	____	____	4.5659/36.271
After 30 min	____	____	4.5590/30.313
After 35 min	____	____	4.5532/25.304



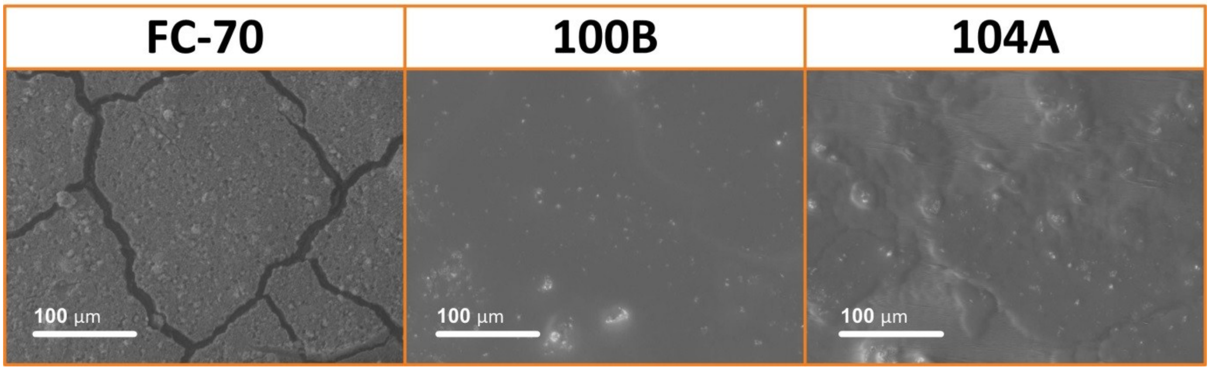
Supplementary Fig. S4. ESEM images of FC-70, 100B and 104A lubricated SLIPS surfaces. It is shown that lubricants were embedded in the SH surface structures.



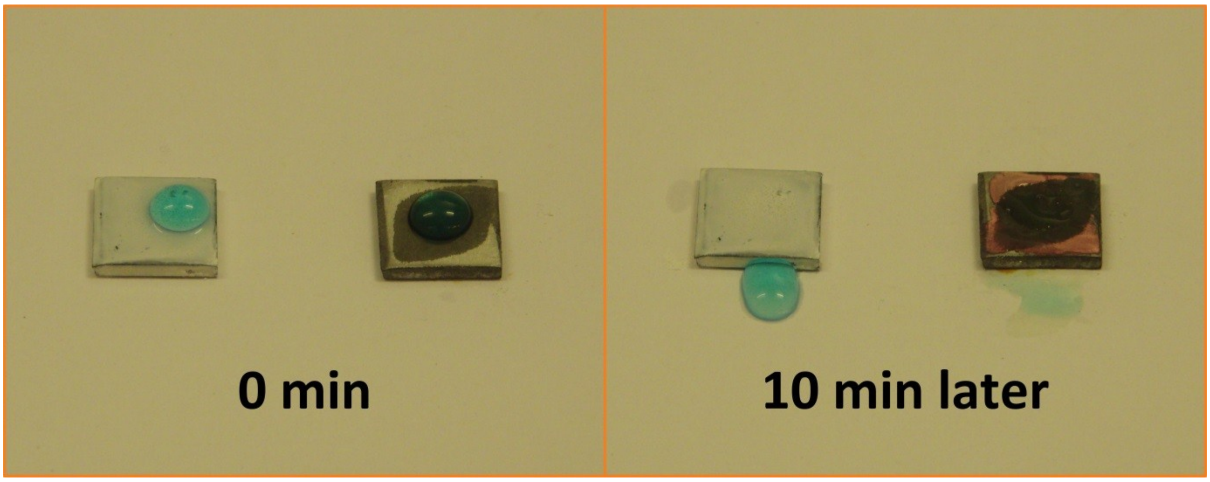
Supplementary Fig. S5. ESEM images of FC-70, 100B and 104A lubricated SLIPS surfaces after being pressed by a force of 175 N (~ 849.02 kPa).

Supplementary Table S4. Scotch tape peeling was used to test the surface robustness. Both water and corn oil sliding angles of FC-70, 100B and 104A lubricated SLIPS surfaces were measured before and after the scotch peeling tests. The data shown in this table is in degrees (°).

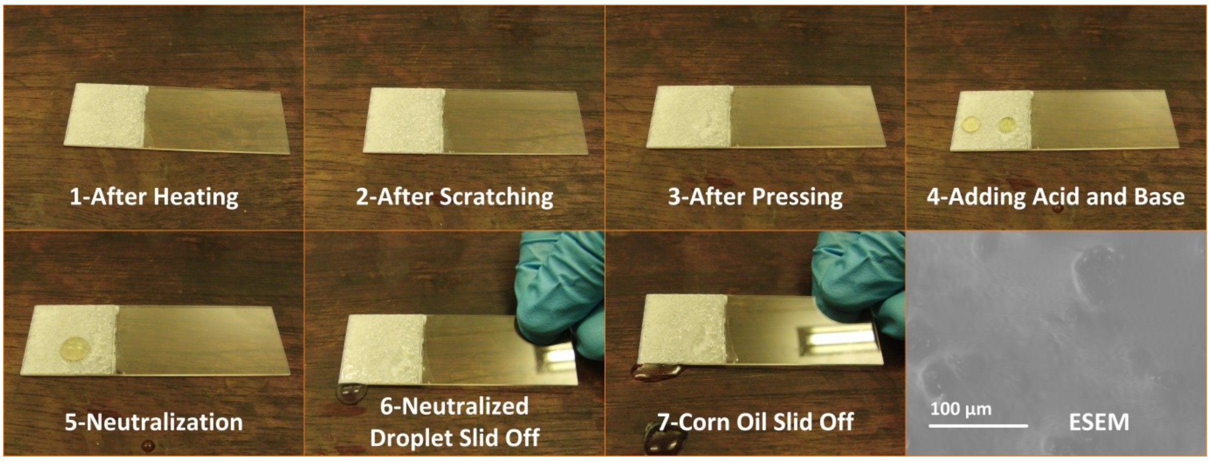
Before/After Peeling	FC 70	100B	104A
Water	1.1±0.1/2.0±0.1	0.8±0.1/1.5±0.1	4.9±0.2/5.1±0.2
Corn Oil	1.0±0.2/1.3±0.1	0.6±0.1/0.7±0.1	2.9±0.2/3.5±0.2



Supplementary Fig. S6. ESEM images of FC-70, 100B and 104A lubricated SLIPS surfaces after the acid-base neutralization.



Supplementary Fig. S7. Droplets of 0.5 mol L^{-1} $CuSO_4$ aqueous solution were positioned onto untreated mild steel and 104A lubricated SLIPS mild steel, respectively. After 10 minutes, the untreated sample was chemically etched, while the SLIPS coated mild steel did not show any traces of corrosions.



Supplementary Fig. S8. Thermal, mechanical and chemical durability tests on one single sample. The sample was heated at 200 °C, scratched, pressed at 175 N, and then acid (the right droplet, pH = 0) and base (the left droplet, pH = 14) were positioned on the sample to neutralize. After these tests, a corn oil droplet was still able to slide off, indicating the surface retained slippery and omniphobic. ESEM image shows that the surface did not significantly change after these tests, indicating that the SLIPS surface is thermally, mechanically and chemically durable.

Movie captions

Supplementary Movie S1

Water (dyed blue), coffee, red wine and corn oil were dropped onto the treated SLIPS glass surfaces to compare with the untreated parts and to test the self-cleaning ability.

Supplementary Movie S2

Water (dyed blue), coffee, red wine and corn oil were dropped onto the treated SLIPS filter paper surfaces to compare with the untreated parts and to test the self-cleaning ability. This is to show that the method of fabricating SLIPS surfaces can be applied to different substrates.

Supplementary Movie S3

Hexadecane, red wine, coffee and water droplets slid around and finally fell off the SLIPS surface. This is to show that the surface was still slippery and omniphobic when impacting different liquids together for some time.

Supplementary Movie S4

Tomato ketchup was dropped onto the treated SLIPS glass surfaces to compare with the untreated parts and to test the self-cleaning ability.

Supplementary Movie S5

Running and continuous liquid (corn oil and water) contaminations were applied to test the self-cleaning properties of the SLIPS surfaces.

Supplementary Movie S6

Recovery tests of the SLIPS surface after being inserted into liquid nitrogen. Liquids were then dropped onto the surface to test the recovery of the omniphobic property.

Supplementary Movie S7

Water and oil droplets were positioned on a (104A lubricated) SLIPS surface which had been heating for 1 min at 200 °C. The water-oil mixture was then fried to splash, and finally slid off and the SLIPS surface retained clean.

Supplementary Movie S8

Water, red wine, coffee, corn oil and hexadecane were dropped on the surface that was lubricated – heated to dry – lubricated for 10 cycles. This is to show that the surface retained self-cleaning properties after multi-cycles of the hot recovery tests.

Supplementary Movie S9

Knife cut tests: FC-70, 100B and 104A lubricated samples were cut by a knife followed by liquid dropping tests. The liquids were corn oil, red wine, coffee, and water, respectively, on each sample.

Supplementary Movie S10

Press tests: FC-70 lubricated sample was pressed by a Newton meter with a force of 175 N (~849 kPa). Then the pressed surface was tested by dropping water and oil.

Supplementary Movie S11

Acid (pH = 0, the left droplet) and base (pH = 14, the right droplet) neutralization on the FC-70, 100B and 104A lubricated samples, respectively. Acid and base droplets were guided by a knife to combine, neutralize and finally slid off.

References

[1]http://multimedia.3m.com/mws/media/64891O/fluorinert-electronic-liquid-fc-70.pdf.

[2]http://www2.dupont.com/Lubricants/en_US/assets/downloads/Typical_Properties_of_Krytox_GPL_H-58510-3.pdf.