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Effect of Lubricant Viscosity on the Self-Healing Properties and Electrically Driven Sliding of Droplets on Anisotropic Slippery Surfaces

Zubin Wang,[a] Liping Heng*[a] and Lei Jiang[a]

a. Key Laboratory of Bio-Inspired Smart Interfacial Science and Technology of Ministry of Education, Beijing Key Laboratory of Bio-Inspired Energy Materials and Devices, School of Chemistry, Beihang University, Beijing 100191, China. E-mail: henglp@iccas.ac.cn; Fax: +86 10-82627566

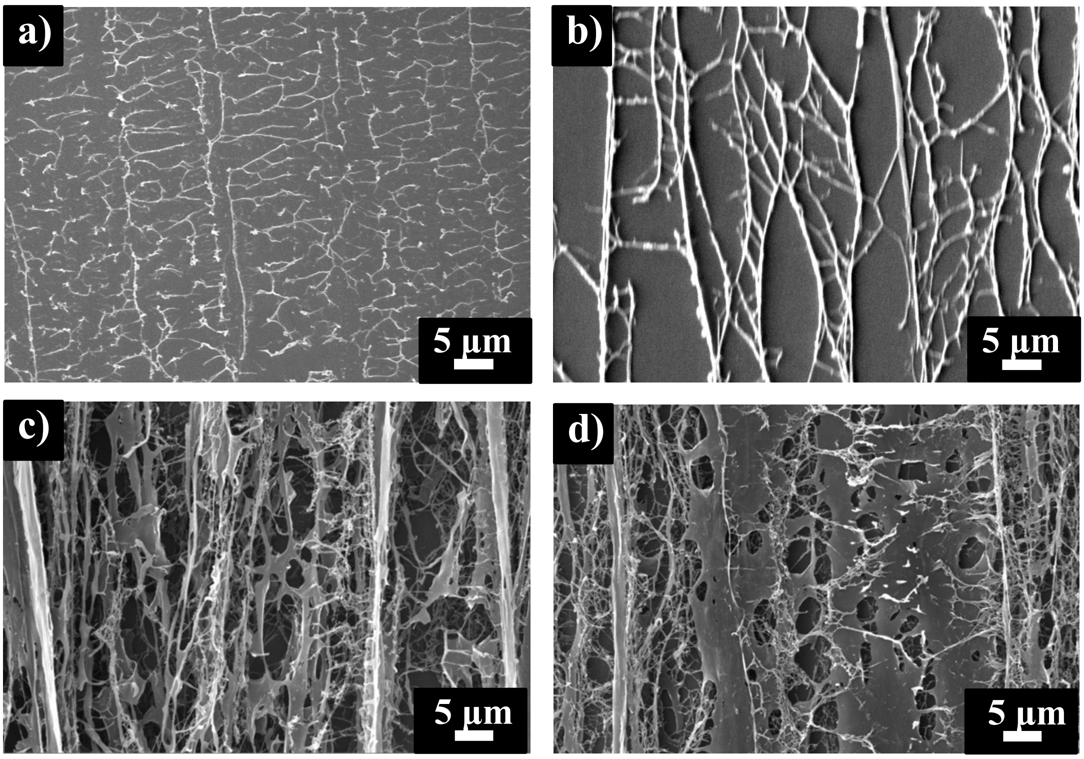

Fig. S1 SEM images of PCDTPT films prepared by directional freeze-drying using 1,2-dichlorobenzene solutions of PCDTPT at different concentrations: (a) 1 mg mL^{-1}, (b) 2 mg mL^{-1}, (c) 4 mg mL^{-1}, and (d) 6 mg mL^{-1}.

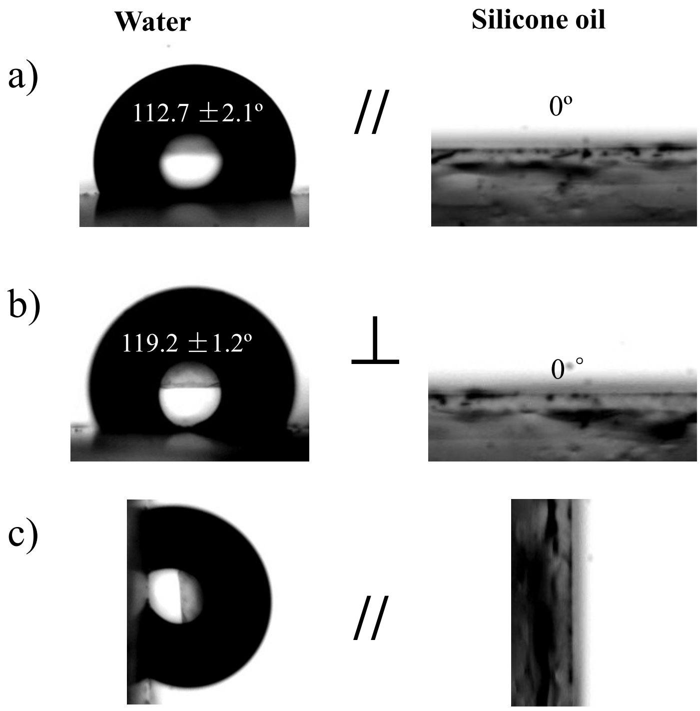

Fig. S2 Anisotropic CA images of liquid droplets on the PCDTPT directional fiber films without a coating of silicone oil. (a) CAs of water and silicone oil droplets parallel to the fiber direction (//). (b) CAs of water and silicone oil droplets in the perpendicular direction (⊥). (c) No sliding is observed on the directional porous PCDTPT films without a coating of silicone oil, even when the surfaces are tilted 90.0° in the parallel direction (//). Silicone oil possesses a low surface tension and completely spread on the film surface. The viscosity of silicone oil used here is 2 cSt.

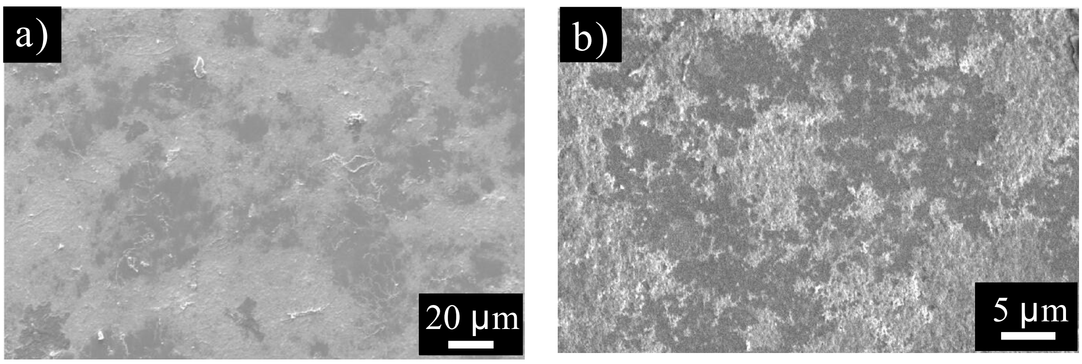

Fig. S3 SEM images of PCDTPT slippery surfaces destroyed by applying a high voltage. (a) Low-magnification image, (b) high-magnification image. The results show that the directional porous fiber structure is broken.

Table S1. The surface tension and puncture voltages of silicone oils with various viscosities.

Viscosity (cSt)	Surface tension (mN m^{-1})	Puncture voltage (kV)
2	28.09 ± 0.43	31.4
20	29.73 ± 0.26	38.5
40	29.87 ± 0.33	46.6
60	30.11 ± 0.17	51.3
80	30.46 ± 0.20	58.5
100	31.13 ± 0.25	67.6

Table S2. Comparison of the spin-coating speed for the surfaces filled with same-thickness silicone oils.

Viscosity (cSt)	Rational speed (rpm)	Thickness (μm)
2	2000	5.67
20	3000	5.67
40	3000	5.63
60	4000	5.63
80	4000	5.72
100	5000	5.68

Table S3. Anisotropic CAs and SAs of a water droplet on the directional porous PCDTPT film filled with silicone oils with different viscosities.

Viscosity (cSt)	CA //	CA ⊥	SA //	SA ⊥
2	103.4 ± 1.1°	108.3 ± 1.5°	2.3 ± 0.8°	5.9 ± 1.5°
20	104.3 ± 2.1°	109.1 ± 1.3°	2.7 ± 1.1°	6.5 ± 1.9°
40	102.5 ± 1.7°	108.7 ± 1.5°	3.3 ± 2.1°	7.4 ± 1.4°
60	102.9 ± 1.5°	109.4 ± 2.1°	3.7 ± 1.3°	7.9 ± 2.5°
80	103.3 ± 2.3°	108.6 ± 1.4°	4.3 ± 1.9°	9.1 ± 1.3°
100	104.1 ± 1.4°	110.0 ± 1.7°	4.6 ± 1.5°	10.3 ± 2.2°

Table S4. Relationship between silicone oil spin-coating speed and self-healing ability. After the PCDTPT films are scratched, increasing the spin-coating speed will increase the SAs and decrease the self-healing ability. The viscosity of the silicone oil used here is 2 cSt.

Rotational speed (rpm)	SA (//) before scratching	SA (//) after scratching
1000	2.0 ± 1.2°	2.0 ± 1.4°
2000	2.3 ± 0.8°	2.5 ± 0.6°
3000	28.4 ± 3.5°	28.6 ± 3.1°
4000	42.2 ± 3.8°	43.1 ± 3.4°
5000	58.5 ± 3.1°	71.2 ± 3.6°

Table S5. CAs of silicone oils (2 μL) with different viscosities on bare glass substrates. The CAs slightly increased with increasing silicone oil viscosity.

Viscosity (cSt)	CA (β)
2	11.2 ± 0.5°
20	12.4 ± 0.3°
40	14.1 ± 0.6°
60	15.8 ± 0.4°
80	17.6 ± 0.2°
100	20.4 ± 0.4°

Table S6. Anisotropic SAs of water droplets on the directional PCDTPT films filled with silicone oils with different viscosities when a copper wire hinders the droplet sliding (no applied voltage). The results show that the SAs in both directions are larger with the copper wire than without it.

Viscosity (cSt)	SA //	SA ⊥
2	11.5 ± 2.9°	22.7 ± 2.3°
20	12.6 ± 1.5°	23.6 ± 1.9°
40	13.8 ± 1.3°	24.9 ± 1.6°
60	14.6 ± 2.1°	26.1 ± 2.5°
80	15.7 ± 3.1°	27.0 ± 2.6°
100	17.1 ± 2.4°	28.2 ± 2.6°

Movie S1. The self-healing process of PCDTPT slippery surface infused with the 2 cSt silicone oil after physical damage when the spin-coating speed is 2000 rpm.

Movie S2. When the spin-coating speed is 5000 rpm, the PCDTPT slippery surface infused with the 2cSt silicone oil show no self-healing property after physical damage.

Movie S3. Electrically controlled water droplet sliding on the slippery surfaces infused with silicone oil of 40 cSt.