Electronic Supplementary Material (ESI) for Soft Matter

Supplementary Information

Rose Petals with Novel and Steady Air Bubble Pinning Effect in Aqueous Medium

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S1 Measurement of the critical flow velocity of water

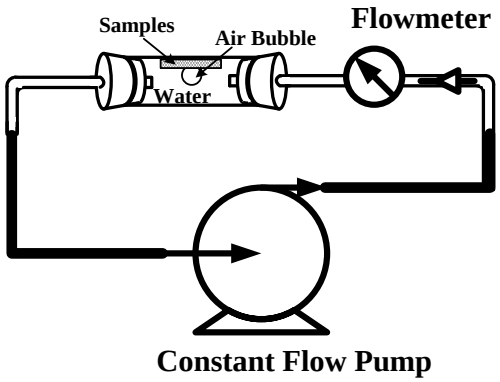

Figure S1. Experimental setup and measurement of the critical flow velocity of water, which can cause the TPCL of the air bubble slide

Schematic diagram of the experimental setup constructed to measure the critical flow velocity of water that allows the TPCL of the air bubble to slide on these surfaces is shown in Figure S1. The samples (rose petal and artificial rose petal) were fixed in a quartz tube (Φ: 25 mm) filled with water. Air bubbles were released from a needle before the measurement. A constant flow pump was used to achieve the water flow with constant and controllable speed. Besides, to avoid the turbulence，the soft samples were pasted tightly on wall of the tube, and the thickness of all the samples was kept less than 0.5 mm.

S2 ESEM images of the artificial rose petal at different stretch ratio

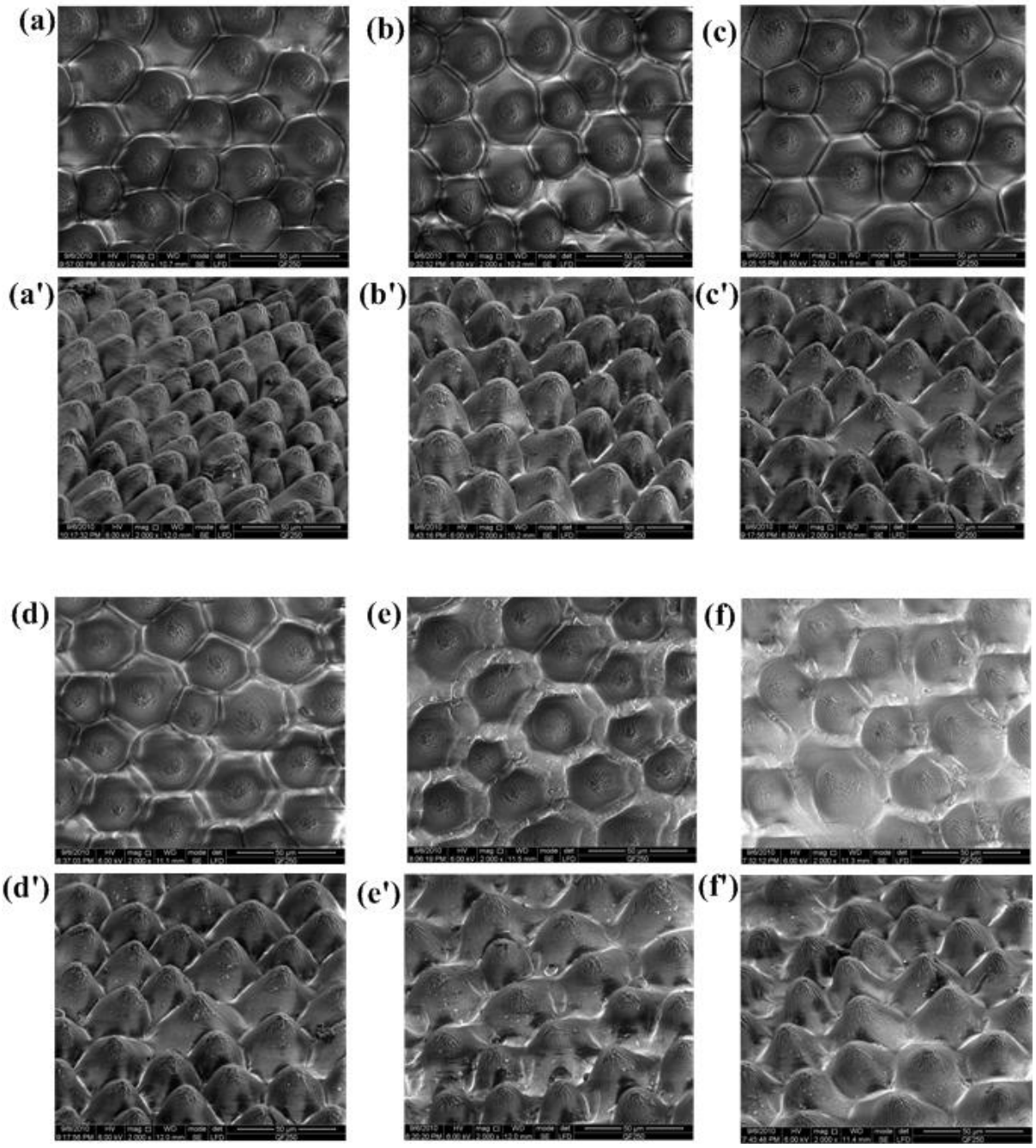

Figure S2. ESEM images of the artificial rose petal at different stretch ratio. (a) - (f) Top view of the large-area ordered artificial micropapillaes at different stretch ratio. (a′) - (f′) Side view of the large-area ordered artificial micropapillaes at different stretch ratio.

S3

Table S1 Water contact angles of the as prepared samples

Sample	Rose petal	Smooth PDMS films	PDMS films with nanofolds	PDMS films with smooth micropalliae
Water CAs	150.8±3.2°	102.7±4.8°	128.3±2.3°	147.8±5.3°

Sample	Artificial rose petal						
Stretch ratio	100%	115%	130%	145%	160%	175%	190%
Water CAs	154.7± 3.0°	151.7± 3.4°	148.3± 4.1°	147.5± 3.7°	150.8± 2.6°	143.2± 3.6°	140.7± 3.8°

S4 The calculation of *r* for nanofolds and micropapillae

According to the typical magnified ESEM image of a red rose petal surface, a periodic array of close-packed micropapillae with average 16 μm width and 7 μm height can be seen. If each micropapillae was considered as half an ellipsoid, its surface area ***A*** can be approximately calculated as in Equation S1:

$$A = \frac{2}{3}\pi\left(h^2 + 2ah\right) \tag{S1}$$

Where, ***h*** and ***a*** are the height and half of the diameter of the micropapilla, respectively. Schematic of the close-packed micropapilla array on the red rose petal is shown in Figure S3. Therefore, ***r*** of the surfaces with close-packed micropapillae is expressed as in Equation S2:

$$r_{micro} = \frac{A\left(n^2 + n/2\right)}{\left(2na\right)^2} = \frac{A\left(n + 1/2\right)}{4na^2} = \frac{\frac{2}{3}\pi\left(h^2 + 2ah\right)\left(n + 1/2\right)}{4na^2} \tag{S2}$$

Where ***n*** is the number of the micropapillae in per unit area, *i.e.*, $n = 1000/2a$.

Since $n \gg 1/2$, therefore, $r_{micro} \approx \frac{\frac{2}{3}\pi\left(h^2 + 2ah\right)}{4a^2} \approx 1.32$

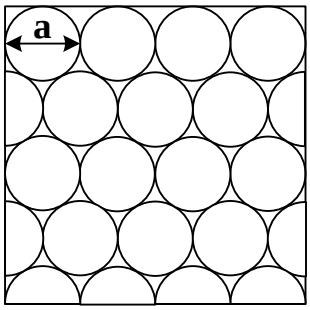

Figure S3. Schematic of the close-packed micropapilla array on the red rose petal

The schematic of nanosized cuticular folds on the top of the micropapillae is illastrated in Figure S4. Therefore, ***r*** of the surfaces with close-packed micropapillae is expressed as in Equation S3:

$$r_{nano} \approx \frac{\left(2a' + b\right)^2 + 4k\left(2a' + b\right)h' + 4bh'}{\left(2a' + b\right)^2} = 1 + 4h'\frac{k\left(2a' + b\right) + b}{\left(2a' + b\right)^2} \tag{SS}$$

Where, ***h'*** and ***a'*** are the height and thickness of the nanosized cuticular folds, respectively. ***b*** is the inside width of the cuticular folds. ***k*** is the factor that the real perimeter of the cuticular folds deviated from the schematic model perimeter.

From the ESEM image of micropapillae at higher resolution, $a' \approx 500 \sim 600$, $h' \approx 800 \sim 900$, $b \approx 400 \sim 500$, $k \geq 2.18$. Thus, $r_{nano} \geq 7.87$.

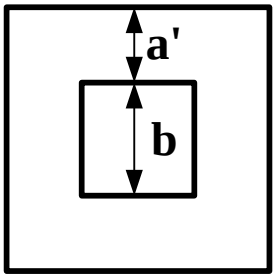

Figure S4. Schematic model of the top view of the nanosized cuticular folds on the close-packed micropapilla array