Electronic Supplementary Information

Droplet Manipulation on A Structured Shape Memory Polymer Surface

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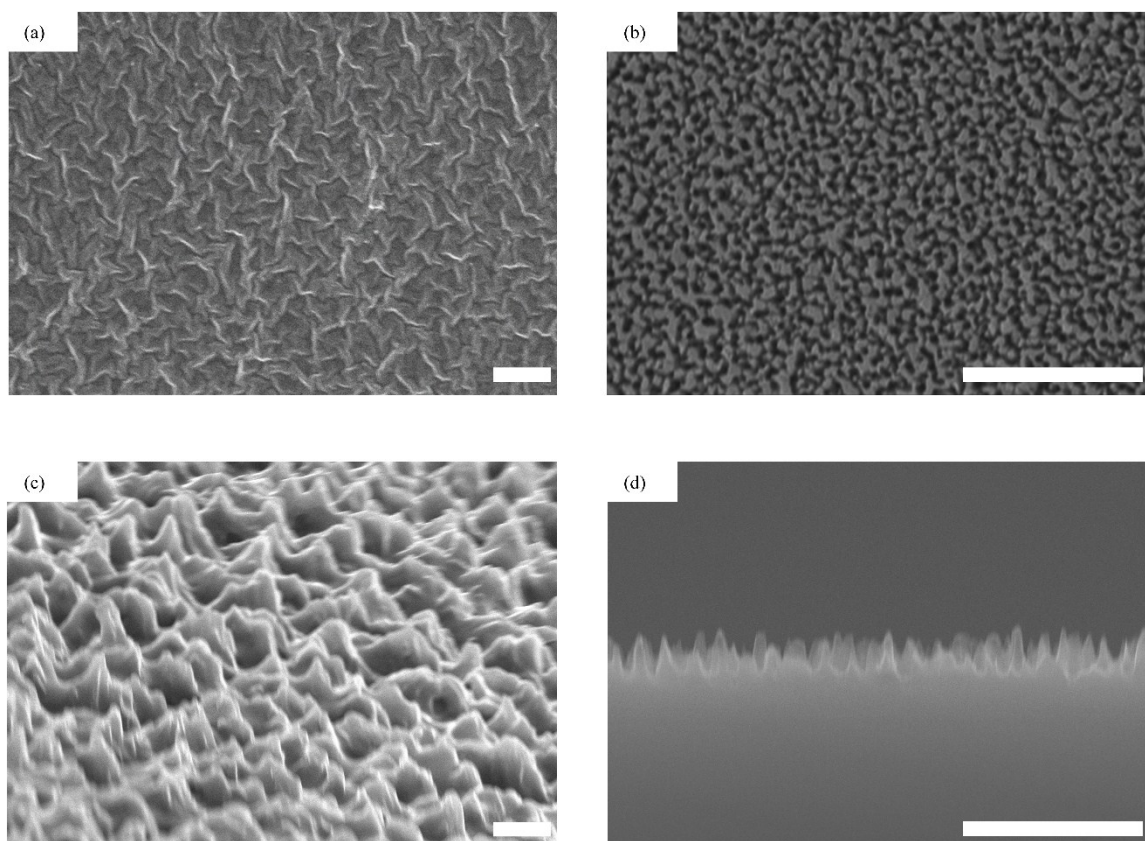
Fig 1S. SEM images of nanostructures on SMP pillar array and Si master. White scale bars indicate 1 µm (a) Nanostructure on SMP pillar array (top view), (b) Nanostructure on Si master (top view), (c) 60° tilted view of Nanostructure on SMP pillar array, (d) Side view of Nanostructure on Si master

Step by step calculation of values in Table. 1

Used values in calculations

- **Geometric values :** N_1, N_2, a, b, c, and d

N_1	N_2	a	b	c	d
1	27	96.82 μm	24.84 μm	158.60 μm	300.00 μm

- **Measured values :** apparent contact angle on nano-textured original pillar array, θ_{ori}^{*}

1. Calculating solid fractions.

On original structure

$$f_{ori} = \frac{N_1 \cdot a^2}{d^2} = 0.10$$

On deform structure

$$f_{def} = \frac{N_1 \cdot c^2 + N_2 \cdot b^2}{d^2} = 0.46$$

2. Calculating roughness ratio.

Smooth texture ; for droplet on smooth original pillar array, roughness ratio is considered as 1

$$r_{ori} = 1$$

$$r_{def} = r_{ori} + \frac{4 \cdot N_1 \cdot a \cdot h_{def}}{N_1 \cdot c^2 + N_2 \cdot b^2} = 0.19$$

Nano-texture ; roughness ratio from nano-texture, r_{ori}, is back-calculated from the measured apparent contact angle on nano-textured original pillar array, θ_{ori}^{*}.

$$r_{ori} = \frac{[(\cos\theta_{ori}^{*} + 1)/f_{ori} - 1]}{\cos\theta_Y} = 1.58$$

$$r_{def} = r_{ori} + \frac{4 \cdot N_1 \cdot a \cdot h_{def}}{N_1 \cdot c^2 + N_2 \cdot b^2} = 1.77$$

3. Calculating theoretical apparent contact angles

With Smooth texture ; values of r_{ori} and r_{def} are used those of smooth texture.

- **On original structure**
  $$\cos\theta^{*} = r_{ori} \cdot f_{ori} \cdot \cos\theta_Y + f_{ori} - 1 = 160.8°$$
- **On deformed structure**
  $$\cos\theta^{*} = r_{def} \cdot f_{def} \cdot \cos\theta_Y + f_{def} - 1 = 140.0°$$

With Nano-texture ; no calculation is done for the apparent contact angles on nano-textured original pillar array. value of r_{def} is used that of nano-texture.

- **Deformed structure**
  $$\cos\theta^{*} = r_{def} \cdot f_{def} \cdot \cos\theta_Y + f_{def} - 1 = 151.5°$$