SUPPLEMENTARY INFORMATION

Water Droplet Bouncing on a non-Superhydrophobic Si Nanospring Array

Samir Kumar,[1,2] Kyoko Namura,[1] Motofumi Suzuki,[1] and Jitendra P. Singh[2,]*

[1]Department of Micro Engineering, Graduate School of Engineering, Kyoto University, Nishikyo, Kyoto 615-8540, JAPAN.

[2]Department of Physics, Indian Institute of Technology Delhi, Hauz Khas, New Delhi 110016, INDIA.

1. Movies

Movies S1, S2, S3, and S4 show the water droplet dynamics on the VC, NS, SC, and TF samples shown in Fig. 3, respectively. The playback speed of the movie is reduced by x0.06.

2. The rebound of the water droplet on vertically aligned nanorods

In Cassie-Baxter state, the water droplet sits on the air trapped between the rough surfaces on the textured surface.[1] When a droplet impacts vertically aligned nanorod-surface, some portion of the droplet compresses the air trapped between the nanorods. If we assume that the structure is sealed, then the water droplet will be pushed by the air as a result of the relaxation of the compressive force of the trapped air, as shown in Figure 1S.

If H_0 is the total height of the trapped air columns at equilibrium, and h_0 is the distance between the droplet and surface at maximum pressure then the force F_a due to the compression of trapped air can be written as:

$$F_a = P_0 A_0 + P A_0 \quad (3)$$

Where P_0 is the standard atmospheric pressure, and P is the pressure under the water droplet due to compressed air, and A_0 is the area between nanorods. Using ideal gas law, $PV= nRT$, where V is the volume of the trapped air underwater between rough space and n is the no of moles of air present, and T is the temperature of air and R is ideal gas constant equation (3) can be rewritten as[2]:

$$F_a = P_0 A_0 + \frac{nRT}{h_0} \tag{4}$$

If F is the force caused by the water surface tension, then the water droplet will leave the surface if $F_a > F$. However, if $F_a < F$, the water droplet will not leave the surface. Figure 1S: Model to describe the water recoiling on vertically standing nanorods.

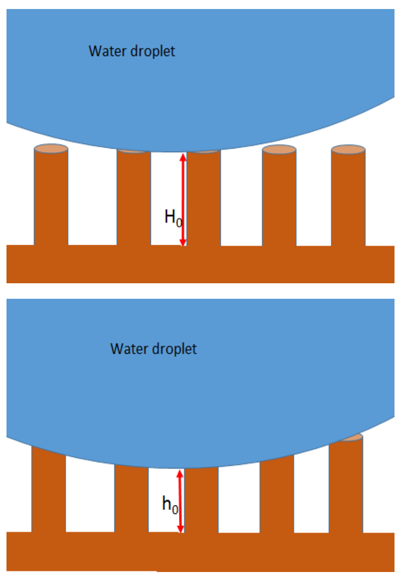

Figure S1. Model to describe the water recoiling on vertically standing nanorods. The trapped air between the nanorods can be considered as compressed because of the pressure of the impacting droplet. [3]

3.

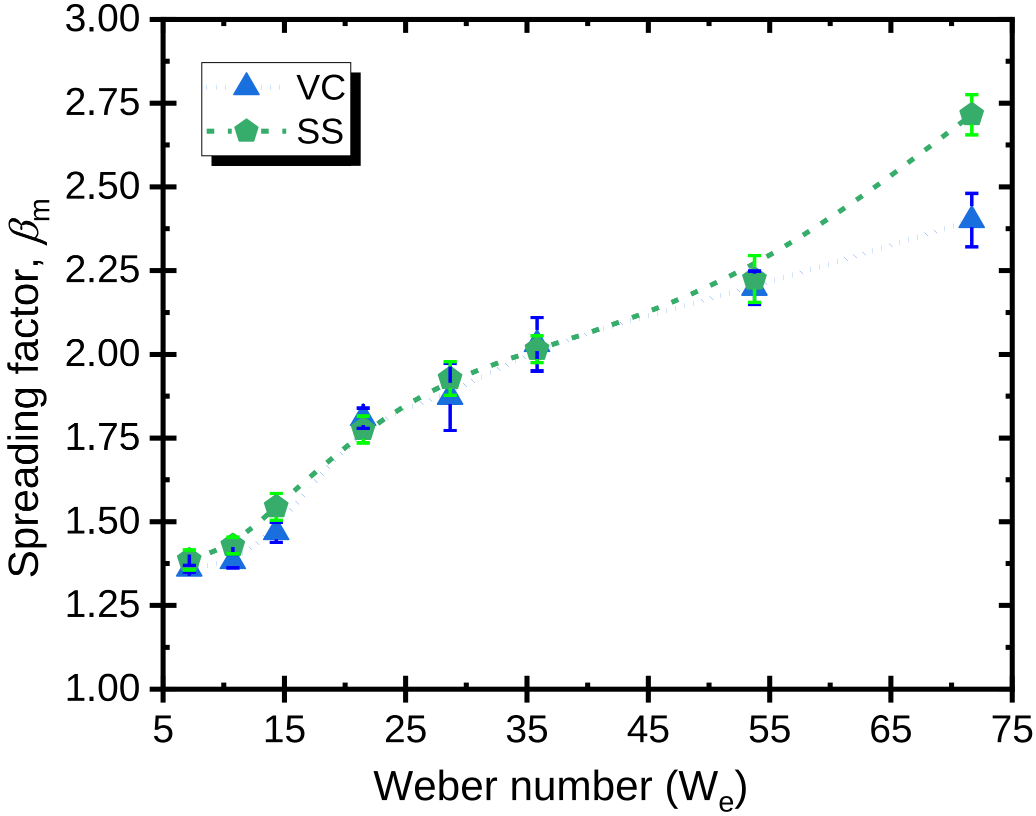

Figure 2S. The dimensionless spreading factor, $\beta_m = d_{max}/d_0$ as a function of W_e for VC, and NS. The β_m was found to increase with increasing W_e.

References

1 A. B. D. Cassie and S. Baxter, *Trans. Faraday Soc.*, 1944, **40**, 546.
2 Y. Liu, L. Moevius, X. Xu, T. Qian, J. M. Yeomans and Z. Wang, *Nature Phys*, 2014, **10**, 515–519.
3 C. R. Crick and I. P. Parkin, *Chemical Communications*, 2011, **47**, 12059–61.