FRICTION AND WETTING TRANSITIONS OF MAGNETIC DROPLETS ON MICROPILLARED SUPERHYDROPHOBIC SURFACES

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Reliable characterization of wetting properties is essential for the development and optimization of superhydrophobic surfaces. Here we study the dynamics of superhydrophobicity including droplet friction and wetting transitions by using droplet oscillations on micropillared surfaces. Analyzing droplet oscillations by high-speed camera makes it possible to obtain energy dissipation parameters such as contact angle hysteresis force and viscous damping coefficients, which indicate pinning and viscous losses, respectively. [1]

An important feature in the design of superhydrophobic surfaces is the robustness against collapse from Cassie-Baxter state to Wenzel state. Upon such transition, low droplet friction and high mobility is lost. The dependency of the experimentally determined Cassie-Wenzel transition pressure on the solid fraction for the moving and static droplets is reported. Cassie-Wenzel transition is found to occur at lower pressure for a moving droplet than for a static droplet. [2]

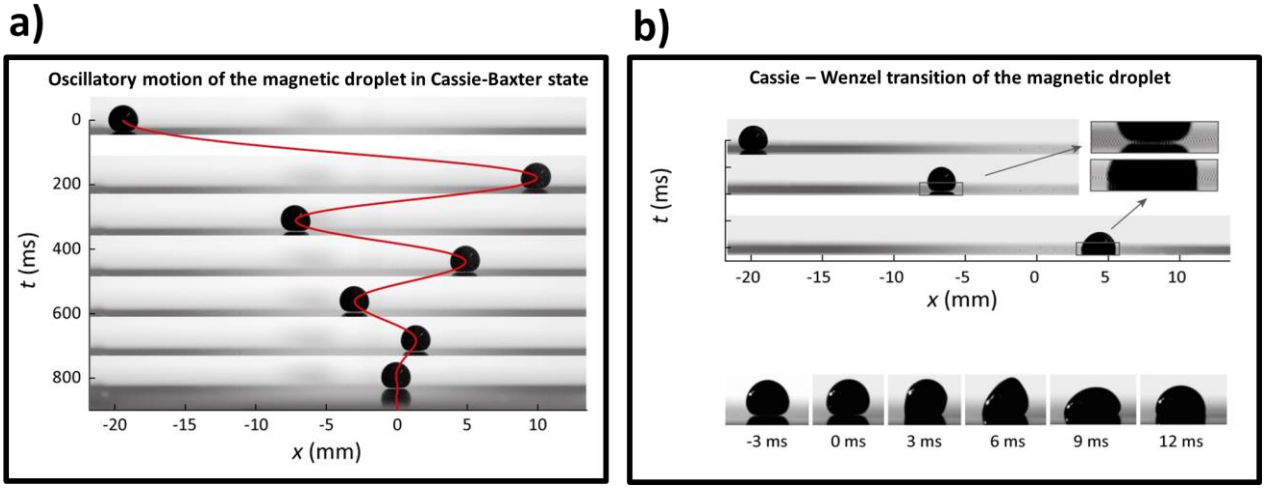

Figure 1. a) Snapshots showing the extreme points of the damped oscillatory motion. The normal force is F_N = 210 ± 20 µN. b) Wetting transition upon lateral motion of the droplet. The distance between the droplet and the magnet is less than in (a), which causes larger normal force equal to F_N = 430 ± 60 µN. Micropillared surface with solid fraction of 1.23 % is used in both cases.

[1] J.V.I. Timonen, M. Latikka, O. Ikkala, R.H.A. Ras, Nature Communications 4, 2398 (2013), http://www.nature.com/articles/ncomms3398.
[2] A. Al-Azawi, M. Latikka, V. Jokinen, S. Franssila, R.H.A. Ras, Submitted.