Two recipes for repelling hot water

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While a hydrophobic microtexture at a solid surface most often reflects rain owing to the presence of entrapped air within the texture, it is much more challenging to repel hot water. As it contacts a colder material, hot water generates condensation within the cavities at the solid surface, which eventually builds bridges between the substrate and the water, and thus destroys repellency. In this talk, we will explore impacts of hot water drops on cold superhydrophobic materials. While both "small" (~100 nm) and "large" (~10 µm) model features do reflect hot drops at any drop temperature and in the whole range of explored impact velocities, surprisingly water does not always bounce on intermediate (~ 1 µm) textures. Hence, we can define two structural recipes for repelling hot water: drops on nanometric features hardly stick owing to the miniaturization of water bridges, while kinetics of condensation in large features is too slow to connect the liquid to the solid at impact.

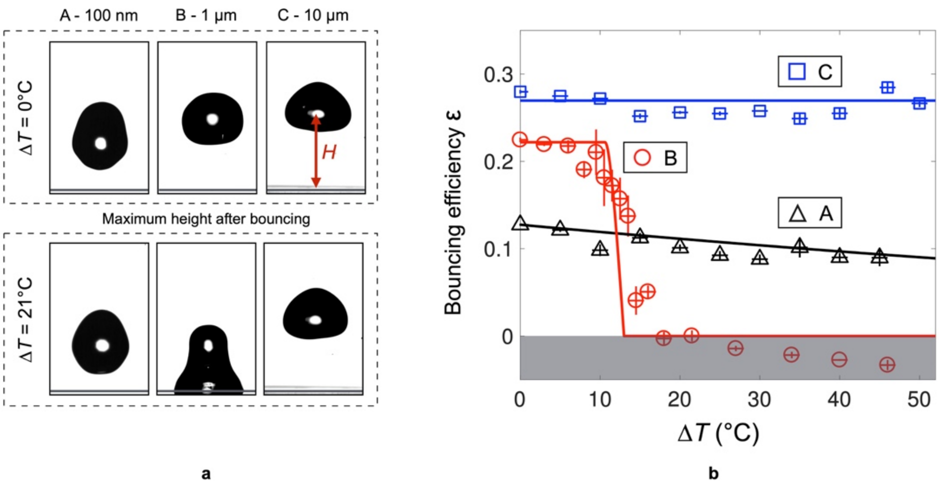

Figure. Bouncing efficiency of hot drops. a. Snapshots of impacting drops (R = 1.4 mm and V = 40 cm/s) at their maximum bouncing height H, for ΔT = 0°C (top images) and ΔT = 21°C (bottom images) on materials A, B and C with respective pillar heights of about 100 nm, 1 µm and 10 µm. b. Bouncing efficiency e as a function of the temperature difference ΔT for substrates A, B and C, R = 1.4 mm and V = 40 cm/s. Water always bounces on samples A and C, while it gets trapped on B above $\Delta T \approx$ 15°C.