

Nucleation-enhanced condensation and fast shedding on self-lubricated silicone organogels

Supplementary Information

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Supplementary note: Calculation of the amplitude constants A and E .

Inspired by references [40] and [42], the calculation of the amplitude constants A (condensation) and E (evaporation) can be expressed as follows:

$$A = E = \frac{4D(c_{\infty} - c_s)f(\Theta)}{3\rho_w \sin\Theta G(\Theta)}$$

With:

$$f(\Theta) = \frac{1}{2}(0.00008957 + 0.6333\Theta + 0.116\Theta^2 - 0.08878\Theta^3 + 0.01033\Theta^4)$$

and

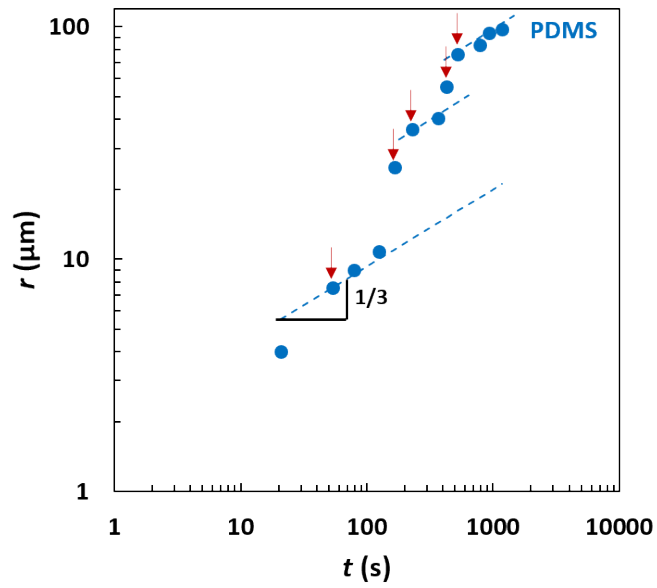
$$G(\Theta) = \frac{2 - 3\cos\Theta + \cos\Theta^3}{3\sin\Theta^3}$$

D being the diffusion coefficient of water; c_{∞}, c_s the concentration of water monomers far and on the drop surface, respectively; ρ_w , the water density and Θ , the dynamic contact angle equal to Θ_a (advancing contact angle) in the case of the condensation and to Θ_r (receding contact angle) in the case of the evaporation.

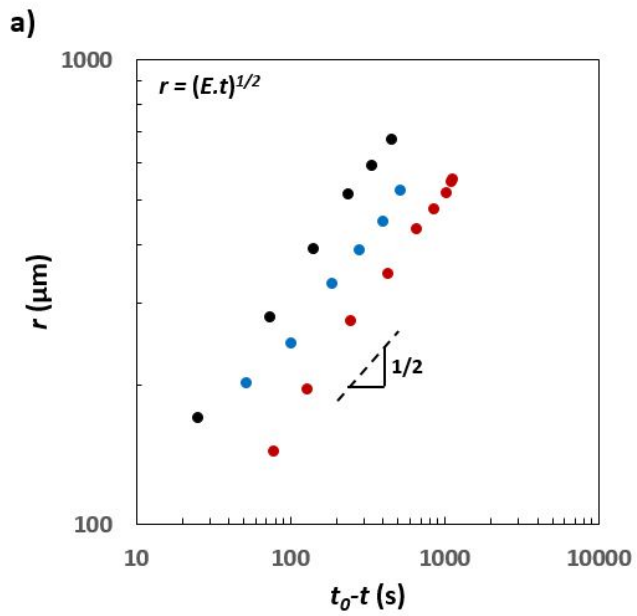
As condensation (/ evaporation) experiments on iPDMS, PDMS and Si were performed in the same conditions, the only varying parameter is the geometrical argument (i.e. $f(\Theta)$, $G(\Theta)$ and $\sin\Theta$) and the respective ratios of A and E were calculated and compared to the experimental values:

| | PDMS | iPDMS | Si | | theo. | exp. |
|--|------|-------|------|----------------------|-------|------|
| θ_a (°) | 120 | 105 | 75 | A_{iPDMS}/A_{PDMS} | 1.4 | 3.8 |
| θ_r (°) | 60 | 105 | 55 | A_{iPDMS}/A_{Si} | 0.6 | 1.2 |
| $A_{theo.}$ ($\mu\text{m}^2/\text{s}$) | 0.41 | 0.57 | 0.97 | E_{iPDMS}/E_{PDMS} | 0.5 | 0.5 |
| $E_{theo.}$ ($\mu\text{m}^2/\text{s}$) | 1.26 | 0.57 | 1.39 | E_{iPDMS}/E_{Si} | 0.4 | 0.2 |

Table 1: Advancing / receding contact angles, theoretical amplitude constants (A for condensation, E for evaporation) and comparison between theoretical and experimental amplitude constants ratios for PDMS, iPDMS and Si.



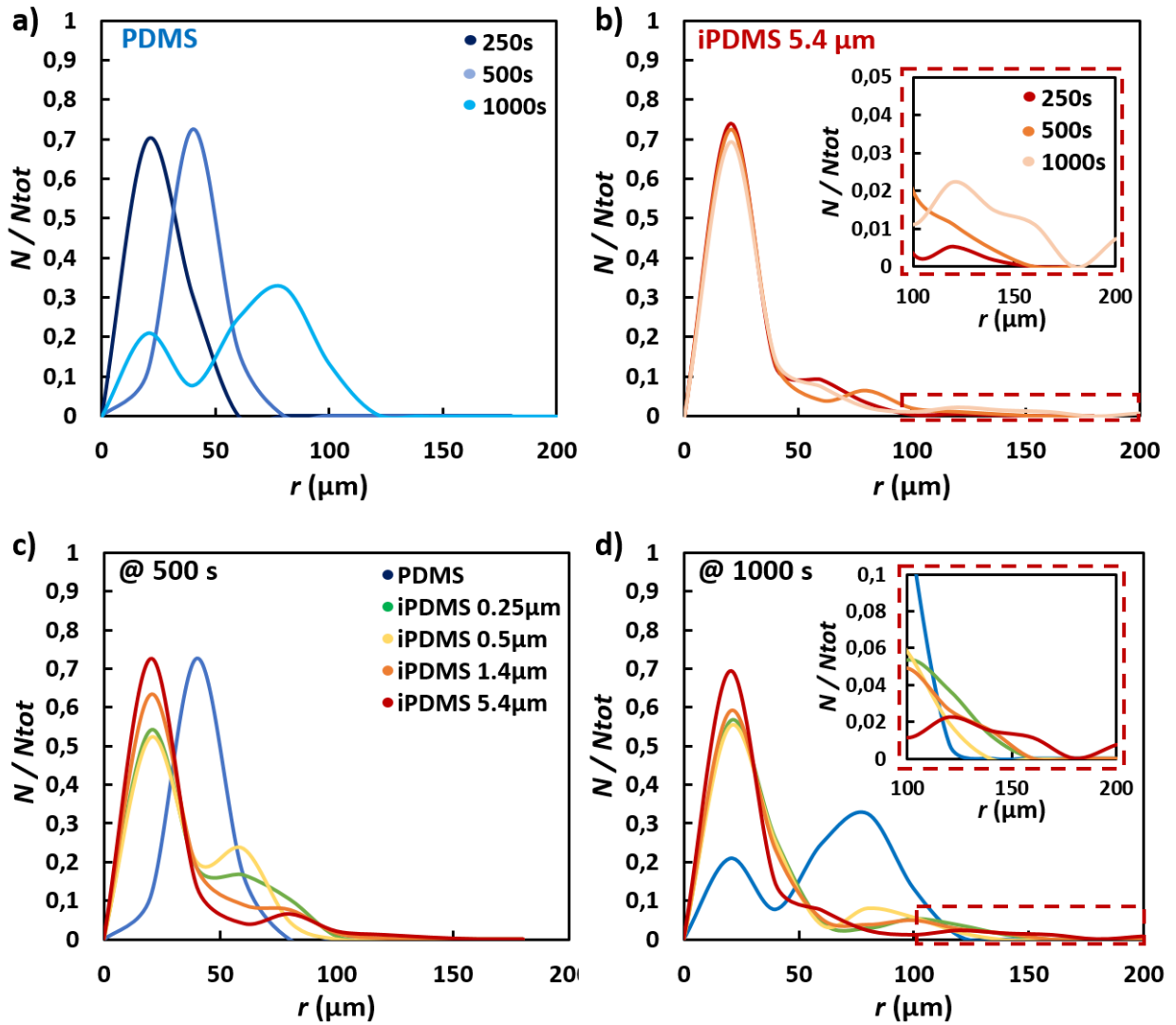
Supplementary Figure S1: Droplet growth on PDMS horizontal surfaces: Typical radius evolution of a single droplet on PDMS with time (coalescence events are indicated by red arrows).



b)

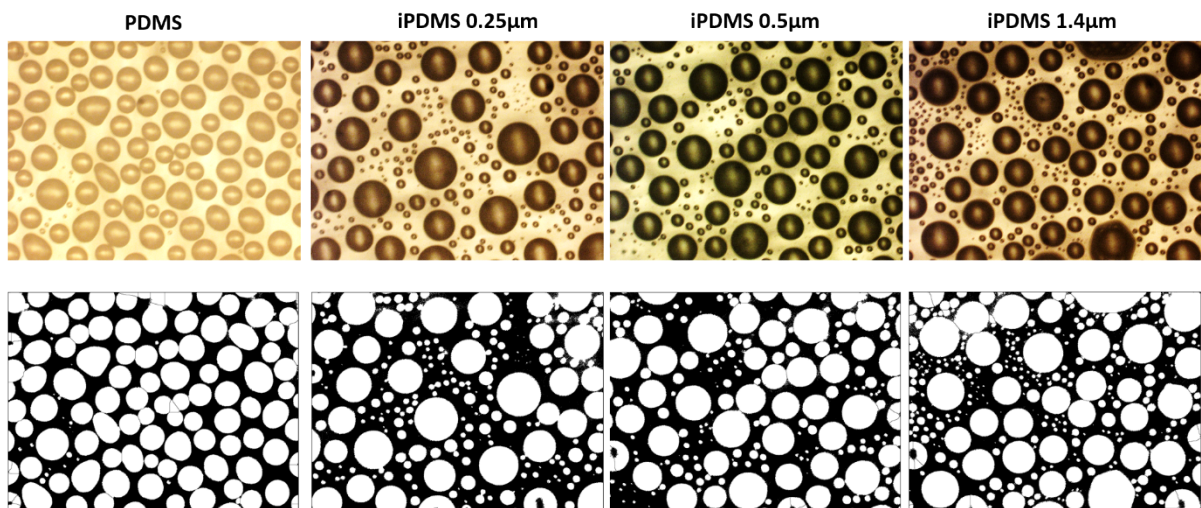
| <u>Material</u> | t_{evap} (s) | E ($\mu\text{m}^2/\text{s}$) |
|-----------------|-----------------------|----------------------------------|
| iPDMS | 1100 | 324 |
| PDMS | 950 | 625 |
| Si | 530 | 1369 |

Supplementary Figure S2: Evaporation of a deposited droplet on iPDMS, PDMS and Si surfaces: a) Radius evolution of 0.5 μL water droplet as function of time (t_0-t , with t_0 the time of droplet disappearance). b) Time needed for the water droplet to completely evaporate and related values of E .

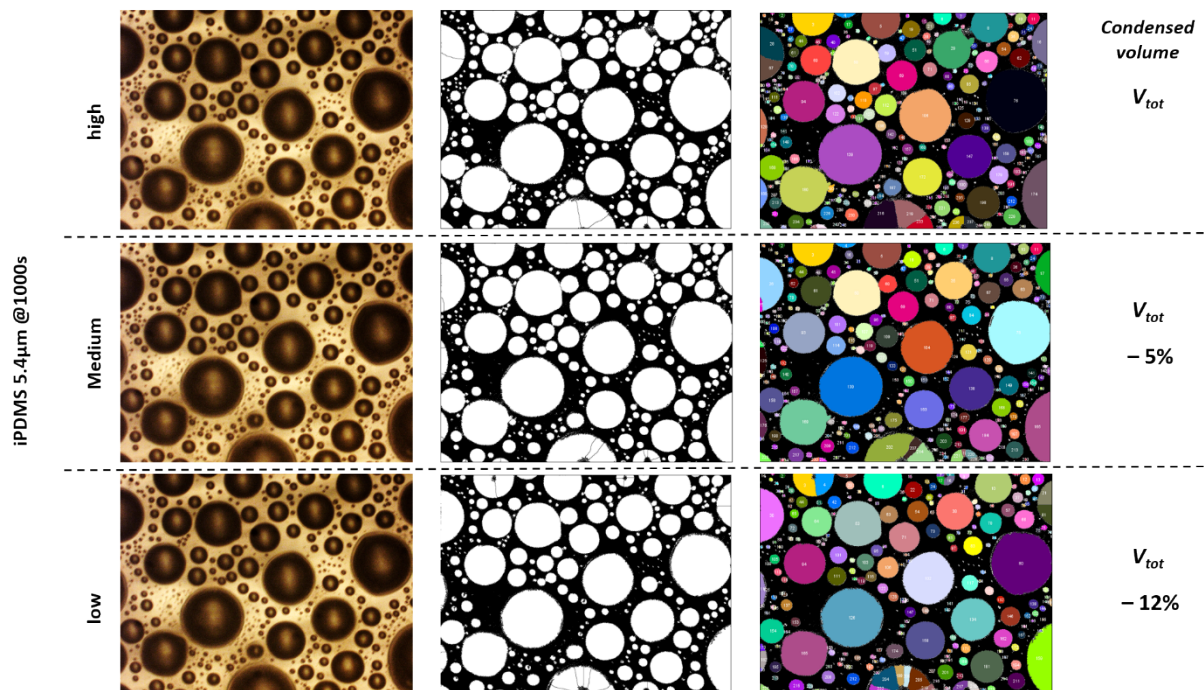


Supplementary Figure S3: Normalized radius distribution of condensed water droplets on horizontal surfaces: Evolution of the number of droplets, N , of radius r , for (a) PDMS and (b) iPDMS with 5.4 μm oil thickness. Normalized size distribution for PDMS and iPDMS with various oil thicknesses at (c) 500 s and (d) 1000 s. (Step of 20 μm).

@1000s



Supplementary Figure S4: Microscope images for PDMS, iPDMS (0.25, 0.5 and 1.4µm): Corresponding threshold images at 1000 s of condensation. The periphery of each droplet is well defined and only a few (2 or 3) drops display a visible wetting ridge for iPDMS 1.4µm.



Supplementary Figure S5: Microscope image for iPDMS 5.4µm at 1000s of condensation: Comparison of the corresponding image analysis with low, medium and high threshold for removing the influence of the wetting ridge in the determination of the drop volumes.

