Rheological Properties of Viscoelastic Drops on Superamphiphobic Substrates

Supplementary Information

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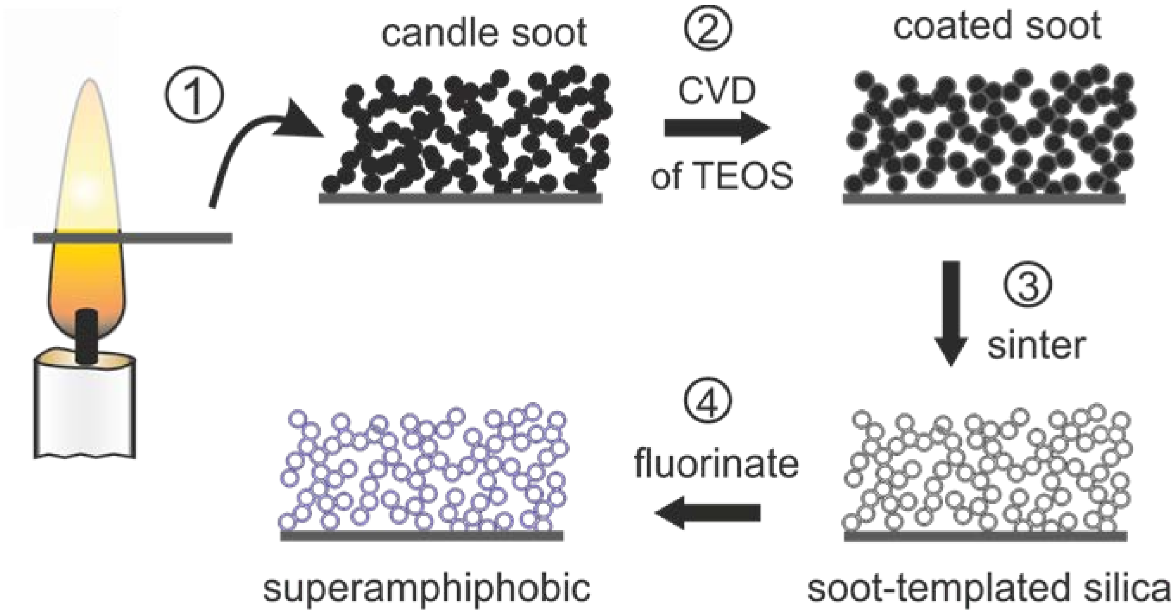

FIG. S1. Schematic diagram illustrating the sample preparation procedure for superamphiphobic surfaces. 1) Candle soot is collected on a substrate by annealing glass in the flame of a parrafin candle. 2) Silica is deposited via chemical vapour deposition (CVD) of tetraethoxysilane (TEOS). 3) Sintering combusts the soot template leading to soot-templated silica surfaces. 4) Hydrophobization with a fluorosilane results in superamphiphobic surfaces.

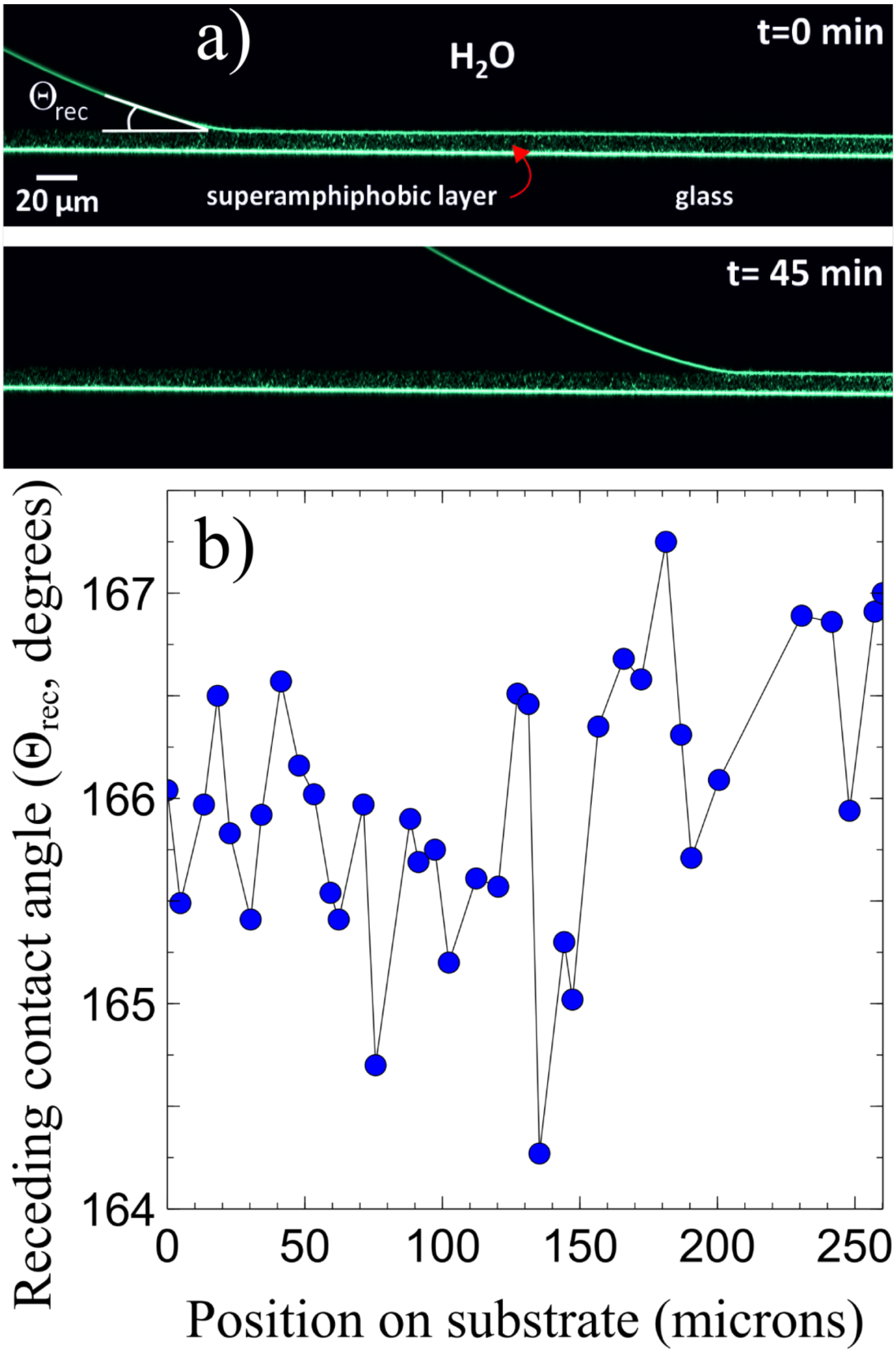

FIG. S2. a) Snapshots of a water drop receding on a superamphiphobic layer prepared on a 170 µm thick glass substrate. The images were collected as the drop evaporated from the surface. The movement of the three phase contact line was imaged once every minute using an inverted laser scanning confocal microscope (LSCM, Leica TCS SP8 SMD). b) Plots of the receding contact angle as function of the distance traveled by the contact line during evaporation.

Treatment of uncertainties

In calculating the uncertainties associated with G' and G" we assume that all the errors are randomly distributed and that the fractional uncertainties in the physical parameters in equations 2 and 3 can be added in quadrature.

Starting with equation 2 we have

$$G' = \frac{\rho f^2 l^2}{n^2}\left(1 - \frac{\pi\gamma n^3}{4\rho l^3(\mathrm{w}^2 + f^2)}\right) = \frac{\rho f^2 l^2}{n^2} X$$

where here, w is the width of the vibrational peaks (note the change of variable name to avoid confusion in calculating uncertainties) and

$$X = 1 - \frac{\pi\gamma n^3}{4\rho l^3\left(\mathrm{w}^2 + f^2\right)}$$

Adding the fractional errors in quadrature* we have

$$\left(\frac{\Delta G'}{G'}\right)^2 = \left(\frac{\Delta\rho}{\rho}\right)^2 + \left(\frac{2\Delta f}{f}\right)^2 + \left(\frac{2\Delta l}{l}\right)^2 + \left(\frac{\Delta X}{X}\right)^2$$

where here Δa represents the uncertainty in each variable, a, and

$$\left(\frac{\Delta X}{X}\right)^2 = \left(\frac{\Delta\gamma}{\gamma}\right)^2 + \left(\frac{\Delta\rho}{\rho}\right)^2 + \left(\frac{3\Delta l}{l}\right)^2 + 4\frac{(w^2\Delta w^2 + f^2\Delta f^2)}{(f^2 + w^2)^2}$$

so that

$$\left(\frac{\Delta G'}{G'}\right)^2 = 2\left(\frac{\Delta\rho}{\rho}\right)^2 + \left(\frac{2\Delta f}{f}\right)^2 + 13\left(\frac{\Delta l}{l}\right)^2 + \left(\frac{\Delta\gamma}{\gamma}\right)^2 + 4\frac{(w^2\Delta w^2 + f^2\Delta f^2)}{(f^2 + w^2)^2}$$

Inserting typical values of parameters of f=50 +/- 0.1 Hz, w=20 +/- 0.1 Hz, l=8 +/- 0.1 mm, γ=70 +/- 0.2 $\mathrm{mJm^{-2}}$ and ρ=1010 +/- 5 $\mathrm{kgm^{-3}}$ we obtain values for the fractional error terms of $\left(\frac{2\Delta f}{f}\right)^2$=1.6x10^{-5}, 2 $\left(\frac{\Delta\rho}{\rho}\right)^2$=1x10^{-5}, 13 $\left(\frac{\Delta l}{l}\right)^2$=2x10^{-3}, $\left(\frac{\Delta\gamma}{\gamma}\right)^2$=8x10^{-6} and $4\frac{(w^2\Delta w^2+f^2\Delta f^2)}{(f^2+w^2)^2}$=1.5x10^{-5}.

The dominant term (by at least two orders of magnitude) is associated with the uncertainties in the profile length, l , of the drops and the formula above can be approximated to get the uncertainty in G' as

$$\Delta G' = \sqrt{13}\frac{\Delta l}{l} G'$$

A similar analysis for G” yields exactly the same form for the uncertainty in this variable i.e.

$$\Delta G" = \sqrt{13}\frac{\Delta l}{l}G"$$

These formula were used to calculate the uncertainties of G’ and G” given in Figure 3.

*We note that the quadrature error formula used above is a simplified version of the error formula

$$\Delta G' = \pm\sqrt{\left(\left(\frac{\partial G'}{\partial \rho}\right)\Delta\rho\right)^2 + \left(\left(\frac{\partial G'}{\partial f}\right)\Delta f\right)^2 + \left(\left(\frac{\partial G'}{\partial l}\right)\Delta l\right)^2 + \cdots}$$