

On the rebound of soapy drops

Aditya Jha, Auriane Huyghues Despointes, Christophe Clanet & David Quéré

*Physique et Mécanique des Milieux Hétérogènes, UMR 7636 du CNRS,
PSL Research University, ESPCI, 75005 Paris, France.*

*LadHyX, UMR 7646 du CNRS,
Institut Polytechnique de Paris, 91120 Palaiseau, France.*

Supplementary information on IPA/water mixtures

We first report in figure S1 the surface tension of isopropyl-alcohol (IPA)/water solutions as a function of the mass concentration of IPA. The surface tension strongly varies, from 72 mN/m to 21 mN/m – all tensions being measured at 25°C, with an uncertainty of ± 1 mN/m.

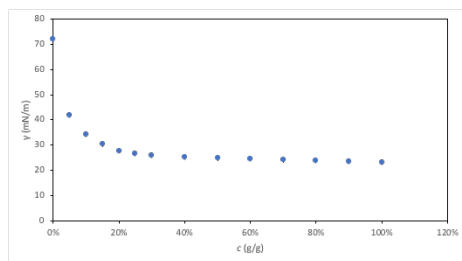


Figure S1. Surface tension of water/IPA solutions as a function of the concentration in IPA. Data taken from G. Vazquez, E. Alvarez and J.M. Navaza, *J. Chem. Eng. Data* **40**, 611–614 (1995).

We report in the accompanying paper that the decrease of surface tension induces a sticking transition. At sufficiently low surface tension (around 30 mN/m), drops stop at the surface instead of bouncing. Approaching this transition, we also observe increasing fluctuations of the contact time, which visually is correlated to pinning events in the recoiling stage of the impacting drop. In

figure 2S, we report the values of the advancing and receding contact angles of IPA solutions placed on our repellent surfaces as a function of the IPA concentration. These values are determined by placing a 20 μL -drop on the material, and then tilting this material until departure of the drop. We deduce the advancing and receding angles from the images of the drops. Both values slightly decrease when increasing the IPA content, but the variation becomes stronger in the region where rebounds stop (IPA content of about 20%) – which qualitatively supports our interpretation of the sticking transition.

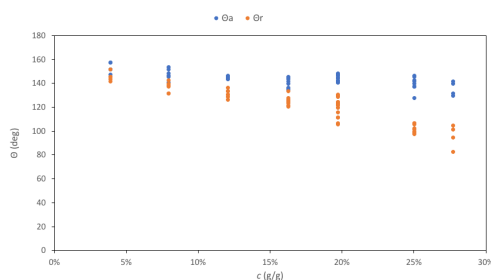


Figure S2. Advancing and receding contact angles (in blue and red, respectively) of a 20 μL drop of IPA/water as a function of the IPA concentration. The repellent substrate is tilted until the drop departs, and we measure the angles just before departure.

In figure S3a, we extract from the figure 3a of the accompanying paper the data for the IPA solution, and plot the contact time of bouncing drops (radius of ~ 1 mm, mass m of ~ 4 mg) as a function of the surface tension γ of the solution. For each solution, we perform a few experiments, which yields the dispersion of the measurements. An excellent agreement is found at high surface tension with the curve expected from the spring model ($\tau_o \approx 1.3(m/\gamma)^{1/2}$, drawn with a dotted line), but times are slightly smaller than expected at small surface tension. We noted that drops are slightly smaller than the targeted value (due to the smaller surface tension that makes them detach earlier from the dispensing needle). If we consider for each drop its measured volume (and mass) and plot the measured contact time τ as a function of its theoretical value τ_o (figure S3b), the agreement between the experiments and the model becomes quantitative whatever the surface tension, as shown by the dotted line, the best linear fit that has a slope of 0.95. This agreement confirms that the spring model remains valid when varying the surface tension of the liquid to a large extent (more than a factor 2).

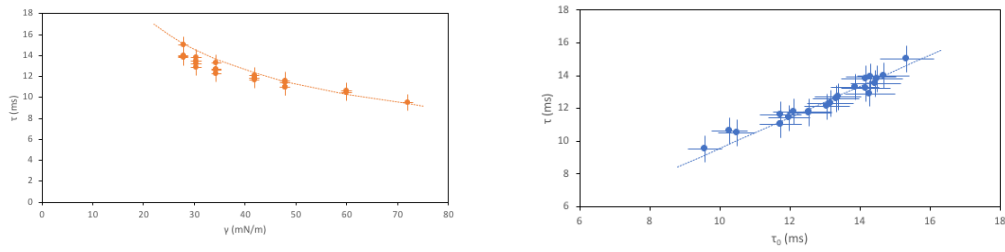


Figure S3. a. Contact time of IPA/water drops (radius of approximately 1 mm) as a function of the surface tension of the solution. The dotted line shows the behavior expected from the spring model ($\tau_0 \approx 1.3 (m/\gamma)^{1/2}$), showing a fair agreement with the data. The model seems however to overestimate the time at low surface tension, which we interpret as a consequence of the slight decrease in drop size when reducing γ . **b.** If plotting the measured contact time τ as function of τ_0 calculated for each drop by considering its actual mass and surface tension, we note a quantitative agreement between the data and the model. Error bars on τ and τ_0 respectively express the dispersion of the data and the uncertainty on the mass measurement.