Drop motion induced by vertical vibrations

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We have studied the one-dimensional motion of few microliters liquid drops on a PMMA inclined plate subject to vertical sinusoidal oscillation ranging from 30 Hz to 120 Hz [1]. The liquids comprised distilled water and different aqueous solutions of glycerol, ethanol and isopropanol spanning the range 1–39 $mm^2\ s^{-1}$ in kinematic viscosities and 40–72 mNm^{-1} in surface tension. Because of contact angle hysteresis, at sufficiently low oscillating amplitudes, the drops are always pinned to the surface. Vibrating the plate above a certain amplitude yields sliding of the drop. Further increasing the oscillating amplitude drives the drop upward against gravity. In the case of the most hydrophilic aqueous solutions, this motion is not observed and the drop only slides downward. Images taken with a fast camera show that the drop profile evolves in a different way during sliding and climbing. This dynamics is due to the asymmetric variations of the front and rear contact angles with respect to the advancing and receding values. In particular, the climbing drop experiences a much bigger variation in its profile during an oscillating period (Figure 1).
We are currently further investigating these phenomena in the case of non-Newtonian fluids, such as Xanthan or polyacrylamide aqueous solutions [2].

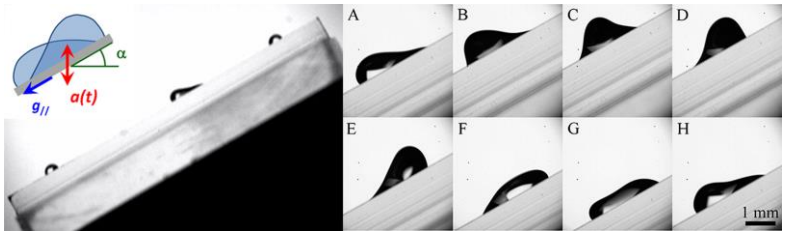

Figure 1 Sketch and side view of the drop on the oscillating plate (left). Profile evolution of a climbing water drop taken with a fast camera (right).

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[2] S. Varagnolo, G. Mistura, M. Pierno and M. Sbragaglia*, Eur. Phys. J. E*, 2015, **38**, 126