How wettability controls nanoprinting: supplementary material

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APPENDIX I: ENERGY BALANCE FOR NANODROPLETS IMPACT

The maximum spreading diameter can be estimated from the balance of the energy between its initial condition (just before the impact) and when the contat diameter reaches its maximum value D_{max}

$$E_k^0 + E_s^0 = E_s^m + W \tag{1}$$

Where E_k^0 and E_s^0 are the kinetic energy and the surface energy before impact

$$E_k^0 = \frac{1}{12}\pi\rho_L D_0^3 V_{imp}^2 \tag{2}$$

$$E_s^0 = \pi D_0^2 \gamma_L \tag{3}$$

and E_s^m is the surface energy at the maximum diameter. With the approximation of a cylindrical geometry at D_{max}, Ukive et al. [1] estimate this energy as

$$E_s^m = \frac{1}{4}\pi D_{max}^2 \gamma_L (1 - \cos\theta^0) + \frac{2}{3}\pi\gamma_L \frac{D_0^3}{D_{max}} \tag{4}$$

Finally, W corresponds to the viscous dissipation. The analysis of the velocity gradients in molecular dynamic simulations of impact of nanodroplets leads Li et al. [2] to propose a model for W

$$W = \frac{1}{4}\pi\eta_L D_0^2 V_{imp}\left(\xi_{max}^2 - \frac{2}{3}\right) \tag{5}$$

Where $\xi_{max} = D_{max}/D_0$. Then, by simple substitution of Eqs. 2, 4 and 5 in Eq. 1 we obtain

$$3(\mathrm{Ca}+1-\cos\theta^0)\xi_{max}^3 - (\mathrm{We}+12+2\mathrm{Ca})\xi_{max} + 8 = 0 \tag{6}$$

Where $\mathrm{We} = \rho_L D_0 V_{imp}^2/\gamma_L$ and $\mathrm{Ca} = \eta_L V_{imp}/\gamma_L$

[1] C. Ukiwe and D. Y. Kwok, Langmuir **21**, 666 (2005).
[2] x.-H. Li, X.-X. Zhang, and M. Chen, Phys. Fluids **27**, 052007 (2015).