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Surfactant-enhanced rapid spreading of drops on solid surfaces[1]
DAVID BEACHAM, Imperial College London, RICHARD CRASTER, University of Alberta, OMAR MATAR, Imperial College London — We consider the surfactant-enhanced rapid spreading of drops on solid substrates. This work is conducted in connection with the ability of aqueous trisiloxane solutions to wet effectively highly hydrophobic substrates. We use lubrication theory to derive coupled advective-diffusion equations for surfactant transport to an interface equation. This model accounts for Marangoni stresses, diffusion, intermolecular forces, basal surfactant transport, micelle formation and break-up in the bulk, and sorptive fluxes at both the gas-liquid and liquid- solid interfaces; the model also employs appropriate surfactant equations of state. Our numerical results show the effect of basal adsorption and the mass of deposited surfactant on the deformation of the droplet and its spreading rate. We demonstrate that this rate is maximised for intermediate rates of basal adsorption and total surfactant mass. We also show that for a certain range of parameter values, the spreading is accompanied by pronounced rim formation, as previously observed experimentally. The stability of this rim to transverse disturbances is briefly explored.

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