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Three-dimensional contact line dynamics on heterogeneous substrates NIKOS SAVVA, SERAFIM KALLIADASIS, Department of Chemical Engineering, Imperial College London, London SW7 2AZ, UK — Three-dimensional contact line dynamics on heterogeneous substrates is examined theoretically by using the motion of a viscous, partially wetting droplet over a horizontal and chemically heterogeneous substrate as a model system. We utilize a long-wave model for the evolution of the droplet thickness, whereby inertial and gravitational effects are neglected and the contact angles are assumed to be everywhere small. Noteworthy is that the present formalism does not depend on an imposed, Cox-Voinov-type relation between the apparent contact angle and the contact line speed. Instead, the contact line speed is found as part of the solution, facilitated by mapping the free-boundary problem to a fixed, circular domain. Analytical progress can be made by considering perturbations from a circular contact line and asymptotically matching the flow in the two-dimensional boundary layer around the contact line with the flow in the bulk of the droplet. This matching procedure eventually leads to a set of differential equations for the Fourier coefficients of the contact line. The derived equations are solved for a few representative substrate configurations.

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