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Modeling of dynamic wetting far from equilibrium ANDREAS CARLSON, MINH DO-QUANG, GUSTAV AMBERG, Linné Flow Center, Department of Mechanics, The Royal Institute of Technology — Moving contact lines in dynamic wetting phenomena have been studied extensively for several decades, nonetheless, the physics that drive such processes are not fully understood. Continuum mathematical models for such phenomena often rely on ad-hoc physical assumptions or simplifications. We present here numerical simulations of dynamic wetting far from equilibrium based on a free energy formulation. A direct qualitative and quantitative match with the experiments by [Bird, J. C., S. Mandre, and H. A. Stone, 2008, PHYSICAL REVIEW LETTERS 100(23)] is shown. To correctly capture the dynamics of rapid wetting, we demonstrate that it is crucial to account for non-equilibrium at the contact line. A term in the boundary condition at the solid surface, that naturally arises in the phase field theory, is interpreted as allowing for the establishment of a local structure in the immediate vicinity of the contact line. Besides one universal non-dimensional number, that is determined here, the model as presented has no free parameters.

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