

Abstract Submitted
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Can the Cahn-Hilliard model quantitatively describe moving contact lines? PENGTAO YUE, Virginia Polytechnic Institute and State University, CHUNFENG ZHOU, JAMES FENG, University of British Columbia — Diffuse-interface models may be used to compute moving contact lines because Cahn-Hilliard diffusion regularizes the singularity at the contact line. This paper investigates the basic questions underlying this approach. Through dimensional analysis and numerical computations, we demonstrate that the Cahn-Hilliard model approaches a sharp-interface limit when the interfacial thickness is reduced below a threshold while other parameters are kept fixed. In this limit, the contact line has a diffusion length that is related to the slip length in sharp interface models, and the relaxation of wall energy determines the deviation of the dynamic contact angle from the static one. From these results, we develop practical guidelines for attaining the sharp-interface limit in numerical simulations and for quantitatively reproducing experimental data on the apparent contact angle. With the wall relaxation parameter fitted to a single experimental measurement, the model gives an excellent representation of experimental data over the entire range of flow rates up to wetting failure.

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