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Dissipation at Moving Contact Lines: Effect of Interface Width and Slip[1] MARK ROBBINS, SHENGFENG CHENG, Johns Hopkins University, COLIN DENNISTON, University of Western Ontario — Continuum mechanics predicts a diverging stress and total dissipation when the contact line between a fluid interface and a solid substrate is advanced. Several models for removing this divergence have been advanced. One is that the divergence is cutoff by a finite slip length. Another is that diffusion can remove the singularity for fluid interfaces of finite width. Extensive molecular dynamics simulations of partially miscible binary fluids were used to test these two pictures. The interfacial tension was changed by a factor of 20 and the interfacial width by an order of magnitude. The interface width had no direct effect on the dissipation and diffusion was orthogonal to the predicted direction. The dissipation only depended on system size, the dimensionless capillary number, and the slip length S associated with the flow boundary condition in the fluid far from the contact line. The divergence in stress is cut off at the sum of S and a distance of order the molecular diameter. The dissipation rises rapidly as the amount of slip is decreased. In all cases there is a first order transition where the advancing contact line becomes unstable and a film is entrained.

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