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Simulations of Contact Line Motion in Partially Miscible Fluids SHENGFENG CHENG, Dept of Physics and Astronomy, The Johns Hopkins University, Baltimore, MD 21218, USA, COLIN DENNISTON, Dept of Applied Mathematics, The University of Western Ontario, London, Ontario, Canada N6A 5B8, MARK ROBBINS, Dept of Physics and Astronomy, The Johns Hopkins University, Baltimore, MD 21218, USA — We report on extensive molecular-dynamics simulations of contact line motion in partially miscible fluids confined between two solid walls and sheared in a Couette geometry. Our results show that diffusion alone cannot remove the stress singularities at the contact line or lead to no-slip boundary conditions on the fluid velocity. Computed velocity fields show that there is a substantial drop of the fluid velocity near the contact line, which is associated with the gradient of the fluid-solid interfacial tension in the same region. However, the fluid velocity does not fall to zero at the contact line, in contrast to the case where fluids are immiscible. The nonzero velocity leads to a net advective flux across the fluid-fluid interface, which is balanced by the diffusive flux induced by the concentration gradient. The advective and diffusive fluxes across the interface are only significant in the very first layer of fluid atoms.

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