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The disparity between thermodynamic and mechanical surface tension in the vicinity of the moving contact line[1] JOSEPH THALAKKOTTOR, KAMRAN MOHSENI, University of Florida — Thermodynamic and mechanical surface tensions are commonly assumed to be equal. Here, we shall show that this is not the case in the vicinity of the moving contact line. In the vicinity of the moving contact line, the stress in the bulk fluid increases rapidly, which we shall show is accompanied by a corresponding increase in surface dilatation rate. We demonstrate that this non-zero rate of surface dilatation results in a disparity between thermodynamic and mechanical surface tension. Considering that surface tension can be interpreted as surface pressure, it is shown that this deviation between mechanical and thermodynamic surface tension is analogous to pressure in bulk fluid, where thermodynamic and mechanical pressures are not necessarily equal for a compressible fluid. We present these findings via molecular dynamics simulations of a forced wetting problem and demonstrate that the surface dilatation rate plays an important role in capturing the difference in dynamic and static contact angles.

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