Abstract Submitted
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Capillary adhesion at nanometer scales[1] MARK ROBBINS, SHENGFENG CHENG, Department of Physics and Astronomy, Johns Hopkins University — Molecular dynamics simulations are used to study the capillary adhesion due to a liquid bridge between a spherical tip and a flat substrate. The atomic scale roughness of the tip, tip radius, contact angles on the two surfaces, and the volume of the liquid bridge are varied. The simulations consider a nonvolatile fluid with constant volume. The adhesive force on the tip is measured as a function of tip-surface separation. The force agrees with continuum predictions for separations down to 5 to 10nm. At even smaller separations, the adhesion oscillates due to liquid layering in the narrow gap between surfaces. This effect is most pronounced for large tip radii and smooth surfaces. There is also a decrease in the average adhesive force that can be as large as a factor of two. This shift is due to an anisotropy in the pressure stress tensor. The in-plane component is consistent with the Laplace pressure predicted by continuum theory, but the normal pressure that determines adhesion is much more positive.

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