Effect of Confinement and Wetting on Liquid-Vapor Equilibrium

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The conditions for liquid-vapor equilibrium in a pure fluid are modified when the fluid is confined. This is well known in the case of capillary condensation. Isochoric confinement also modifies the stability and equilibrium conditions, as was studied in a series of work [1-4]. Intriguing phenomena have been identified, such as the case of "superstability", which corresponds to a range of densities in which no vapor can form, making the liquid indefinitely stable at pressures below its saturated vapor pressure. Here we present a simplified approach [5], which provides an analytic formulation valid for any fluid, and includes the case of partial wetting. The quantitative effects are captured by a single length, the Berthelot–Laplace length $\lambda = (2/3)\gamma\kappa$, where γ is the surface tension and κ is the isothermal compressibility.

References

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