

Liquid Nanostructures: Phase Transitions, Forces and Friction

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Abstract

Grand canonical Monte Carlo calculations and molecular dynamics simulations are used to investigate binary mixtures confined between chemically patterned surfaces. For certain patterns and surface separations, a surface-induced phase consisting of liquid “bridges” joining like-patterned regions of the plates is observed. Furthermore, since these bridges involve liquid-liquid interfaces their shape and extent can be dramatically altered by simply adding an appropriate surfactant to the mixture. The nanoscale liquid structures associated with a bridge phase can strongly influence both the perpendicular and frictional forces acting on the plates at separations well beyond those where molecular “ordering” is dominant. The origin, nature and interesting physical implications of these forces will be discussed.