Evidence for Colloidal Equilibrium States in Supercritical Fluids

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Since earlier reports of fluid-state bounds being determined by percolation loci, we have accumulated compelling evidence that the intermediate region at supercritical temperatures is a colloidal state. This poster will contain a selection of recent pictorial and graphical results showing that the structure of supercritical fluids in the mid-range between liquid- and gas-like states is a one-component colloidal suspension. The poster will show cluster distribution graphics, alongside phase diagrams from simulation studies of the properties of percolation threshold loci that bound liquid and gas structures. When percolation transitions have the same pressure, i.e. on intersection of the loci in the p-T plane, a critical dividing line is defined. Below the critical divide the surface tension is positive, hence two-phase coexistence with minimal area. Above the critical divide the surface tension becomes negative giving rise to colloidal states between gas- and liquid-states that maximizes the surface/bulk contribution to Gibbs energy. The poster will pictorially demonstrate existence of these equilibrium colloidal states for some one-component model fluids alongside graphical cluster-size distribution functions showing divergence at percolation thresholds. Colloidal structures create an interfacial area that balances the pressure difference of gas and liquid at the respective percolation points along a supercritical isotherm. We will present an analysis in graphical form for simple fluids. The thermodynamic state functions comprise 3-component contributions from dispersed liquid state droplets, a continuous gaseous state, and an interfacial contribution proportional to the colloidal area. The poster will show that density dependence of state functions in the meso-phase is consistent with a linear combination rule rather like the lever rule for subcritical 2-phase properties. These findings are in agreement with a wide body of other experimental evidence. The colloidal supercritical meso-phase concept is fundamental to an understanding fluidphase equilibrium states and state bounds.