Stability Limits in Pure and Binary Fluid Mixtures Obtained from Equations of State

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In several non-equilibrium processes such as particle or structure formation in supersaturated systems the limit of the accessible metastable region is of importance. The growth mechanism of a new phase - and the structural/mechanical behavior of the new system - differs depending on whether a limit of stability is approached as close as possible or whether the system is in sufficient distance to such spinodal limit. The reason for this different behavior is in case of pure substances the diverging density fluctuation at the spinodal. Despite its nonclassical behavior the location of the spinodal can be estimated by classical equations of state. The comparison with experimental data is difficult since experiments rather give the maximum supersaturation being more or less close to the spinodal. However, comparison between experiments and calculations with classical equations of state is possible in the sense that the maximum experimental supersaturation should be lower than the supersaturation at the calculated spinodal.

The spinodals are calculated for several different pure substance equations of state [1] and compared to experimental data taken from the literature. The effect of different molecular properties represented by the equations of state on the distance between saturation curve and spinodal are reported. Besides the regular spinodal the adiabatic spinodals are briefly discussed. For binary fluid systems the shapes of the mechanical and diffusion spinodals are reported [2].

[1] T. Kraska, *Ind. Eng. Chem. Res.* **43**, 6213 (2004).
[2] A. Imre, T. Kraska, *J. Phys. Chem*. **122**, 064507 (2005).