Physical Limit Stability in Supercooled Water

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Study of the curved interfaces is an urgent problem of the first-order phase transitions. Kiselev and Ely developed a general, based on the fluctuation theory of homogeneous nucleation, approach for the calculation of kinetic spinodal of liquids. The kinetic spinodal is defined by them as a locus, where the mean time of a formation of a critical nucleus becomes shorter than a characteristic time needed to decay fluctuations to the local equilibrium. The kinetic spinodal in their theory can be completely determined by the surface tension and the equation of a state of the metastable fluid. They discussed also the kinetic boundary for supercooled water. We will use our parametric crossover model for supercooled water and our measurements of the surface tension in supercooled region of water, and also the different models of the size dependence of the surface tension, to recalculate the kinetic spinodal for supercooled water. We will compare the calculated values with the ones calculated by Kiselev and Ely, and with the homogeneous nucleation curve presented by Holten et al., and with experimental data. Different models of the size dependency of the surface tension and their influence on the calculated spinodal curves will be discussed. One of the issues of the recent parametric equation of state of water is that the actual location of the hypothesized critical point is uncertain. We will discuss the problems connected with the uncertainty.