The Predictions of the Critical Points for Several Metal on the Basis of Correspondence Between the Critical and Unit Compressibility Line (Zeno Line) Parameters for Classical and Quantum Liquids

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We make some predictions with respect to the critical parameters for metals (Al, Cu, W, U and Zr, critical parameters of which are still inaccessible experimentally). To do it we introduce two new similarity relations on the basis of the correspondence between the critical point and unit compressibility line positions in the temperature-density plane. Below this line is referred to as Zeno–line. ($Z=P/\rho T=1$ is the compressibility factor, P is the pressure, T is the temperature, ρ - is the particle density). For a wide class of substances the Zeno–line is the straight line in the density – temperature plane. This line is also the tangential to the liquid branch of binodal at T -> 0 in this plane. These facts allow us to construct general expression for the coexistence curve liquid – vapor (liquid branch), which is transformed into the Zeno – line at low temperatures. This expression depends on the four parameters, which were determined by the condition of minimum deviation of calculated and experimental binodals. The analysis of a large number of experimental data for non-metallic substances (Ar, Ne, CO_2, O_2, CH_4 and others) and metals (Hg, alkali metals) with known coexistence curves have shown good agreement between calculated and measured binodals. We also find that two factors are weakly dependent on the type of substance. These factors are $\rho_c/\rho_B+T_c/T_B$ and$\rho_c T_c$-$P_c/(\rho_B T_B)$, where subscript "c" refers to the critical point parameters, subscript "B" refers to the Zeno-line parameters. Thus, these factors can be considered as the similarly relations. Another classification parameter is the compressibility factor at the critical point. It defines the binodal opening. The less this factor is, the more the binodal opening is. We showed that the compressibility factor at the critical point for classical substances Z_c<0.32. Mercury and quantum substances (H_2, He^4, He^3) belong to another group where Z_c>0.37. The binodal opening for this group is defined by effective compressibility factor $Z^*=Z_c(1+aB)$, where "*a"* is some constant, B is the de Boer parameter. We applied the technique in hand to find the critical parameters of several metals (see above), located in a high temperature domain inaccessible for measurements. Our critical parameters were compared with estimates of other researchers.