Researching Parameters of Intermolecular Interaction Potential for Dense Gases and Gas Mixtures by Using the Equation of State

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In condensed matter physics the problem of finding functional form and intermolecular interaction potential parameters is referred to be the crucial one. At the moment the problem is to get intermolecular interaction potential parameters corresponding to repulsive forces and in theory this can be solved only partially.

In our report we propose the new method for estimating value of intermolecular interaction potential parameters by means of an equation of state. The equation of state is derived from thermodynamic perturbation theory based on scale transformation of the partition function in canonical ensemble with use of a reference state instead of a reference system. This equation is a modified form of the famous Tait's equation. It describes adequately the isothermal compression for dense gases in smallness compressibility condition. Its constants are bound with the characteristic parameters of intermolecular interaction potential and radial distribution function in a reference state. We propose another modification of Tait's equation of state for case of high pressures (up to 2200 MPa). We do not take into account pressure, that is corresponding to attractive forces between molecules. Good interpolation capacities in a wide pressure range of the equation proposed are revealed in processing experimental data on dense gases and gas mixtures. On a base of experimental data analysis for nitrogen, helium, argon, neon, krypton and argon-helium, argon-neon the isotherms and parameters of potential are calculated. We have found the dependence between the exponent of power of the intermolecular interaction potential that corresponds to repulsive forces and mass number of the nucleus for a number of inactive gases.