**Full Paper** _____ *Thematic Section:* Thermodynamic Research.
*Reference Object Identifier* – ROI: jbc-02/15-44-10-64 *Subsection:* Physical Chemistry.
Publication is available for discussion in the framework of the on-line Internet conference "*Butlerov readings*".
http://butlerov.com/readings/ *(English Preprint)*
Contributed: September 01, 2015.

# About the relation between the critical compressibility factor and maximal size of clusters at the critical point

**© Ikhtier H. Umirzakov**
*The Laboratory of Modeling. Kutateladze Institute of Thermophysics of the SB RAS. Lavrenteva Prospect, 1. Novosibirsk, 630090. Russia. Phone: +7 (383) 354-20-17. E-mail: tepliza@academ.org*

***Keywords**:* cluster, liquid, gas, solid body, crystal, lattice, coordination number, first order phase transition, critical point, critical compressibility factor, cluster model of substance, equation of state, virial coefficient, phase equilibrium, melting.

**Abstract**

The model of ideal gas of clusters with various number of atoms or molecules of one-component substance is considered. It is shown that the compressibility factor of the gas is inversely proportional to the mean size of clusters. This relation is valid with a good accuracy for many substances. It is shown that the number of clusters in the unite volume does not depend on the number of atoms or molecules in the cluster and it is not equal to zero only up to maximal size of clusters. The formula to define critical compressibility factor via maximal size of clusters is found. It is shown that the formula describes critical factor of compressibility of many of one-component substances with experimental accuracy. The formula to define the value of the triple point temperature via densities and surface tensions of liquid and solid at the triple point temperature is found. The formulae to define the temperature dependencies of compressibility factor at the lines of liquid-gas and solid-gas phase equilibria are found. It is shown that the spinodal lines – boundary lines of thermodynamic stability – of metastable vapor and sublimating ideal gas of clusters do not exist or they coincide with corresponding lines of phase equilibria. The formulae to define the lines of vapor-liquid and gas-solid phase equilibria are found. The temperature dependencies of change of the entropy and the latent heat in liquid-gas and solid-gas phase transitions are found. The change of the entropy and the latent heat in liquid-solid phase transition at the triple point are found.