About some features of description and determination of thermodynamic properties of substances near critical point

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Abstract

It is shown that the difficulties of determining the critical parameters from the lines of phase equilibrium – specific volume dependences of pressure and temperature – can be easily overcome by examining the specific volume dependencies of some complexes consisting of the dependencies and the specific volume, and having no broad maximum near the critical point. In particular, such complexes can be compressibility factor, the products of pressure and temperature on the specific volume, ratios of specific volume to pressure and temperature, which can determine the critical volume, pressure and temperature.

The relationship between the conditions imposed on thermal equation of state at the critical point and parameters of the equation of state is discussed.

Three new equations of state were proposed satisfying the conditions of stability at the critical point and describing the critical point.

It is shown that most widely used equations of state equal to the sum of products of functions of temperature on the functions of the volume, in principle, can not describe the singularity of the isochoric heat capacity at the critical point.

It is proved that all critical amplitudes and exponents depend only on one parameter for normal un-dissociated substances, that is, there must be relations between all the critical amplitudes and exponents, and they must depend on only one of them.

The classification of substances according to the value of the critical exponent β is suggested.

The uniqueness of this classification for normal un-dissociated substances is proved.

Relation is found between the critical exponent β and the critical amplitude B .