

METHOD OF CONSTRUCTION OF THE FUNDAMENTAL EQUATION OF STATE FOR SF₆

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A method for constructing a fundamental state equation (FEOS) based on the Schofield linear model, the Benedek hypothesis, and the representation of the scale hypothesis of the critical point in the following form is considered [1]

$$\Delta S \cdot X^{\frac{1-\alpha}{\chi}} = \varphi_0 + \varphi_1 \cdot m^2, \quad m = \Delta\rho \cdot X^{\frac{\beta}{\chi}}, \quad (1)$$

where $\Delta S = (\rho_c T_c / p_c) [S(\rho, T) - S_0(\rho, T)] / \phi(\omega)$; S is the entropy; $\phi(\omega)$ is the crossover function; $\Delta\rho = \omega - 1$; $\omega = \rho / \rho_c$; α , β , χ and Δ are the critical indices; X is the thermodynamic function that has a singularity at the critical point, which is characterized by a critical index χ (for example, if $X = K_T$, then $\chi = \gamma$).

On the basis of the system of equations (1) the structure of FEOS and the scale function of the Helmholtz free energy are calculated:

$$a(x) = A \left[(x + x_1)^{2-\alpha} - \frac{x_1}{x_2} (x + x_2)^{2-\alpha} \right] + B(x + x_3)^\gamma + C. \quad (2)$$

FEOS with the scale function (2) was tested on sulfur hexafluoride. The analysis of the obtained results is carried out. The tables of the equilibrium properties of SF₆ in the range of the state parameters have been calculated: for temperature from 223.555 to 625 K and for pressure up to 150 MPa. Detailed thermodynamic tables for a wide neighborhood of the critical point are also calculated. It is shown that the accuracy of calculating the equilibrium properties in the regular part of the thermodynamic surface suggests that the proposed equation R1234yf is not inferior to the fundamental equations of state [2, 3].

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 2. Scalabrin G., Bettio L., Marchi P., Stringari P. // J. Phys. Chem. Ref. Data. 2007. V. 36. P. 617.
 3. Guder C., Wagner W. // J. Phys. Chem. Ref. Data. 2009. V. 38. P. 33.