

Investigation of some scaling models connected with thermodynamic properties and complexes near the critical point of SF₆

Ustyuzhanin E E^{1,®} and Rykov S V²

¹ National Research University Moscow Power Engineering Institute, Krasnokazarmennaya 14, Moscow 111250, Russia

² ITMO University, Kronvergskiy 49, Saint-Petersburg 197101, Russia

® evgustevgust18@mail.ru

In this paper we consider a number of tasks; among them the first concerns the study of some thermodynamic functions ($\Delta\rho_{lg}(\tau)$, $\mu_{lg}(\tau)$ etc.) in the critical region ($0 < \tau < \tau_{lm}$), here $\Delta\rho_{lg} = (\rho_{lg} - \rho_c)/\rho_c$ are relative substance densities, ρ_l , ρ_g are liquid and gas densities, μ_l , μ_g are chemical potentials, $\tau = (T_c - T)/T_c$ is the relative temperature, $D = (T_c, \rho_c)$ are parameters of the critical point. Within the framework of task 1, it is tested several variants, which are related to structures of $(\Delta\rho_g(\tau), \Delta\rho_l(\tau))$. At the stage, a method is proposed, which allows us to choose the optimal structures of $(\Delta\rho_g(D, \tau), \Delta\rho_l(D, \tau))$. This method uses: (a) the provisions of the scale theory of critical phenomena, (b) the differential forms, which are related to $\mu_{lg}(\tau)$ and oriented to the interval ($0 < \tau < \tau_{lm}$).

Task 2 is related to the study of thermodynamic complexes, which include several properties; among them, we have considered: $f_d = (\rho_l + \rho_g)/(2\rho_c) - 1$ (the average diameter of the binodal), $f_s = (\rho_l - \rho_g)/(2\rho_c)$ (the order parameter), $ur = f_d/f_s$, $Z_l = \Delta\rho_l/\tau^\beta$, $W = (f_s - f_d)/(f_s + f_d)$, here β is the critical index. At the stage, numerical data and graphs are obtained. On the example of SF₆, this information let us: (a) to describe the behavior of these complexes in the range $10^{-5} < \tau < 10^{-2}$, (b) to represent some functions including $(\Delta\rho_g(D, \tau), \Delta\rho_l(D, \tau))$ in the same interval.