A comparative study of some scaling and traditional models describing the densities of the liquid and the gas on the SF_6 saturation line

Ustyuzhanin E.E.[1,@], **Rykov S.V.**[2], **Kudryavtseva I.V.**[2], **Rykov V.A.**[2] **and Ochkov V.F.**[1]

[1] National Research University Moscow Power Engineering Institute, Krasnokazarmennaya 14, Moscow, 111250, Russia
[2] ITMO University, Kronvergskiy 49, Saint-Petersburg, 197101, None

[@] evgust@gmail.com

In this report we consider a number of objects; among them there are: (a) the liquid (ρ_l) and the gas (ρ_g) densities on the saturation line of SF_6, (b) the average diameter (f_d), the order parameter (f_s), (c) $\Delta\rho_l = (\rho_l - \rho_c)/\rho_c$, $\Delta\rho_g = (\rho_g - \rho_c)/\rho_c$, (d) thermodynamic complexes $Z_l = \Delta\rho_l/f_s$, $Z_g = |\Delta\rho_g|/f_s$. One of the purposes of our study is to get numerical data on complexes (Z_l, Z_g, $ur = f_d/f_s$, etc.) in the range ($2\times10^{-8} < \tau < 0.3$). In accordance with the goals, the authors consider tasks I...III. Due to tasks I, we are generating the initial array (SA) on the bases of experimental (ρ_l, ρ_g, T) data in the range ($2\times10^{-8} < \tau < 0.3$) (step 1). In the second step, we are building model A ($f_s = B_{s0}\tau^{\beta} + B_{s1}\tau^{\beta+\Delta} + \ldots$) and model B ($f_d = B_{d0}\tau^{2\beta} + B_{d1}\tau^{1-\alpha} + \ldots$), which work in the range ($2\times10^{-8} < \tau < 0.3$) satisfactorily and follow to the scaling theory of critical phenomena (ST). In the frame of tasks II, we are investigating the equations C ($Z_l = 1 + ur = 1 + ur_{bas} + (B_{d1}/B_{s0})\tau^{1-\alpha-\beta} + \ldots$, $Z_g = 1 - ur = 1 - ur_{bas} - (B_{d1}/B_{s0})\tau^{1-\alpha-\beta} + \ldots$), here $ur_{bas} = (B_{d0}/B_{s0})\tau^{\beta}$. Using the SA array and C models, we calculate (Z_l, Z_g, ur_{bas}) data, experimental ($Z_{l\ exp}$, $Z_{g\ exp}$, ur_{bas}) data and construct a liquid as well as gasose branches of the binodal in these coordinates. In accordance with tasks III empirical equations ($Z_{l\ eff}(x_1, x_2, \tau)$, $Z_{g\ eff}(x_1, x_2, \tau)$) is being developed (step 1). In the second step, we determine (Z_l, Z_g, ur_{bas}) data, which are connected with some literature (ρ_l, ρ_g, T) values.