Comparative analysis of some models describing densities of the liquid and the gas at the saturation line for SF_6

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This report considers some problems, which are connected with the behavior of the gas density (ρ_g) and the liquid density (ρ_l) at the saturation line of SF_6. We pay an attention to some thermodynamic models, $\rho_l(\tau)$, $\rho_g(\tau)$, which have a scaling form, here $\tau = (T_c - T)/T_c$ is the relative temperature, T_c is the critical temperature. There is an Anisimov model between these models. The model is valid at relative temperatures, $0 < \tau < 0.02$, and includes scaling components with indices, α, β, 2β, ... Another model is developed in the work; the model is referred to as a combined scaling model and works up to $\tau \approx 0.1$ for SF_6. We have investigated one more problem: to evaluate (ρ_l, ρ_g, τ) data of SF_6 accordingly to experimental (h, τ) data [1] in the interval, $\tau = 10^{-2}$ to 10^{-6}, here h is the position of the meniscus. The last separates the liquid and gas phases of a sample. This sample of a substance is placed in a horizontal cylinder. It is shown that the function, $y(\tau) = 2h/d$, can take values in the range, $y = -0.04$ to 0.03, if τ decreases in the interval, $\tau = 10^{-2}$ to 10^{-6}. We have solved a number of tasks, including: (i) to investigate $y(\tau)$ theoretically, (ii) to evaluate (ρ_l, ρ_g, τ) data of SF_6 accordingly to experimental (y, τ) data [1], (iii) to build a combined model, which let us describe the coexisting densities (ρ_l, ρ_g) at temperatures, $0 < \tau < 0.1$.

[1] Garrabos Y, Lecoutre C, Marre S, Beysens D and Hahn I 2018 *Phys. Rev. E* **97** 020101