

THERMAL DIFFUSION IN BINARY MIXTURES
 $H_2 - CCl_2F_2$ AND $H_2 - CHClF_2$

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Thermal diffusion coefficients were measured in two gaseous mixtures, in which one component was close to the critical temperature, in the pressure range $(19.6-127.4) \cdot 10^4 \text{ N/m}^2$ and at a freon concentration of 0.25-0.8.

Thermal diffusion coefficients α_T have been measured for the two binary gaseous mixtures $H_2 - CCl_2F_2$ and $H_2 - CHClF_2$, together with their dependence on pressure and composition, using a single-stage stainless-steel separator. The experimental apparatus also made it possible to determine the partial pressures by a separation method and by a catharometer method (from the thermal conductivity) [1, 2, 3].

Thermal diffusion coefficients were calculated from the formula

$$\alpha_T = \lg q / \lg(T'/T), \quad q = \frac{x'_{H_2}/x'_F}{x_{H_2}/x_F}$$

The mixtures were studied at a temperature difference ΔT between the hot and cold ends of the apparatus of 30°C ($T' = 319^\circ\text{K}$, $T = 292^\circ\text{K}$).

Thermal diffusion coefficients were measured at three pressures: $(19.6, 49, \text{ and } 78.4) \cdot 10^4 \text{ N/m}^2$ for mixtures of H_2 and CCl_2F_2 and $(29.4, 78.4 \text{ and } 127.4) \cdot 10^4 \text{ N/m}^2$ for mixtures of H_2 and $CHClF_2$ at different concentration of the components in the mixtures.

We obtained results which agree well for both methods within the limits of experimental error. The results were plotted as graphs, which are presented in Figs. 1 and 2, where the absolute experimental errors are indicated. The temperature dependence was not measured. As a final confirmation of the accuracy of the results obtained, we determined the separation coefficients of the mixtures on a working thermal diffusion column. These results confirmed the accuracy of the values obtained for the thermal diffusion coefficients.

In the pressure region studied, the thermal diffusion coefficients depend essentially on p. From the point of view of the kinetic theory of gases, it would be impossible to accept a determination of α_T by the usual method of calculation based on pair interactions among molecules. Qualitatively, it is possible to explain the dependence $\alpha_T(p)$ on the basis of the thermodynamics of irreversible processes [4]. For a quantitative estimation of α_T it is necessary to measure the dependence of the volumes of mixtures of $H_2 - CCl_2F_2$ and $H_2 - CHClF_2$ on p, T, and x.

NOTATION

q - separation factor; x'_{H_2} and x_{H_2} - mole fractions of hydrogen in hot and cold zones; x'_F and x_F - mole fractions of freon.

REFERENCES

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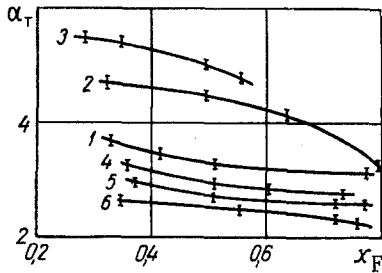


Fig. 1. Dependence of α_T on composition of mixtures: 1, 2, 3) for mixtures $H_2 - CCl_2F_2$; 4, 5, 6) for $H_2 - CHClF_2$ at p = (29.4; 49; 78.4) $\cdot 10^4 \text{ N/m}^2$

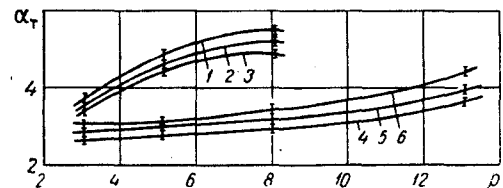


Fig. 2. Dependence of α_T on pressure: 1, 2, 3) for mixtures $H_2 - CCl_2F_2$ at $x_{CCl_2F_2} = 0.35$ and $x_{H_2} = 0.65; 0.45 \text{ and } 0.55; 0.55 \text{ and } 0.45$; 4, 5, 6) for mixtures $H_2 - CHClF_2$ at $x_{CHClF_2} = 0.35$ and $x_{H_2} = 0.65; 0.45 \text{ and } 0.55; 0.55 \text{ and } 0.45$.