

Association and Viscosity of Methanol-Triethylamine Vapor Mixtures

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The viscosity coefficients of methanol-triethylamine mixtures and of their pure components methanol and triethylamine was measured at low densities in the vapor phase. The relative measurements were performed using a high precision all-quartz oscillating-disk viscometer at temperatures from 297 to 498 K (603 K in the case of pure methanol vapor). The densities cover the ranges from 4 to 50 mol·m⁻³ for methanol, from 2 to 8 mol·m⁻³ for triethylamine, and from 10 to 30 mol·m⁻³ for an equimolar mixture and for a mixture with a mole fraction of methanol, $x_M = 0.33$. At low temperatures, values for the viscosity of the saturated vapors and vapor mixtures were also determined. The uncertainty is estimated to be ± 0.2 % at ambient temperatures and increases up to ± 0.3 % at the highest temperature.

Isothermal values, recalculated from the original isochoric data, were analyzed with a density series for the viscosity in which only a linear contribution is considered. Hence, zero-density and initial-density viscosity coefficients resulted for the pure components as well as for the mixtures. The zero-density viscosity coefficients of the pure components were correlated individually, based on the kinetic theory of dilute gases and an extended corresponding states model. The results of these correlations were used to determine the interaction viscosity in the limit of zero density. The evaluation of the initial-density viscosity coefficient expressed as a second viscosity virial coefficient accounts for the association in the vapor mixture and in each pure vapor. Since high mole fractions of methanol promote the formation of larger methanol associates compared to the formation of associates with triethylamine, measurements were only carried out for an equimolar mixture and one with a lower mole fraction of methanol.