

Determination of Saturated Vapor Pressure of Freons for the Entire Range of the Liquid Phase

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An investigation of the thermophysical properties of Freons has had an immense importance, as these substances are extensively used in many fields of science and technology. A study of the liquid-vapor equilibrium of Freons was carried out from the triple point temperature to the critical temperature by both experimental and calculation methods. A comparative differential ebulliometry was developed for the determination of the saturated vapor pressure in the atmospheric pressure range from 2 to 101.6 kPa. The enthalpy of vaporization at $T = 298.15$ K and the heat of capacities in the temperature range from 5 to 320 K were determined by adiabatic calorimetry. Numerous precision data of the normal boiling temperatures, enthalpies, and entropies of vaporization, and their dependence on the temperatures, enthalpies, and entropies of solid-to-solid transitions and fusions were obtained earlier. In this work, the saturated vapor pressures of 19 Freons in the atmospheric pressure range were extrapolated to the whole range of liquid phases, from the triple to critical points. For that, the vapor pressures and densities of liquids were treated by the methods of corresponding states principal of L.P. Filippov, which allowed us to compute the critical parameters of the Freons under study, and to extrapolate the vapor pressures from the normal boiling point temperature to the critical temperature. The method of the combined treatment of the vapor pressures and low-temperature differences of the heat capacities of an ideal gas and liquid was developed, in order to reliably extend the vapor pressure towards the triple point temperature. The temperature range of the liquid phases of the Freons under study is from 260 to 400 K, and the vapor pressure of the liquids changed 10,000 to 10,000,000 times.