

Measurements of Critical Parameters and Vapor-Liquid Coexistence Curve for 2,3,3,3-Tetrafluoropropene

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The vapor-liquid coexistence curve near the critical point for 2,3,3,3-tetrafluoropropene (HFO-1234yf) has been measured by visual observation of the meniscus disappearance. Twenty-two data of the saturated vapor and liquid densities for HFO-1234yf have been obtained in the temperature range between 348.047 K and critical temperature, and in the density range between 195.5 kg/m³ and 848.2 kg/m³. The experimental uncertainties of the temperature and density measurements are estimated to be within 5 mK and 1.7 kg/m³, respectively. On the basis of the present results of the vapor-liquid coexistence curve near the critical point, the critical temperature and the critical density have been determined in consideration of the meniscus disappearing level as well as the intensity of the critical opalescence. The critical pressure was determined from the vapor-pressure correlation formulated on basis of the measurement in our laboratory. The critical parameters determined in this study are $T_C = 367.85 \pm 0.01$ K, $\rho_C = 478 \pm 3$ kg/m³, and $P_C = 3381 \pm 3$ kPa. Saturated vapor and liquid densities of HFO-1234yf are compared with the predictive method by Peng-Robinson equation of state and Hankinson-Thomson equation, respectively. It is found the reliabilities for both of Peng-Robinson equation of state and Hankinson-Thomson equation was improved by the accuracy of the determination of the critical parameters.