

Determination of the Critical Parameters for Propane (R290) and Isobutane (R600a)

Y. Higashi ^{C, S}

Department of Mechanical Engineering, Iwaki Meisei University, Iwaki, Japan

The vapor-liquid coexistence curves near the critical point for propane (R290) and isobutane (R600a) have been measured by visual observation of the meniscus disappearance. Twenty-one data for the saturated vapor and liquid densities of propane have been obtained in the temperature range $347.425 \text{ K} < T < 369.818 \text{ K}$ and in the density range $87.6 \text{ kg/m}^3 < \rho < 397.4 \text{ kg/m}^3$. For isobutane, twenty-one data for the saturated vapor and liquid densities have been obtained in the temperature range $390.397 \text{ K} < T < 407.795 \text{ K}$ and in the density range $90.6 \text{ kg/m}^3 < \rho < 388.9 \text{ kg/m}^3$. The standard uncertainties of the temperature measurements and density measurements are estimated to be 10 mK and 0.55 %, respectively. On the basis of the present results of the vapor-liquid coexistence curve, the critical temperature and the critical density for propane and isobutane have been determined in consideration of the meniscus disappearance level as well as the intensity of the critical opalescence. The critical pressure has been calculated from the vapor-pressure correlation. For propane, the critical parameters determined in this study are $T_c = 369.818 \pm 0.010 \text{ K}$, $\rho_c = 227 \pm 2 \text{ kg/m}^3$, $V_c = 194.3 \pm 1.7 \text{ cm}^3/\text{mol}$, and $P_c = 4246.5 \pm 2.9 \text{ kPa}$. For isobutane, the critical parameters are $T_c = 407.795 \pm 0.010 \text{ K}$, $\rho_c = 229 \pm 2 \text{ kg/m}^3$, $V_c = 253.8 \pm 2.2 \text{ cm}^3/\text{mol}$, and $P_c = 3628.2 \pm 1.4 \text{ kPa}$. In addition, the critical exponent β and the law of the rectilinear diameter were also discussed.