Thermodynamic Properties of HFO-1234yf (2,3,3,3-Tetrafluoropropene)

Katsuyuki Tanaka [C, S] and Yukihiro Higashi

Department of Mechanical Systems and Design Engineering, Iwaki Meisei University, Iwaki, Fukushima, Japan

HFO-1234yf (2,3,3,3-tetrafluoropropene) is a promising alternative to HFC-134a for the air-conditioning system of an automobile car. In this work, thermodynamic properties of HFO-1234yf at saturated conditions were measured. Critical properties, i.e., critical temperature T_C, critical density ρ_C, and critical pressure P_C, were determined by visual observation of the meniscus disappearance. The critical temperature, the critical density and the critical pressure were determined to be 367.85 ± 0.01 K, 478 ± 3 kg/m^3, 3382 ± 3 kPa, respectively. Vapor pressures were measured by a batch-type calorimeter with a metal-bellows in the temperature range from 310 K to 360 K. The present data of the vapor pressure were correlated by the Wagner-type equation. Surface tensions were measured by the differential capillary-rise method in the temperature range from 273 K to 340 K. The data of the surface tension were correlated by the van der-Waals type equation. The acentric factor was determined to be 0.280 by the vapor-pressure correlation. Based on the critical parameters and acentric factor, saturated vapor and liquid densities were estimated by the Peng-Robinson equation and the Hankinson-Thomson equation, respectively. The heat of vaporization was also calculated from the Clausius-Clapeyron equation.