

Measurements of the P_vT_x and Critical Parameters for the Hydrocarbons and Their Mixtures in the Temperature Range to 600 K at Pressures Up to 200 MPa

Yusuke Nishira^S, Yoshikazu Nagata and Hiroyuki Miyamoto^C

Department of Mechanical Systems Engineering, Toyama Prefectural University, Imizu-shi, Toyama, Japan

Recently, the natural working fluids such as CO₂ and hydrocarbons, and their mixtures are considered as long-term alternatives for replacing HFCs, and as working fluids for high energy efficiency heat pump systems. For further improvements and higher efficiency of several energy conversion systems, more reliable experimental information will be required, especially in the higher temperature and pressure regions for fluids. Taking such background into account, we present new and more reliable (p , v , T , x) properties and critical parameters for such natural refrigerants at higher temperatures and pressures. This will aid in the development of more reliable thermodynamic equations of state in the near future. During the measurements, we used two kinds of apparatus. One is the metal-bellows volumometer valuable for the measurements at higher pressures up to 200 MPa. The other is the apparatus with an optical cell, from which visual observations of critical phenomena of the sample can be obtained. For the measurements in higher temperature regions, both apparatuses have thermostatted air bathes, in which the temperatures of the sample vessel can be raised up to 600 K, and also can be controlled to within fluctuations of ± 3 mK. The goals of the present study are to elucidate the binary and/or ternary interactions of such natural working fluids with quantitative accuracy for further improvement of the available equations of state. In this presentation, we will report new measurements in higher ranges of temperatures and pressures, and will also report comparisons with the available thermodynamic property model.