# Phase Equilibria Measurement of the Tetrafluoromethane (R14) + Isobutane (R600a) System

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Mixed-gas Joule-Thomson refrigerators (MJTRs) have been widely used over a large refrigeration temperature range from (78 to 233) K for their high reliability, high thermodynamic performance, and low cost. They ares driven by a single-stage oil-lubricated commercial compressor with optimal compositions of the refrigerant mixtures. There are no moving parts at low temperatures. However, there are still many important and difficult problems with MJTRs, such as the accurate prediction of the thermodynamic properties of multicomponent mixtures, especially in two-phase regions. Phase equilibria data are one of the most important and fundamental properties. Multicomponent mixtures are usually calculated using binary interaction parameters from binary experimental data. Tetrafluoromethane (R14) and isobutane (R600a) are key component for the MJTRs, but no phase equilibria experimental data were found from the literature. In this work, phase equilibria data for the system of R14 + R600a were measured using an apparatus based on the recirculation method at temperatures from (183.150 to 243.150) K. A 25 Ω standard platinum resistance thermometer was used to measure the temperatures of the equilibrium cell. The pressures in the cell were measured by a Mensor series 6000 digital pressure transducer with uncertainties of ± 0.0006 MPa. The compositions of the vapor and liquid phases were analyzed by a gas chromatograph (Shimadzu GC2014). The measured uncertainties of the temperature, pressure, and compositions are ±5 mK, ±0.0008 MPa, and ±0.005, respectively. All of the experimental data were correlated by the Peng–Robinson equation of state (PR EoS) with the Huron–Vidal (HV) mixing rule involving the non-random two-liquid (NRTL) activity coefficient model. Then the vapor phase compositions were calculated, and the results agree well with the experimental data.