Absolute Viscosity Measurements of Binary and Ternary Alternative Refrigerant Mixtures in the Vapor, Liquid and Supercritical Regions

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The viscosity of the binary mixtures of R32 (difluoromethane) + R134a (1,1,1,2-tetrafluoroethane), R125 (pentafluoroethane) + R134a, R32 + R290 (propane) and R134a + R290 were measured at two compositions with 30 and 70 mol% of either component. Measurements were also performed on the ternary mixture, R32 + R125 + R134a, at the compositions of 33.4/33.3/33.3 and 30/10/60 mol%. The instrument was a torsionally vibrating quartz crystal viscometer designed for temperatures above ambient. It was automated with newly developed software to determine bandwidths of the crystal resonance along isotherms at preset pressures using an impedance analyzer and a personal computer. The accuracy of the measurements was estimated to be 2% excluding polar fluid effects. This paper presents data on the 323 K isotherm in the vapor and liquid regions and on the supercritical 398 K isotherm at pressures up to 65 MPa and at densities from 1 to 1430 kg/m^3. Also, based on the higher density data of these target mixtures, the influence of fluid polarity on the measurements will be discussed. Comparison of the experimental data with predicted values from the extended corresponding states model in NIST Standard Reference Database REFPROP reveals deviations of 20% and more. It becomes clear that the reference fluid formulation has a considerable influence on the accuracy of the mixture predictions.