Prediction of Phase and Volumetric Behavior of Mixtures of Natural Refrigerants and Lubricant Oil Using the PC-SAFT Equation of State

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The Perturbed-Chain Statistical Associated-Fluid Theory (PC-SAFT) equation of state (Gross and Sadowski, 2001) with a single temperature dependent binary interaction parameter was utilized to correlate the phase behavior of the following oil-refrigerant mixtures: R-600a/AB ISO 5, R-744/AB ISO 32 and R-744/POE ISO 68 between 12 and 75°C, with pressures up to 2 MPa and 15 MPa for the R-600a and R-744 mixtures, respectively. The absolute average deviation between the experimental data and the equation of state predictions of the phase behavior was lower than 6% for all oil-refrigerant pairs. Liquid densities were predicted with absolute average deviations lower than 5% for all oil-refrigerant pairs. Miscibility gaps have been predicted at 12, 25 and 35°C for the R-744 mixtures and barotropic behavior was observed in the R-744/AB ISO 32 at 12°C at pressures of the order of 12.5 MPa.