

Density Measurements on 0.95 CO₂ + 0.05 CH₄ at the Vicinity of The Critical Point in the Supercritical State by Single Sinkers Densimeter

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Measurements of volumetric properties of binary mixture 0.95 CO₂ + 0.05 CH₄ were performed at 300.15 – 313.15 K and 8.0 – 10.0 MPa, which is at the vicinity of the critical point in the supercritical state, with intervals 1.0 K and 0.2 MPa for temperature and pressure, respectively, by single sinkers densimeter. The extended uncertainties ($k=2$) of measurement are estimated to be 21.5 mK for temperature, 3.39 kPa for pressure, and 0.024% ρ for density. The combine density uncertainty is 0.042% - 0.048% at the measuring range. The uncertainty contribution from molar fraction to density is possibly up to 0.115%, with mixture preparation and gas absorption and desorption effect as the domination factors. The measurement results were compared with GERG-2004 equation of state. Generally, the deviation from experiment data to GERG-2004 EOS increases when approaching to the critical point, peaking at -4.8% at (301.07K, 7.97 MPa). In an isothermal state with increasing pressure, the deviation reaches maximum when crossing the Widom Line. The isobaric expansibility α_p , i.e. $(\partial V/\partial T)_p$, was calculated from the experiment results and a maximal locus of α_p in the measuring range is obviously observed. The maximal locus stretches close to critical point but the critical point is not on the extension of this maximal locus. This phenomenon is different with that in purity, for which critical point is on the extension of the maximal locus of α_p .