Isochoric Heat Capacity Measurements for a CO_2 + n-Decane Mixture in the Near-Critical and Supercritical Regions

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The isochoric heat capacity of a (0.7367 mol fr.)CO_2 + (0.2633 mol fr.)n-decane mixture was measured in a range of temperatures from 362 K to 577 K, at nine near-critical liquid and vapor densities between (298 and 521) $kg \cdot m^{-3}$ by using a high-temperature, high-pressure, nearly constant volume adiabatic calorimeter. The measurements were performed in both the one- and two-phase regions including the vapor + liquid coexistence curve. The uncertainty, with a coverage factor k=2, of the heat capacity is estimated to be 2 %. The liquid and vapor one- and two-phase isochoric heat capacities, temperatures and densities at saturation were extracted from raw experimental data for each filling density. The critical temperature (T_C=509.71 K) and the critical density (ρ_C=509.71 $kg \cdot m^{-3}$) for this CO_2 + n-decane mixture (x=0.7367 mol fraction of CO_2) were derived from isochoric heat capacity measurements using the well-established method of quasi-static thermograms. The measurements were compared with values calculated with an equation of state model. The near-critical isochoric heat capacity behavior for CO_2 + n-decane mixture will be discussed in light of the principle of isomorphism of critical phenomena. The observed isochoric heat capacity along the critical isochore of the CO_2 + n-decane mixture exhibits a renormalization of the critical behavior of C_V unlike that of the pure components. A value of the Krichevskii parameter was calculated by using the critical loci and vapor pressure data and those results were compared with values reported by other authors.