

Measurements of the Coexistence Curve Near the ^3He Liquid-Gas Critical Point

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The shape of the liquid-gas coexistence curve of ^3He very near the critical point ($-2 \times 10^{-6} < t < -5 \times 10^{-3}$) was measured using the quasi-static thermogram method. The study was performed in Earth's gravitational field using two different height calorimetry cells, both originally designed for simultaneous measurements of the isochoric heat capacity, isothermal compressibility and PVT. The heights of two cells were 0.5 mm and 4.8 cm. The uncertainty in measuring the phase transition temperature was typically $\pm 2 \mu\text{K}$. The measured coexistence curve near the critical point was strongly affected by the gravitational field. Away from the critical point, the coexistence curve obtained using this technique was also consistent with the earlier work using the local density measurements of Pittman et al. Both the restricted cubic model and the recent crossover parametric model of the equation-of-state are used to analyze the height dependent, measured coexistence curves. Data analyses have indicated that micro-gravity will permit measurements within two additional decades in reduced temperatures beyond the best gravity-free data obtained in Earth bound experiments.