ABSTRACT

This bulletin presents data on liquid-vapor phase equilibria, gas phase pressure-volume-temperature relationships, and saturated liquid and vapor densities for the ethane-nitrogen system, obtained by detailed experimental investigation with specific mixtures of ethane and nitrogen.

The liquid-vapor phase equilibrium data were determined by study of the dew and bubble point pressure-temperature relations of ten mixtures of ethane and nitrogen. During experimental runs the mixture was confined in a heavy-walled glass cell immersed in a cryostat, and stirred by a magnetically-raised and lowered steel ball. Dew and bubble points were determined by direct visual observation, and the critical region of the mixture was carefully noted if critical conditions were within the operating limits of the equipment. The range covered was from 50 to 1950 psia, and —297° to +90°F, the critical temperature of ethane. It was not possible to determine the highest pressure at which liquid and vapor can coexist, due to equipment limitations.

Pressure-temperature, temperature-composition and pressure-composition diagrams were prepared from the dew and bubble point data. Equilibrium vaporization ratios were determined from these diagrams, and are presented in graphical and tabular form. It is estimated that the phase equilibrium data are reliable to ±2 psi or ±0.2°F, whichever is greater.

The gas-phase pressure-volume-temperature data were determined by a study of the pressure-temperature relations of five mixtures of ethane and nitrogen at constant density. Seven or eight constant density lines (isometrics) were investigated for each mixture. The data, covering the range from the critical region to +110°F and pressures to 4000 psia, are presented in plots of compressibility factor versus pressure, with lines of constant temperature. Compressibility factors calculated from the data are believed accurate to ±0.3%.

The experimental compressibility factors have been compared with values calculated with the Benedict-Webb-Rubin equation of state, the constants for the mixtures being obtained by combining the constants for ethane and nitrogen. An empirical combination rule for the A_o term was used to adjust the method of combining constants and improve the agreement with the experimental data. A comparison of the experimental pressure-volume-temperature data with the data of Reamer *et al.*[18] show good agreement, with a maximum deviation of about 1.2%.

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