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The CO_2-H_2O system: III. A new experimental method for determining liquid-vapor equilibria at high subcritical temperatures

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ABSTRACT

A highly precise and accurate vibrating U-tube technique was developed to determine the upper baric stabilities of liquid-vapor assemblages in the CO_2-H_2O system at high subcritical temperatures (~275–360 °C). The first step is to create an isobaric-isothermal, physically isolated and chemically homogeneous sample of "high-pressure" CO_2-H_2O fluid of known composition. Fluid pressure (P) is then lowered slowly at constant temperature. Pressure readings and matching values for τ (the period of vibration of the U-tube) are recorded at 0.1 or 0.2 MPa intervals. When the fluid begins to separate into two phases (liquid + vapor), a distinct inflection is observed in the trend of P vs. τ. Performing such experiments for fluid compositions at 0.05 mole fraction CO_2 (X_{CO_2}) intervals in the range $0.05 \leq X_{CO_2} \leq 0.40$ at 300 °C produced a complete high-P liquid-vapor boundary curve for the CO_2-H_2O system at that temperature. Agreement with corresponding curves determined in previous studies ranges from poor to excellent.