Simultaneous Measurements of Speed-of-Sound, Isothermal Compressibility and Isentropic Exponent in a Gas Condensate Fluid, Using a Combined Acoustic Resonator and Burnett Expansion Apparatus

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In a companion paper to this Symposium, we described conventional p-V-T measurements around high pressure pipeline conditions on a gas condensate fluid deriving from a gas processing facility. In particular, these measurements on a well characterized fluid delineated the phase boundary for the fluid, with special emphasis on the cricondentherm.

In this paper, we report simultaneous acoustic and volumetric measurements made on this same fluid. These measurements were made in a dual spherical resonator apparatus, enabling speed-of-sound measurements to be made using the acoustic resonance techniques of Moldover, combined with Burnett expansion measurements between the state points of the acoustic determinations. We briefly describe this apparatus and its calibration with pure methane.

The dual apparatus was used in the pressure range 0-120 bar, and the temperature range -20°C to 40°C, and we present results obtained along paths that were (a) completely outside and some distance from the phase boundary, (b) cutting the two phase region, and (c) along the cricondentherm.

These results are compared and contrasted with those obtained with the gas condensate p-V-T apparatus. In particular, we comment on the speed and precision, and the limitations, of the acoustic approach to measuring the phase boundary in a multicomponent fluid.

We also compare our results with predictions from the NIST-14 and AGA8-DC92 equations of state.

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