High Accuracy Density Measurements for two Light Synthetic Natural Gas-Like Mixtures Using a Single-Sinker, Magnetic-Suspension Densitometer

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Natural gas reserves vary considerably in both composition and thermodynamic properties. Accurate knowledge of the phase boundary and PVT behavior of these gases at pressures well above atmospheric pressure is important for custody transfer. It is also necessary to have highly accurate PVT data, in order to validate equations of state (EoS). Development of the current industry standard EoS for natural gas, AGA8-DC92, used a databank of mixtures with pentane compositions up 0.3 mole percent and hexane compositions up to 0.2 mole percent, the normal composition range reported by the American Gas Association (AGA). Natural gas-like mixtures containing N_2 and CO_2 have lower cricondenbars and cricondentherms on the phase envelope. It is important to perform a systematic study of density measurements on mixtures with and without N_2 and CO_2 compositions, in order to determine how accurately EoS predict the densities of the mixtures.

It is also important to have a better understanding of AGA8-DC92 predictions, and how they deviate for mixtures that fall in the expanded range defined by AGA. Such a study requires experiments for expanded range mixtures. High accuracy density data are necessary to test the ability of AGA8-DC92 to cover the entire range of pressures, temperatures, and compositions encountered in custody transfer.

In this paper, we report density measurements for two light, synthetic natural gas-like mixtures performed using a single-sinker, magnetic-suspension densitometer. The data cover the ranges from 270 to 340 K and 3.44 to 34.47 MPa. The measured data indicate that AGA8-DC92 has some serious problems outside of Region I.