Optimal Design of Apparatus for High-Pressure Density Measurements of Natural Gas Mixtures

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The density ($pVTx$, $p\rho Tx$) measurements for natural gas custody transfer applications require a high level of accuracy and compatibility with a variety of numerical simulations. To date, many computational models have been developed and applied to the analysis of thermodynamic properties of natural gas mixtures. In order to ensure reliable custody transfer across pipelines, it is necessary to determine experimentally their performances over wide ranges of temperature, pressure, and composition. In the present study, we present an optimal design of high-pressure density measuring apparatus for the study of the pipeline natural gas (PNG) transportation system that is operational in permafrost regions. The methodological details of our system were determined through analysis of existing experimental approaches such as the Burnett apparatus and the magnetic suspension densimeters. Potential applications of this experimental system are expect to include studies of fundamental phase behavior to evaluate and improve gas flow models and measurements of industrially important fluids requiring high-accuracy properties.