

Metrology for LNG - Design of a Small Scale Reference Liquefier for the Validation of Optical Composition Measurement Methods

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The composition of liquefied natural gas (LNG), and consequently the thermophysical properties, varies depending on the origin of the LNG. Furthermore, the composition in carriers and storage tanks changes over time through a process known as “ageing” whereby the LNG gets richer in heavier components. For custody transfer, equations of state are used to determine the energy quantity of LNG by calculating the density and the gross calorific value of the LNG based on measurements of the pressure, temperature, and composition. Usually, composition analysis is carried out with gas chromatography and recently also with Raman spectroscopy. The reliable validation of optical methods, like Raman and Fourier-Transform Near Infrared (FT-NIR) spectrometers for composition measurement of LNG, requires a synthetic sample of traceable composition. To obtain such a liquid sample, it is necessary to use an apparatus that enables the liquefaction of a gravimetrically prepared gas mixture without changing its composition. Based on the cryostat of the cryogenic densimeter at Ruhr-University Bochum developed by Richter (2011) and Richter et al. (2016) we will present the design of a small scale reference liquefier, that uses supercritical liquefaction in conjunction with a special VLE-cell. The work carried out by Richter et al. (2016), Lentner et al. (2017) and Lentner (2017) has proven that this particular liquefaction technique yields a liquid sample of known composition. The new small scale reference liquefier will enable spectroscopic measurements over the temperature range from (100 to 300) K at pressures up to 10 MPa. Thus, composition measurements can be carried out in the homogeneous liquid region, in the supercritical region and if required in the homogeneous gas phase.

References:

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