Advances in metrology for energy-containing gases and emerging demands

Adriaan M.H. van der Veen, Gerard Nieuwenkamp, Ewelina Zalewska, Jianrong Li, Iris de Krom, Stefan Persijn, Heleen Meuvelaar
VSL, Thijssenburg 11, 2629 JA Delft, The Netherlands, avdveen@vsl.nl

Abstract

Metrological services related to energy gases have been supported by the programme of key comparisons of the CCQM-GAWG since its conception in 1993. Most of the key comparisons have been performed on natural gas composition measurement, which is key to the calculation of natural gas properties. Furthermore, comparisons have been organized on sulphur-containing components, non-conventional energy gases (refinery gas, LPG) and on the liquid injection in the preparation of Primary Standard gas Mixtures. The use of non-conventional and renewable energy gases requires the use of spectroscopic techniques and dynamic primary gas standards for providing services in these areas to meet industry demand in assessing fuel quality with established specifications. These emerging challenges concern especially the measurement of the concentrations of impurities, such as silicon and halogenated compounds in biomethane and upgraded biogas and many others.

Equivalence of national natural gas standards

The table shows the differences (%) in the amount fractions of six components in type II natural gas in CCQM-K1 and CCQM-K23. Over the years, the number of NMIs providing services has increased. The measurement capabilities are very similar.

Refrinery gas

One of the ways to diversify the gas supply is to use energy gases from industrial processes, such as refinery, coke oven, blast furnace or synthesis gas. One key comparison (CCQM-K77) has been organised dedicated to the total composition of refinery gas.

Siloxanes in methane

Siloxanes appear in biomethane and form SiO₂ deposits in the gas transmission infrastructure. Hence, the silicon concentration is part of the biomethane specification EN 16723. Siloxanes are reactive components, showing reactions among themselves and with (metal) surfaces. A suite of 10 gas mixtures has been prepared containing 5 of the most volatile siloxanes (I₂, L3, D3, D4, and D5) using gravimetric dilution from multi-component parents to study cylinder treatment effects.

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Measurement of the NH₃ in CH₄

Primary gravimetric dynamic gas standard based on permeation

Measurement of the HCl in CH₄

Background corrected WMS 2f spectra of HCl in CH₄ collected at 100 mbar in the ppb and low ppm range

Six of the mixtures have been used in a proficiency test.

The assigned values were obtained from analysis using freshly prepared traceable gas standards. Z-scores were used to assess the performance of the labs.