

Measurements of the Calorific Value of Methane with the New GERG Reference Calorimeter

P. Schley^{C, S}, M. Beck and M. Uhrig
E.ON Ruhrgas AG, Essen, Germany

S. Sarge and J. Rauch
Physikalisch-Technische Bundesanstalt, Braunschweig, Germany

F. Haloua, J. R. Filtz and B. Hay
Laboratoire National de Métrologie et d'essais, Paris, France

M. Yakoubi and J. Escande
GDF Suez, Paris, France

A. Benito
Enagás, Zaragoza, Spain

P. Cremonesi
SNAM Rete Gas, S. Donato Milanese, Italy

For billing natural gas deliveries the precise measurement of energy quantities and thus superior calorific values is commercially very important. Currently, superior calorific values are usually calculated on the basis of gas chromatography analyses in accordance with International Standard ISO 6976. The superior calorific values specified in ISO 6976 are based on measurements of pure natural gas components made in the 1930s and 1970s. The uncertainties involved in the ISO values can only be roughly estimated today and are specified to amount to 0.12 % for methane based on the repeatability of the measurements mentioned (two times the standard deviation). While gas chromatography has been constantly improved over the years, only little progress has been made in the field of gas calorimetry. For this reason a GERG (Groupe Européen de Recherches Gazières) project has been initiated to develop a new reference calorimeter for determining the superior calorific values (SCVs) of pure gases and gas mixtures based on the principle of a Rossini calorimeter [1]. The objective of the project is to determine superior calorific values with a measurement uncertainty of less than 0.05 % (95 % confidence level) and ensure traceability of the values measured to national standards.

The reference calorimeter has meanwhile been fully set up and commissioned by the German Institute of Physics and Metrology (Physikalisch Technische Bundesanstalt - PTB). The experimental set-up was described in detail in the proceedings of the IGRC Conference in 2008 [2]. This paper is to focus on the measurement results obtained for methane. A series of measurements were made to examine the superior calorific value of methane. To validate the results obtained, Physikalisch-Technische Bundesanstalt (PTB) and Laboratoire national de métrologie et d'essais (LNE) made a full uncertainty calculation for the measurement series. The measurements made confirmed a total uncertainty of 0.05 % as was envisaged. Following completion of the tests on methane, the superior calorific values of other pure gases (ethane, propane, n-butane and isobutane) as well as of several multi-component mixtures will be measured.

[1] F. D. Rossini: The heat of formation of water, Bur. Stand. J. Res. 6 (1931) 1-35, The heat of formation of water and the heats of combustion of methane and of carbon monoxide. A correction, Bur. Stand. J. Res. 7 (1931) 329-330.

[2] J. Rauch et. al: GERG Project: Development and Setup of a New Reference Calorimeter. Phase 2: Measurements on Pure Gases. Proceedings of the International Gas Research Conference 2008, Paris, France.