Application Note

Rapid Analysis of Syngas using Micro GC Fusion®

OVERVIEW This application note describes the advantages of using the FAST Enabled Micro GC Fusion Gas Analyzer to rapidly analyze typical synthesis gas (syngas) components to optimize the process of generating high quality syngas.

INTRODUCTION In 2012, the World Bank estimated that 140 of the 3370 billion cubic meters (bcm) of natural gas produced worldwide was flared. Flaring burns surplus gas and is detrimental to the environment – contributing over 350 million tons of CO2 in annual emissions1.
An alternative to flaring is to convert the associated natural gas into syngas, which is an intermediate gas used to produce synthetic liquid fuel. Converting syngas to liquid chemicals through the Fischer-Tropsch (FT) process presents an economical and greener alternative to flaring2.
Coal gasification through pyrolysis of coke is another application for syngas. Driven by EPA regulations for cleaner air, Integrated Gasification Combined-Cycle (IGCC) plants convert coal to syngas, which is then introduced into turbines to produce electricity. This solution increases energy conversion efficiency, provides more electricity, and reduces the generation of harmful chemicals, such as SOx and NOx compounds3.
Syngas is composed primarily of H2 and CO. It may also contain CO2, N2, CH4, C2H6, C2H4, or H2S in the high ppm to percent level. Catalyst researchers, synthetic fuel producers, and IGCC plants require accurate analysis of syngas to maximize their productivity and generate a high quality syngas.
Building on proven microelectromechanical systems (MEMS) technology, the compact Micro GC Fusion is capable of providing rapid analysis of common syngas components.

EXPERIMENTAL A syngas calibration gas standard (Air Liquide) was analyzed on a two module Micro GC Fusion:

- Module A: Rt®-Molsieve 5A temperature programmable column with a variable volume injector and TCD detector
- Module B: Rt®-Q-Bond temperature programmable column with a variable volume injector and TCD detector

Table 1 displays the compound concentrations for the syngas calibration gas standard..

Table 1 Concentration information of the gas standard

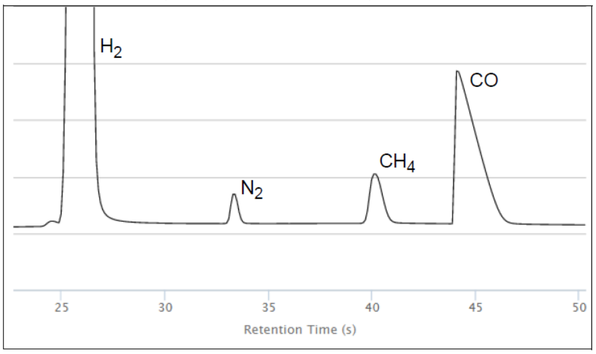
Component	Mole %
H_2	50.0
N_2	2.02
CH_4	3.01
CO	36.9
CO_2	5.00
C_2H_4	1.08
C_2H_6	1.99

A temperature ramp is implemented to remove CO2 and heavier hydrocarbons from the Molsieve column. This prevents column performance degradation and late eluting peak carryover effect.
Ten consecutive runs were conducted to calculate the percent relative standard deviation (%RSD) for peak area and retention time.

RESULTS The components of interest in the syngas calibration gas were fully analyzed within 50 seconds using a two module configuration. Figure 1 and Figure 2 display the labeled chromatograms.

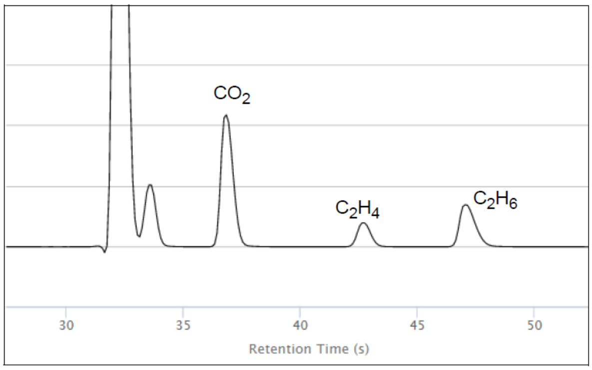
Micro GC Fusion demonstrated excellent retention time and area repeatability, producing %RSD values under 0.1% for retention time and under 0.8% for area count. The retention time and area %RSD values are illustrated in Table 2.

Figure 1 Chromatogram of the calibration gas standard - Module A



Column: Rt-Molsieve 5A, 10 m
Column Temperature: 120°C 140°C; 1°C/s;
Column Head Pressure: 35 psi

Figure 2 Chromatogram of the calibration gas standard - Module B



Column: Rt-Q-Bond, 12 m
Column Temperature: 75°C, isothermal;
Column Head Pressure: 25 psi

Table 2 Repeatability data for calibration gas standard

Module	Compound	Retention Time (s)	Retention Time %RSD	Area %RSD
A	H_2	26.32	0.039	0.138
A	N_2	33.38	0.052	0.260
A	CH_4	40.18	0.046	0.712
A	CO	44.24	0.029	0.130
B	CO_2	36.86	0.036	0.094
B	C_2H_4	42.72	0.039	0.094
B	C_2H_6	47.10	0.049	0.115

CONCLUSION

An analysis time of less than 50 seconds and excellent repeatability make Micro GC Fusion the ideal instrument to measure syngas components. These fast and accurate measurements enable researchers and industry users to optimize their processes to efficiently generate high quality syngas.

REFERENCES

1 The World Bank. Zero Routine Flaring. http://www.worldbank.org/en/programs/zero-routine-flaring-by-2030 (accessed April 7, 2016)

2 Tonkovich, A.L.; Jarosch K.; et al; Microchannel Gas-to-Liquids for Monetizing Associated and Stranded Gas Reserves. 2011. http://www.velocys.com/press/wp/wp110206_microchannel_GTL_White_Paper_060211[1].pdf (accessed November 14, 2011)

3 Meeting Indiana’s Growing Energy Needs: The Edwardsport Project. https://www.duke-energy.com/pdfs/Edwardsport_Fact_Sheet.pdf (accessed April 7, 2016)