Global Analyser Solutions

Carbon Capture, Utilisation & Storage gas analyser

- For assuring CO_2 purity
- Combined GC and FTIR methodology
- 19" rack size; small footprint,
- Fast results (< 3 minutes)
- Highly sensitive (LOD ppm-ppb range)

Get ready for ***tomorrow's analytics***

Global Analyser Solutions

GAS offers custom configured GC analysers for many application fields for over 50 years. GAS analysers are designed to meet many standardised methods from GPA, ASTM, UOP, ISO, EN and others. The efficient configurations are based on proven GC technology, resulting in robust, highly productive instruments with an optimal return on investment.

CCUS (Carbon Capture, Utilisation and Storage) is considered a critical technology for achieving significant reductions in CO_2 emissions, particularly in sectors that are difficult to decarbonise, such as heavy industry and fossil fuel-based power generation. It is also seen as an important component of strategies to achieve net-zero emissions and mitigate the impacts of climate change. Understanding and managing impurities in CO_2 is crucial for the efficiency, safety, cost-effectiveness, and environmental compliance of CCUS projects.

Combined GC and FTIR methodology

To ensure specification, CO_2 must be checked for several possible impurities. Gas Chromatography (GC) is known for its specific detection capabilities using dedicated separation columns tuned to the required components of interest. Additionally, a wide range of detectors is available, offering either a universal response to several components or selective detection of specific component groups, thereby isolating them from the matrix. With CompactGC$^{4.0}$ (figure 2) fast run times are provided, usually below 3 minutes.

FTIR (Fourier Transform Infrared Spectroscopy) complements GC by providing detailed molecular identification through the detection of specific functional groups and molecular vibrations. It offers rapid, precise analysis of chemical structures, enhancing GC's separation capabilities with additional molecular information using spectral data.

Instrument configurations

CompactGC$^{4.0}$ is equipped with 4 analytical channels, using the following detectors:

- Thermal Conductivity Detector (TCD) for detecting permanent gases and light hydrocarbons.
- Flame Ionisation detectors (2) for analysing hydrocarbons and other carbon containing species.
- PFPD for selective and sensitive detection of sulphur components.

(Configuration may vary due to different CCUS specification)

Fourier Transform Infrared (FTIR) Spectroscopy works by measuring how a sample absorbs infrared (IR) light at different wavelengths.
A broad-spectrum IR source passes through the sample, and the transmitted light is collected. A interferometer modulates the IR light, creating an interferogram, which is then converted into an absorption spectrum using Fourier Transform. The resulting spectrum reveals characteristic absorption peaks corresponding to the molecular vibrations of chemical bonds in the sample (figure 3).
FTIR is highly effective for detecting gases like water vapour, ammonia, carbon monoxide, carbon dioxide, formaldehyde and others because of their unique IR absorption fingerprint due to molecular vibrations.
FTIR can detect multiple gases simultaneously with high sensitivity.
It is widely used in environmental monitoring, industrial safety, and atmospheric studies for gas analysis.

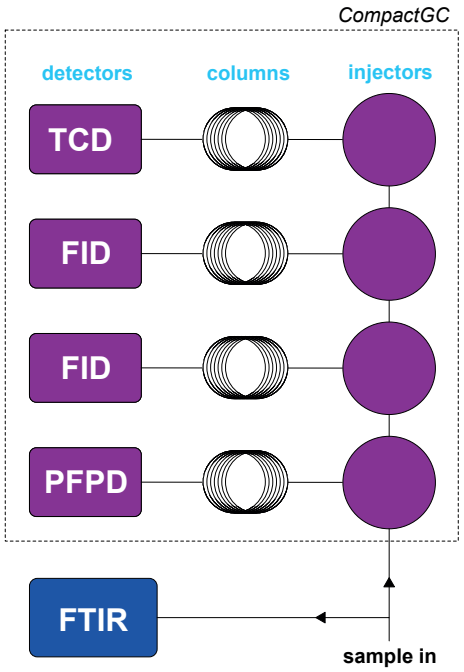

Figure 1 Diagram CCUS gas analyser

Figure 2 CompactGC$^{4.0}$

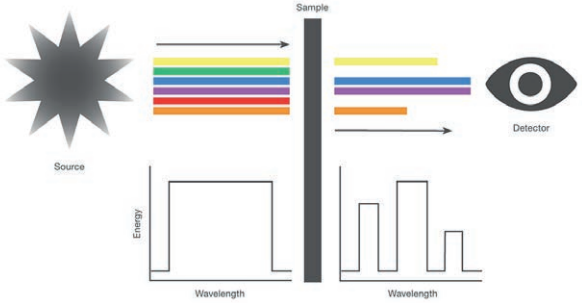

Figure 3 FTIR principle

Results

Figures 4, 5, and 6 show example chromatograms of the CompactGC4.0 using TCD, FID, and PFPD detectors, respectively. Figures 7, and 8 display calibration of the FTIR gas analyser. Figures 9 and 10 present the analysed components and their limits of detection.

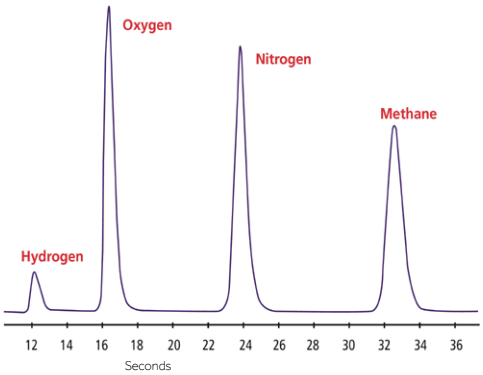

Figure 4 Permanent gas on TCD

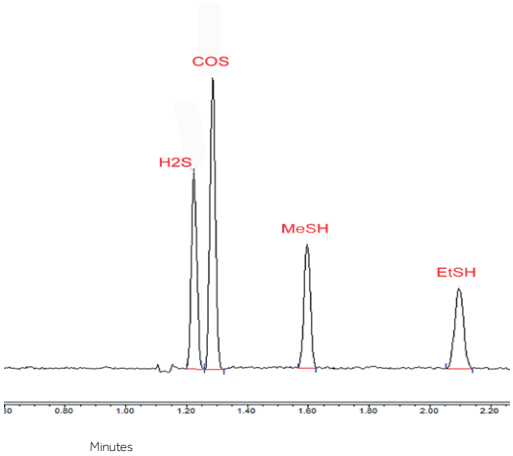

Figure 5 Sulphur components on PFPD

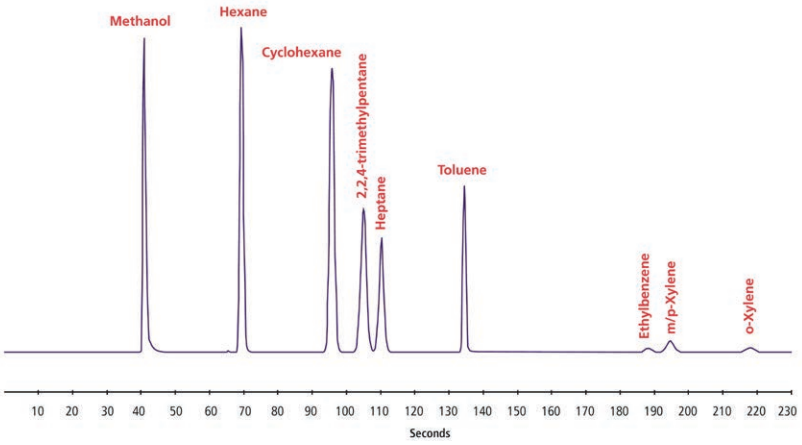

Figure 6 Hydrocarbons on FID

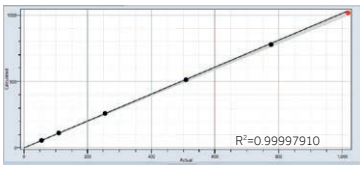

Figure 7 FTIR calibration for Acetaldehyde

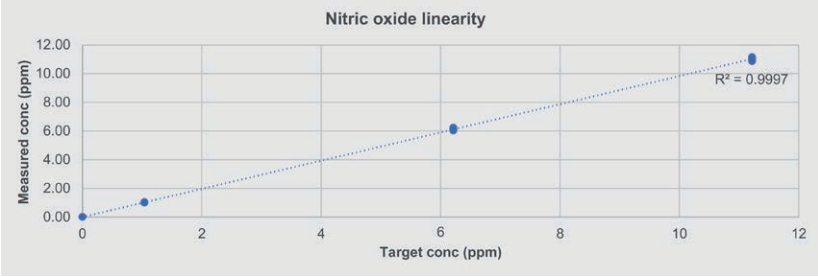

Figure 8
FTIR linearity for NO

Specifications

Configuration:	• 4 channel CompactGC$^{4.0}$ equipped with: - TCD (Thermal Conductivity Detector) - FID (Flame Ionisation detector) (2) - PFPD (Pulsed Flame Photometric Detector) • FTIR gas analyser equipped with DTGS detector
Application:	Carbon Capture, Utilisation and Storage gas analyser; analysis of impurities in CO_2
Analysed components:	• CompactGC: H_2, Ar, O_2, CH_4, CO, hydrocarbons, sulphur components. • FTIR: CO_2, CO, CH_4, H_2O, methanol, ethanol, acetaldehyde, ammonia, formaldehyde, NO, NO_2
Optional:	- Pressure reducer; back-pressure regulator - Sample pump - Stop flow valve - Stream selector
Sample tubing:	Sulfinert® tubing for inert sample path (sulphur and other polar components)
Sample requirements:	See our pre-installation guide for additional requirements
Analysis time:	3 minutes, depending on analysed components
Minimum detectability:	See figure 9 & 10
Data systems:	Chromeleon

FTIR		
Gas	unit	LOD (3σ)
Acetaldehyde	ppm	0.002
Ammonia	ppm	0.01
Carbon dioxide	%	n/a
Carbon monoxide	ppm	0.07
Ethanol	ppm	0.05
Formaldehyde	ppm	0.09
Methane	ppm	n/a
Methanol	ppm	0.07
Nitric oxide	ppm	0.05
Nitrogen dioxide	ppm	0.003
Nitrous oxide	ppm	0.10
Water ppm	ppm	0.41

Figure 9 Analysed components and limits of detection (FTIR).

CompactGC			
Gas	unit	LOD (3*noise)	Detector
Hydrogen	%	< 0.1	TCD
Argon	ppm	< 10	TCD
Oxygen	ppm	< 10	TCD
Nitrogen	ppm	< 10	TCD
Methane	ppm	< 10	TCD
Hydrocarbons *	ppm	< 1 *	FID
Sulphur components	ppm	< 0.1	PFPD
Amines *	ppm	< 1 *	FID
* dependant on component			

Figure 10 Analysed components and limits of detection (CompactGC$^{4.0}$)