Global Analyser Solutions

Greenhouse gas analyser

- Air, water and soil samples
- LOD N_2O < 20 ppb
- Manual, online & automated headspace sampling
- Highest uptime, robust

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

AN17WA1123D

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.

Burning of fossil fuels (like coal, oil and natural gas), agriculture and land clearing contribute to increasing levels of greenhouse gases, which affects earth's temperature. GAS offers the greenhouse gas analyser for measuring ppb/ppm to % levels of CO_2, CH_4, N_2O and SF_6.

Figure 1 Greenhouse gas analyser based on Thermo GC1600 with external valve oven.

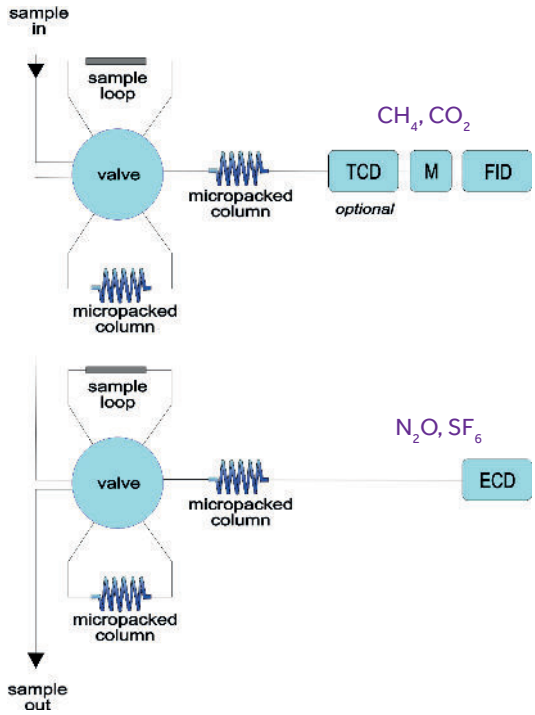

Figure 2 Greenhouse gas analyser for manual and online sampling

Manual loop filling and online analysis

The greenhouse gas analyser is configured with two analytical channels. The first channel is dedicated to measuring CH_4 (methane) and CO_2 (carbon dioxide). It incorporates a 10-port valve for injection/backflush, a methaniser, and a FID (Flame Ionisation Detector). The methaniser converts CO_2 to methane, allowing for sub-parts per million (ppm) detection by the FID. Optionally, a TCD (Thermal Conductivity Detector) can be included in series with the methaniser-FID for measuring high percentage levels of CO_2. This analyser setup allows for manual loop filling and online analysis using a sample pump. Manual loop filling entails the manual introduction of gas samples, while online analysis ensures continuous or real-time monitoring of gas samples through a sample pump.

N_2O is detected using an ECD (Electron Capture Detector) on the second channel, following separation from air and CO_2. Water is backflushed to a vent. Additionally, SF_6 can be measured on this channel, achieving sub-parts per trillion (ppt) level detection limits.

Sampling from Headpace vials

Automated sampling from headspace vials, for instance in case of soil samples or organic material, is provided by the setup shown in figure 3 & 8. After injection of the gas sample, water is backflushed by the upper valve, and the lower valve directs CH_4/CO_2 to methaniser-FID, and N_2O/SF_6 to ECD.

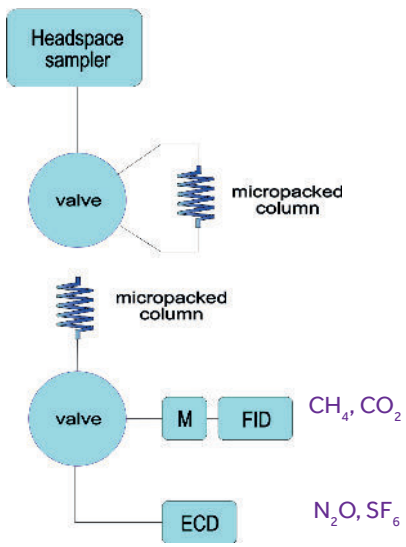

Figure 3 Greenhouse gas analysis using headspace sampling

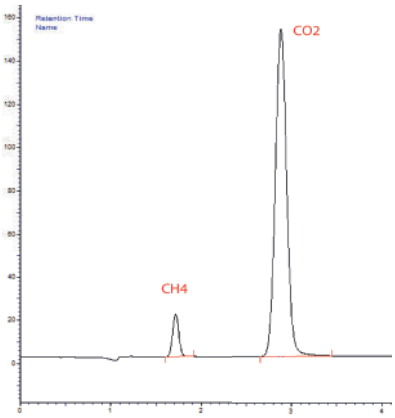

Figure 4 CH_4 and CO_2 using Methaniser/FID detection

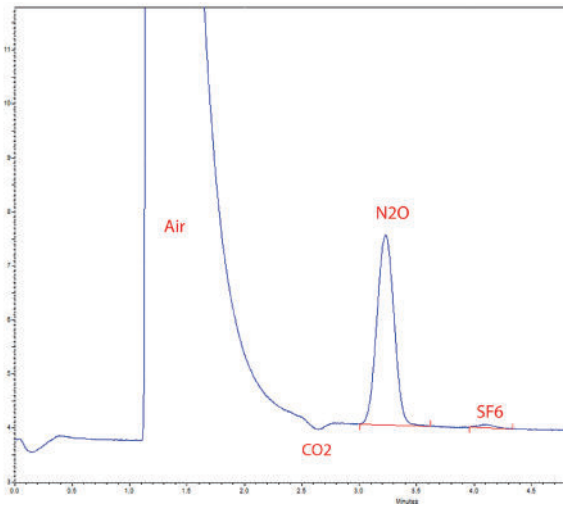

Figure 5 N_2O and SF_6 using ECD detection

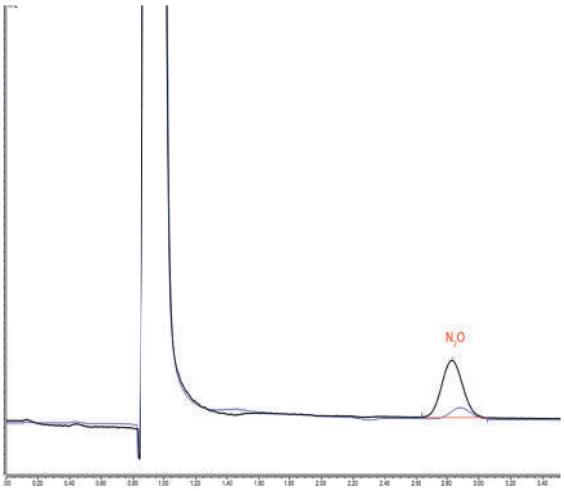

Figure 6 Effect of make-up gas on ECD sensitivity for N_2O.

Blue: N_2 ; black: Ar/CH_4 make-up gas

Results

Figure 4 shows the chromatogram of the methaniser/FID channel, while figure 5 shows N_2O and SF_6 detection on ECD. The minimum detectability is < 50 ppb for CH_4, < 100 ppb for CO_2 and < 20 ppb for N_2O. SF_6 is analysed in the sub-ppt range.

The Electron Caputure Detector requires make-up gas for providing electrons that are captured during detection by the component of interest. Nitrogen or argon/methane (95:5) are used for this purpose. The best sensitivity is achieved using the latter: LOD < 20 ppb for Ar/CH_4 vs LOD < 100 ppb for N2. See figure 6.

All components are analysed with repeatability < 1 % RSD. Figure 7 shows the statistical results for N_2O at 330 ppb concentration level in air.

TRACE 1300 GC-C...	N2O
Sample ID	Area
niowag_N2O_067	4713403.00
niowag_N2O_068	4695494.00
niowag_N2O_069	4689598.00
niowag_N2O_070	4779851.00
niowag_N2O_071	4731030.00
niowag_N2O_072	4706694.00
niowag_N2O_073	4780556.00
niowag_N2O_074	4778467.00
niowag_N2O_075	4748329.00
niowag_N2O_076	4784289.00
Min:	4689598.00
Max:	4784289.00
Mean:	4740771.10
Std Dev:	38232.97
%RSD:	0.81

Figure 7 Repeatablity (%RSD) of N_2O in air at 330 ppb level.

Figure 8 Triplus 500 Headspace autosamper for analysis of greenhouse gases in water, soil and organic materials

Specification

Application:	Analysis of greenhouse gases in air, water, soil or organic material samples
Configuration:	- Manual sampling/online analysis - Automated headspace sampling
Detectors:	Methansiser-FID (Flame Ionisation Detector) ECD (Electron Capture Detector) TCD (Thermal Conductivity Detector) optional
Injection:	GSV (Gas Sampling Valve) or Head Space sampler
Optional:	Head Space sampling using GSV (closed loop sampling) TCD for high levels of CO_2 Bypass valve in case of high O_2 content
Analytes:	CH_4, CO_2, N_2O, SF_6 ; chlorofluorohydrocarbons on request
Analysis Time:	5 minutes
Minimum Detectability:	CH_4 < 50 ppb CO_2 < 100 ppb N_2O < 20 ppb using Ar/CH_4 as ECD make-up gas; < 100 ppb using N_2 as ECD make-up gas SF_6: sub-ppt range
Repeatability:	1% RSD (n=10) or better (N_2O @ 330 ppb; CH_4 @ 2 ppm; CO_2 @ 10 ppm; Gas Sampling Valve)
Data system:	Chromeleon

Figure 9 Modular iConnect FID

iConnect injector and detector modules on GC1600 are exchanged by the user in a couple of minutes, offering great flexibility and low operational costs