H_2 - O_2 analyser

for electrolysers

- Analysing O_2 in bulk H_2 and H_2 in bulk O_2
- Fast analysis: < 1 min
- Small footprint
- Robust analyser

AN307WA1122A

GAS offers custom configured GC analysers for many application fields since 40 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 instruments with an optimal return on investment.

An electrolyser is a device that utilises electricity to split water into hydrogen and oxygen.
Through electrolysis, hydrogen and oxygen gases are generated; hydrogen plays an important role the in the energy transition, and oxygen can be captured for industrial and medical use.

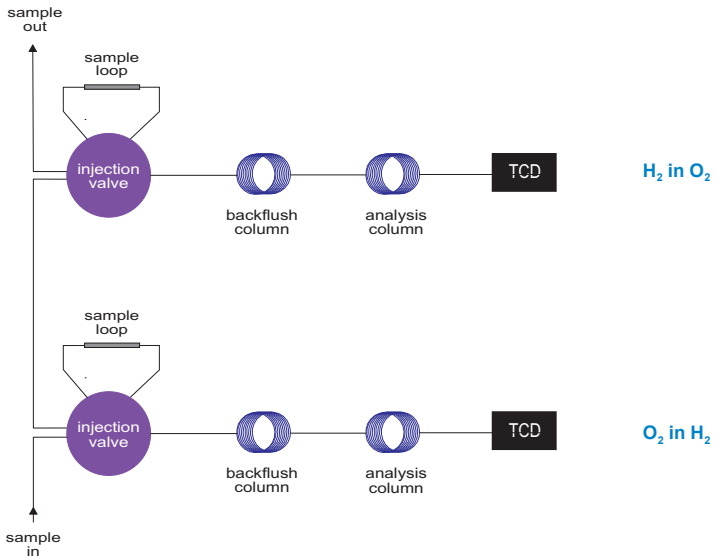

Figure 1. Diagram electrolyser gas analyser

Analyser for electrolyser gases

Electrolysis of water, also known as electrochemical water splitting, is the process of using electricity to decompose water into oxygen and hydrogen. Hydrogen will appear at the cathode and oxygen will appear at the anode. Figure 1 shows a 2 channel gasanalyser for the measurement of

- ppm to % level hydrogen in oxygen
- ppm to % level oxygen in hydrogen

Both channels use Thermal Conductivity Detector (TCD). Helium carrier gas is used for oxygen analysis, and nitrogen or argon is used for hydrogen detection. Both channels use a backflush column to avoid water from entering the analysis column, which would reduce its separation power.
The analyser can have separate inlets for anode and cathode gases, or they can be combined to a single inlet.
Nitrogen is also analysed with this analyser configuration.
The instrument can also be configured for analysing additional components, like argon or water.

Limit of detection

The analyser provides low ppm limits of detection using thermal conductivity detectors. When lower levels need to be analysed, the Pulsed Discharge Detector (PDD) is available, offering down to ppb level detection. When concentration levels vary from ppb to %, both TCD and PDD are offered.

24/7 operation

The instrument is designed for continuous 24/7 operation. With a short runtime of only 1 minute, rotary injection valves would need frequent service intervention. Therefore robust diaphragm valves are used for high uptime and low operational costs. The use of a backflush column is also important for this application, to achieve continuous unattended operation.

Results

Figure 2, 3, 4 and 5 show the chromatograms of both analysis channels, and their repeatability.

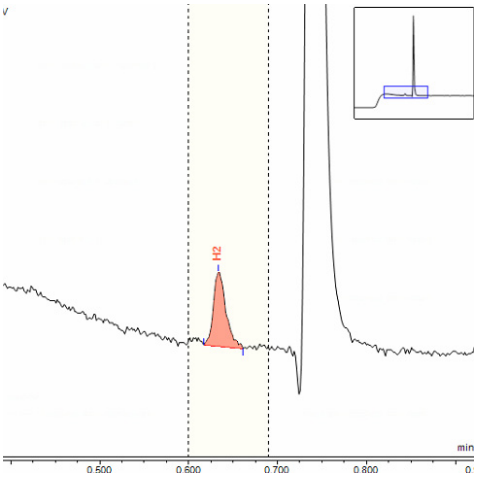

Figure 2. low ppm H_2 in O_2

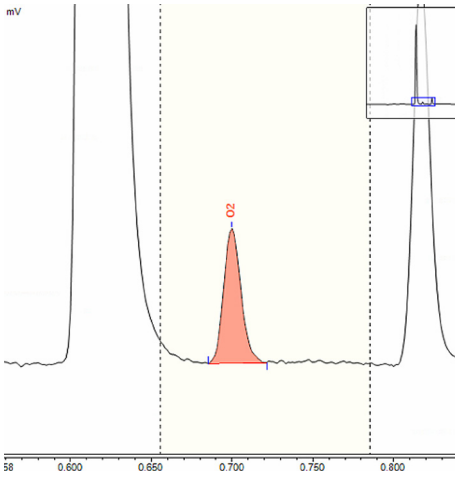

Figure 3. 235 ppm O_2 in H_2

Inj. No.	Injection Name Selected Peak:	Type	Ret.Time min TCD_Ch1 O2	Amount % TCD_Ch1 O2
34	*TM2 rep*	*Unknown*	*0.696*	*5.4695*
35	TM2 rep	Unknown	0.696	5.4700
36	TM2 rep	Unknown	0.696	5.4746
37	TM2 rep	Unknown	0.696	5.4987
38	TM2 rep	Unknown	0.696	5.5029
39	TM2 rep	Unknown	0.696	5.5012
40	TM2 rep	Unknown	0.696	5.4721
41	TM2 rep	Unknown	0.696	5.5516
42	TM2 rep	Unknown	0.695	5.5071
43	TM2 rep	Unknown	0.695	5.5015
44	TM2 rep	Unknown	0.695	5.5026
Maximum			0.696	5.5516
Average			**0.696**	**5.4956**
Minimum			0.695	5.4695
Standard Deviation			0.001	0.0240
Relative Standard Deviation			**0.09%**	**0.44%**

Figure 4. Repeatability oxygen analysis

Inj. No.	Injection Name Selected Peak:	Type	Ret.Time min TCD_Ch2 H2	Amount % TCD_Ch2 H2
34	*TM2 rep*	*Unknown*	*0.635*	*1.0024*
35	TM2 rep	Unknown	0.635	0.9979
36	TM2 rep	Unknown	0.635	0.9992
37	TM2 rep	Unknown	0.633	1.0020
38	TM2 rep	Unknown	0.633	1.0055
39	TM2 rep	Unknown	0.633	1.0073
40	TM2 rep	Unknown	0.635	1.0013
41	TM2 rep	Unknown	0.635	0.9974
42	TM2 rep	Unknown	0.633	1.0033
43	TM2 rep	Unknown	0.633	1.0084
44	TM2 rep	Unknown	0.633	1.0082
Maximum			0.635	1.0084
Average			**0.634**	**1.0030**
Minimum			0.633	0.9974
Standard Deviation			0.001	0.0040
Relative Standard Deviation			**0.11%**	**0.40%**

Figure 5. Repeatability hydrogen analysis

Figure 6. The GAS diaphragm valve offers a long life span.

Specification

Standard methods:	ASTM 2504
Configuration:	One channel instrument based on CompactGC$^{4.0}$ using micro TCD
Options:	- stop flow valve for quantitative analysis in case of pressure fluctuation - Pulsed Discharge Detector for ppb sensitivity - input selector for various streams - input selector for calibration gases - analysis channels for additional components - same analyser based on Thermo Trace GC1600
Application:	Custom configured analyser for the analysis of H_2 in O_2 and O_2 in H_2
Sample requirements:	See our pre-installation guide
Analysis Time:	1 minute.
Minimum Detectability:	< 10 ppm
Dynamic Range:	4 decades (TCD)
Repeatability:	Better than 1% RSD (n=10)
Data systems:	Chromeleon CDS

Figure 7. CompactGC$^{4.0}$