



Semiconductor industry gas analyser



- Analyses permanent gases in HCl, HBr, BCl₃, Cl₂, NH₃, CF₄, NF₃, N₂O, and DCS
- Low ppb limit of detection
- Robust analyser built to endure aggressive bulk gases

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CG600

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Bulk gases are essential in the semiconductor industry, supporting key processes such as deposition, etching, oxidation, purging, and cooling. Common examples include permanent gases, ammonia, hydrogen chloride, hydrogen bromide and chlorine. Each gas serves specific functions - from maintaining inert atmospheres to enabling precise chemical reactions during wafer fabrication. Gas purity is critical, as even trace contaminants can cause defects or yield losses at the nanometre scale. To ensure process stability and device reliability, semiconductor manufacturing requires ultra-high-purity gases (often N6/6.0 or higher). The GAS semiconductor gas analyser measures the impurities at low ppb level.

Principle of operation

The semiconductor gas analyser measures permanent gases and light hydrocarbons in bulk gases such as HCl, HBr, BCl₃, Cl₂, NH₃, CF₄, NF₃, N₂O, and DCS (dichlorosilane).

Figure 1 shows the schematic diagram of the system. Two specially adapted 10-port valves enable sample injection, backflushing, and column selection. Column 1 backflushes the bulk component, while columns 2 and 3 separate the permanent gases and light hydrocarbons. Detection is performed using a Pulsed Discharge Detector (PDD, figure 2), in which a spark generates a discharge gas that ionises the target components. The limit of detection is below 20 ppb. The analyser is equipped with a flush valve, to minimise the contact time with the sample.

To prevent interference between acidic and alkaline bulk gases, separate analysis channels or instruments are recommended.

The high sensitivity and possible aggressive nature of the samples place high demands on the analyser design and components. For this reason, valves with an advanced low leak rate and additional purging are used, and sample-wetted parts are passivated.

Instrument specification

- Thermo GC1600 with external valve oven, 3 specially adapted valves, packed columns and PDD
- Chromeleon chromatography data system
- Runtime 5.5 minutes
- Minimum detectability < 20 ppb
- Repeatability < 1 %

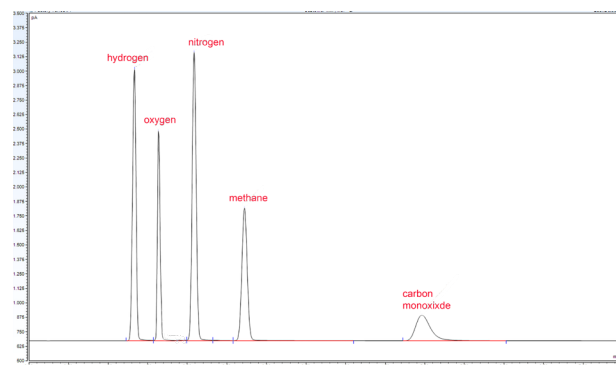


Figure 2 Chromatogram Molsieve column. 5 ppm concentration level.

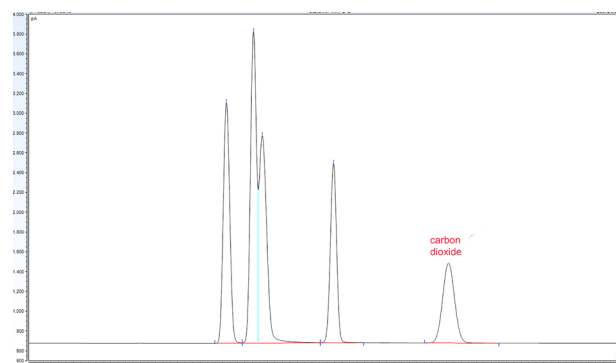


Figure 3 Chromatogram Hayesep column. 5 ppm concentration level.

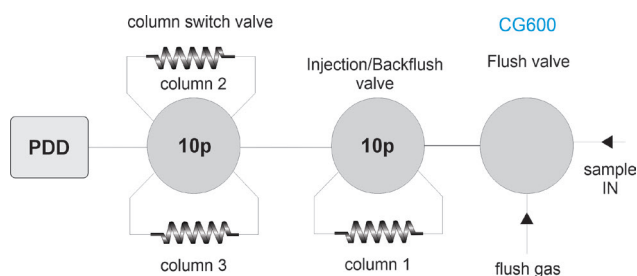


Figure 1 Diagram semiconductor gas analyser

Inj. No.	Injection Name Selected Peak:	Type	Area pA*min				
			BackDetector	Hydrogen	Oxygen	Nitrogen	Methane
3	Repro D-Mol	Unknown	7.0893	22.5266	18.7149	46.6925	26.1843
4	Repro D-Mol	Unknown	7.1186	22.5458	18.7035	46.7208	25.9457
5	Repro D-Mol	Unknown	7.1193	22.5424	18.7284	46.8505	26.1814
6	Repro D-Mol	Unknown	7.1069	22.7037	18.8005	47.2026	25.9366
7	Repro D-Mol	Unknown	7.0507	22.3820	18.6271	46.6996	25.9038
8	Repro D-Mol	Unknown	7.1170	22.5775	18.5839	46.5334	25.8935
9	Repro D-Mol	Unknown	7.1269	22.5624	18.5365	46.8769	26.0692
10	Repro D-Mol	Unknown	7.1294	22.6114	18.5890	46.9211	26.0906
Maximum			7.1294	22.7037	18.8005	47.2026	26.1843
Average			7.1073	22.5565	18.6605	46.8122	26.0256
Minimum			7.0507	22.3820	18.5365	46.5334	25.8935
Standard Deviation			0.0261	0.0901	0.0898	0.2011	0.1208
Relative Standard Deviation			0.37%	0.40%	0.48%	0.43%	0.46%

Figure 4 Repeatability at 5 ppm concentration level

Results

Figures 2, 3 and 4 show chromatograms and repeatability of the GAS semiconductor industry gas analyser. The limit of detection is < 20 ppb.

Key benefits

- Low ppb level limit of detection in bulk gases
- Reliable performance in harsh media gases
- Low maintenance costs; modular iConnect injector/detector concept