Global Analyser Solutions

Hydrogen Impurity Analyser

ER120 | ER105



- Green hydrogen testing
- ISO 21087 (based on ISO 14687)
- PEM fuel cell applications and risk assessments
- Combined GC / GC-MS / FTIR methodology

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Hydrogen Impurity Analyser

Fuel cell electric power is a promising zero-emission alternative to combustion engines, particularly for heavy-duty transport, buses, trains, and other applications requiring long range and rapid refuelling. Fuel cell performance depends on sensitive platinum catalysts and proton exchange membranes (PEM), which are highly susceptible to trace hydrogen impurities. Contaminants introduced during hydrogen production, purification, storage, transport, or dispensing can reduce efficiency, shorten fuel cell lifetime, and damage critical components. Maintaining hydrogen quality in accordance with standards such as ISO 21087 is therefore essential. Reliable trace impurity analysis enables quality assurance throughout the hydrogen supply chain, ensuring safe, efficient, and long-term fuel cell operation.

Principle of operation

This product note describes the analysis of impurities in hydrogen using GC, GC-MS and FTIR combined methodology. Figure 1 shows the analytical channels used:

(1) Argon, oxygen and nitrogen are analysed using Pulsed Discharge Detector (PDD).
(2) Hydrocarbons are analysed using flame ionisation detector (FID)
Channel (1) and (2) are based on Thermo Trace GC 1600 or CompactGC[4.0]

(3) Helium is analysed using TCD
(4) Sulphur components are analysed with GC-MS with Advanced Electron Impact (AEI) source enabling detection limits of < 1 ppb per component.
Channel (3) and (4) are based on Thermo Trace GC 1600.

(5) All remaining components, including water, ammonia and HCl are analysed using FTIR
Channel (5) is based on MAX-iR FTIR

Specifications

- GC1: Thermo Trace GC 1600 or CompactGC[4.0] with four diaphragm gas switching valves (rotary valves are optional), PDD and FID, 3 capillary columns
- GC2: Thermo Trace GC 1600 with 2 diaphragm valves, packed and capillary columns, TCD and ISQ-AEI
- MAX-iR FTIR
- Run time: 15 minutes
- Limits of detection: see figure 2

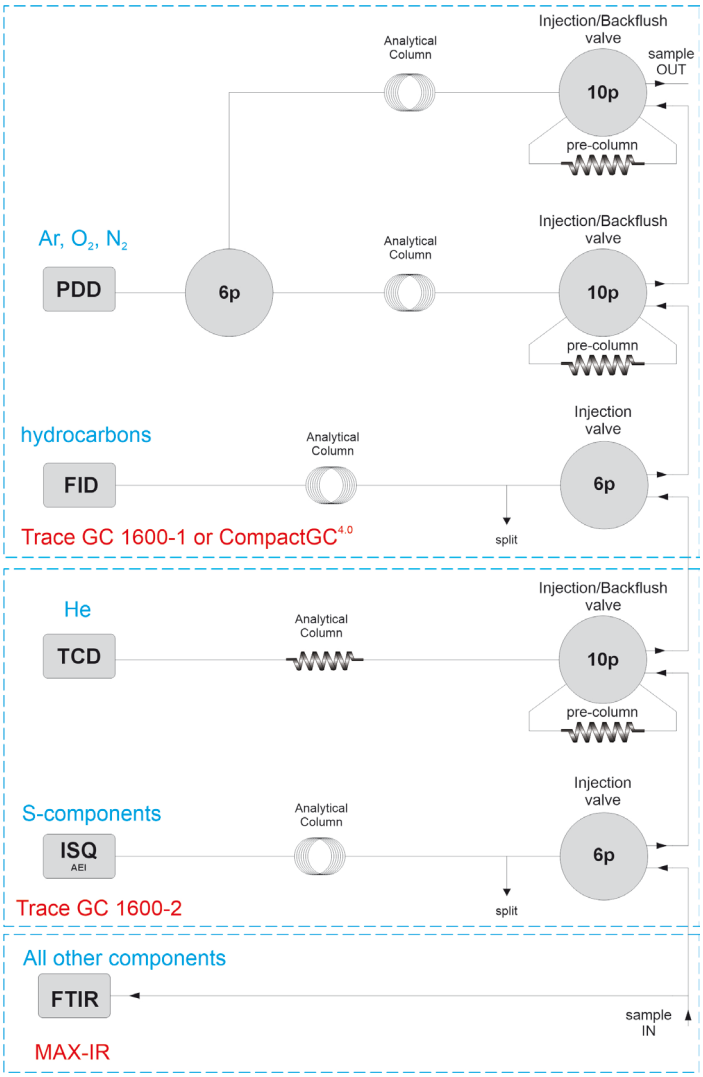


Figure 1 Hydrogen Impurity Analyser diagram: ER120 and ER105

Impurity	Limit ISO 14687/21087 (umol/mol)	Technique	Instrument LOD (umol/mol)
Total hydrocarbons	2	FID	0.1
Oxygen	5	PDD	0.1
Helium	300	TCD	10
Nitrogen	300	PDD	0.1
Argon	300	PDD	0.1
Carbon dioxide	2	FTIR	0.1
Carbon monoxide	0.2	FTIR	0.1
Total sulphur components	0.004	MS-AEI	0.001 (per comp.)
Formaldehyde	0.2	FTIR	0.03
Ammonia	0.1	FTIR	0.02
Organic halogenated comp.	0.05	FTIR	0.001 (per comp.)
Water	5	FTIR	0.1

Figure 2 Analysed components per detector and limits of detection

Results

Figures 3-8 show the results of the described channels.

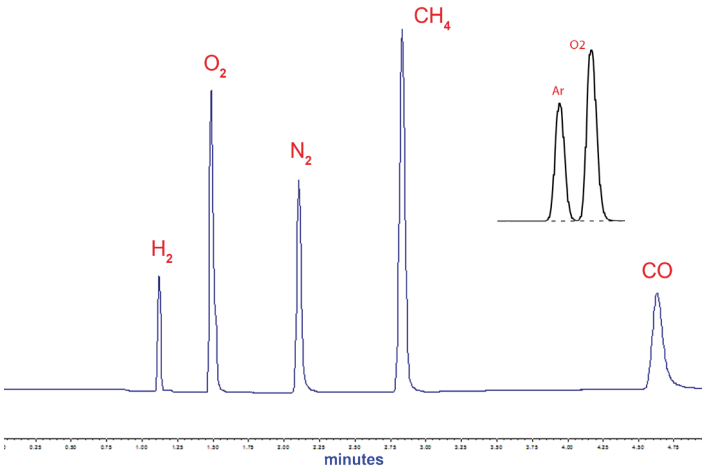


Figure 3 Permanent gases using GC-PDD. 5 ppm standard.

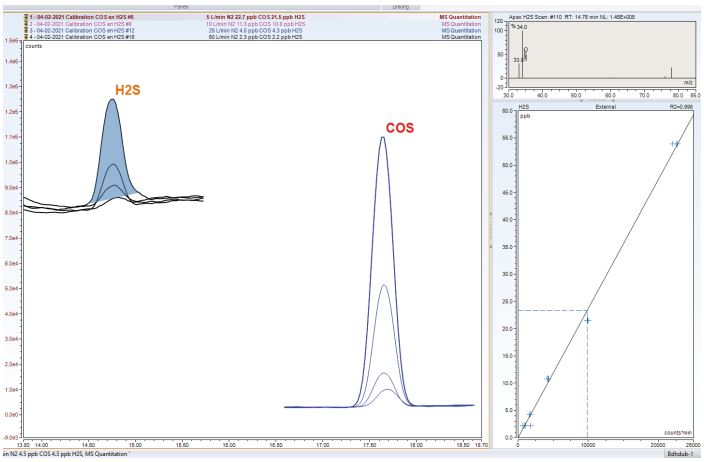


Figure 4 Overlay of 5 H_2S/COS concentration levels using GC-MS-AEI:
H_2S: 2.2, 4.3, 10.8, 21.5 and 53.9 ppb
COS: 2.3, 4.5, 11.3, 22.7 and 56.6 ppb

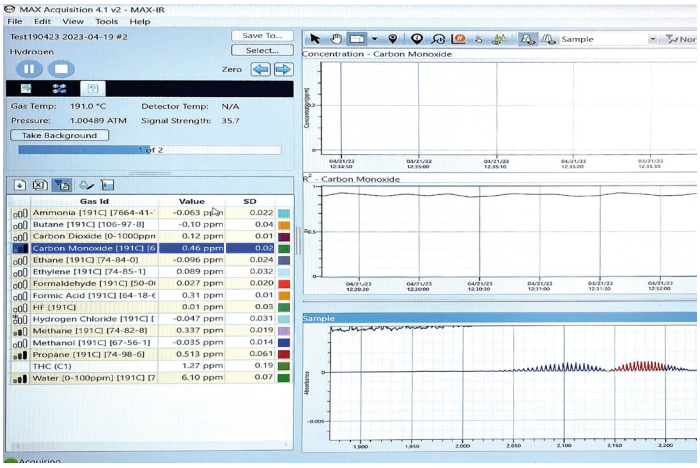


Figure 5 MAX-IR acquisition screen

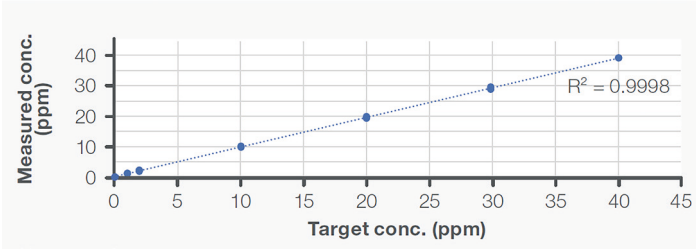


Figure 6 FTIR linearity curve of H_2O

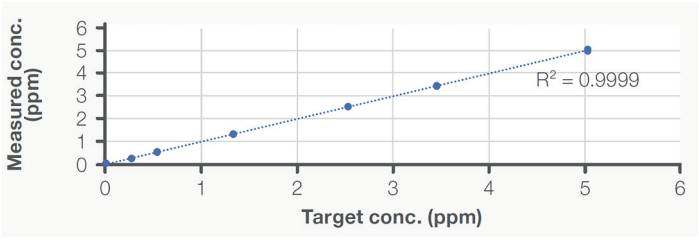


Figure 7 FTIR linearity curve of NH_3

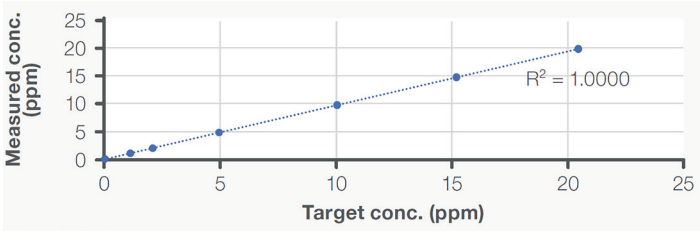


Figure 8 FTIR linearity curve of CO

Ordering information	ER12X - ABCDE - Hydrogen Impurity Analyser based on dual Trace GC 1600 and MAX-IR FTIR ER105 - ABCDE - Hydrogen Impurity Analyser based on Trace GC 1600, CompactGC[4.0] and MAX-IR FTIR			
code X	0	1	2	3
GC model, power	1600, 230V	1610, 230V	1600, 115V	1610, 115V

For selecting options ABCDE (e.g. valve type and passivation, pump and vacuum sampling, rotameter and sample connections, pressure and moisture sensors, hydrogen sensor for safety shut-off, power plug type and more), see the options table in the order guide.

About **GAS**

Global Analyser Solutions provides GC & GC-MS solutions for Energy, Refinery, Chemical and Environmental markets. Our analysers address a broad spectrum of measuring requirements with high precision and reliability. Please reach out for more information on our website. www.gassite.com