

APPLICATION NOTE

LD16-09



Measurement of trace impurities in UHP hydrogen



▲ MultiDetek2

▲ PlasmaDetek2

The production of UHP hydrogen requires analysis of trace impurities to control and certify the gas purity. Multiple instruments are usually dedicated to this task. Combining everything in the same instrument, the MultiDetek2 compact gas chromatograph is very efficient for this type of requirement. The detection down to part per billion can be achieved, what makes the instrument capable of certifying different hydrogen grades.

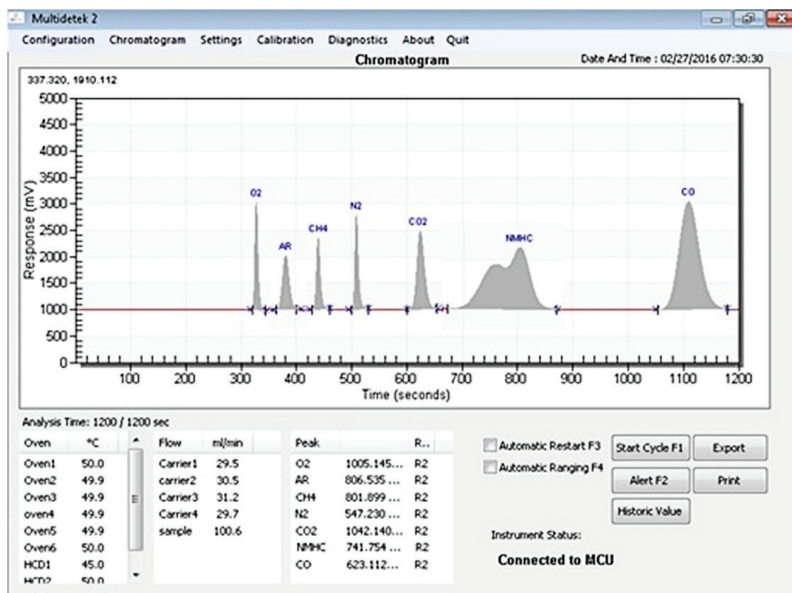
LDETEK SOLUTION:

Most of the gas chromatographs will use some combinations of hydrogen traps or membranes for measuring some impurities like Ar-O₂ and N₂ at low part per billion to eliminate the interference from hydrogen. The selectivity of the PlasmaDetek2 detector has the ability to measure those difficult impurities down to ppb level without the use of any hydrogen traps or membranes. It reduces the operation cost and simplifies the running operations of the system.

The configuration has 5 channels all converging in 3 different plasma detectors as follows:

- ▶ **Channel#1:** Measuring CH₄-CO₂ with HayeSep columns merging in plasma#1
- ▶ **Channel#2:** Measuring O₂-N₂ with Molecular Sieve columns merging in plasma #1
- ▶ **Channel#3:** Measuring NMHC with HayeSep column merging in plasma #2
- ▶ **Channel#4:** Measuring CO with Molecular Sieve column merging in plasma #2
- ▶ **Channel#5:** Measuring Ar with ArgoTek* column merging in plasma #3

*ArgoTek column is manufactured by LDetek to offer the trace argon separation from matrix Oxygen or Hydrogen. The column is packed type operating at 45 Celsius / 20 sccm helium carrier flow rate. With these conditions, the column offers the desired separation for measuring part per billion argon in either oxygen or hydrogen.



The three plasma detectors are respectively configured with the appropriate optical filters for blocking the hydrogen matrix and focussing on the dedicated impurities. This plasma configuration allows the analysis of multiple impurities in one single compact gas chromatograph unit.

Figures 1 and 2 show an example of results that such configuration can achieve for measuring low ppb/ppm concentrations of UHP hydrogen.

Figure 1: chromatogram of trace impurities in UHP hydrogen

COMPONENT	CONCENTRATION	PEAK HEIGHT	NOISE	LDL (3X NOISE)
O ₂	1005.1 ppb	2090 mV	2.1 mV	3.02 ppb
Ar	806.5 ppb	1017 mV	0.8 mV	1.90 ppb
CH ₄	801.8 ppb	1415 mV	1.6 mV	2.71 ppb
N ₂	547.2 ppb	1821 mV	1.4 mV	1.26 ppb
CO ₂	1042.1 ppb	1500 mV	2.2 mV	4.58 ppb
NMHC	741.7 ppb	1299 mV	2.2 mV	3.76 ppb
CO	623.1 ppb	2055 mV	5.1 mV	4.63 ppb

Note: other LDL could be obtained with different injection volume and chromatographic condition

Figure 2

CONCLUSION:

The analysis of UHP hydrogen can be performed using this LDetek solution that combines a selective plasma detector configuration, a complete industrial compact gas chromatograph system, a unique separation column type with an impressive expertise in this field of application. Having all this makes LDetek solution perfect for this type of industrial application.



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