



Low level sulphur analysis in hydrogen using PFPD.

KEY WORDS: Hydrogen, Sulphur, NEN-ISO 21087, ISO14687, Fuel Cell Technology

INTRODUCTION

Hydrogen is becoming more of a go to green solution for different applications, it can be produced by generators using renewable energy. Hydrogen supply infrastructures require specifications and operation protocols to maintain and monitor the quality of the hydrogen used. Sulphur containing compounds are catalyst poisons that even in small concentration can cause irreversible effects on the fuel cell performance.

This analyser is based on international standards NEN-ISO 21087 and ISO 14687 and is designed specifically for sulphur analysis in hydrogen. This special analyser combines a super inert injector with a built in sample pre-concentration trap (SPT) so even ppt levels of sulphur can be analysed. As a detector a SCION Instruments PFPD detector is used which is a low cost robust alternative for a SCD detector.

It is possible to configure this specific analyser solution for different matrices for example biogas, air or natural gases. For more information please contact our pre-sales experts for all the possibilities.

Figure 1 shows the new SCION Instruments GC 8500 sulphur analyser using a SCION Instruments PFPD as a detector. This application is also applicable on the old SCION Instruments 465-GC.



Figure 1. The SCION Instruments GC 8500 sulphur analyser.

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HARDWARE

The SCION Instruments sulphur analyser is the perfect solution for the analysis of sulphur components in hydrogen. This analysis can be implemented on the SCION Instruments 456-GC and new 8500 GC.

This custom made analyser is equipped with a robust PFPD detector and super inert injection system with full electronic split control. This system uses super inert industry standard high quality materials such as: sample lines, (gas sample) valves, sample loops, pre-concentration loops and capillary columns.

A big advantage of this system is the special built in SPT pre-concentrator and thermal desorb system which is completely integrated in the system. Available with LCO₂ and LN₂ cryogenics. In addition it is also possible to perform injections with a sample loop.

Because of the SPT and sample loop this device has a huge flexibility regarding concentrations. For a higher concentration the sample loop injector can be used in the low ppb to ppm range. For the lower concentrations the system can switch to the SPT method to preconcentrate the sample and perform this measurement even in ppt range.

Switching between ppb/ppm and ppt levels is done by selecting the correct method in our Compass CDS system. No extra steps have to be taken, this practically means plug and play.

Both methods, sample loop and SPT have the possibility to process samples above and below ambient pressure.

Table1. Sulphur components

Nr.	Component	Nr.	Component
1	COS	7	Iso-Propyl Mercaptan
2	H ₂ S	8	n-Propyl Mercaptan
3	CS ₂	9	Iso-Butyl Mercaptan
4	Methyl Mercaptan	10	n-Butyl Mercaptan
5	Ethyl Mercaptan	11	Tetra Hydro Thiophene
6	Di Methyl Sulfide		

The results discussed in this application note is specific for the determination of sulphur in hydrogen but it is also possible to configure this analyser for different matrices for example biogas, air or natural gases. For more information please contact our pre-sales experts for all the possibilities

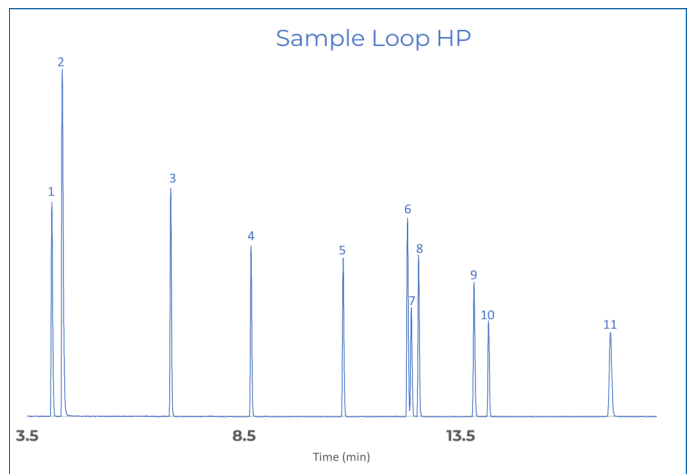


Figure 2. Chromatogram of a pressurised sulphur standard using the sample loop.

RESULTS

Results show that the SCION Instruments low level sulphur analyser is perfectly capable of analysing different sulphur components in hydrogen gas.

The PFPD shows a robust, sensitive and selective detector and both the SPT and sample loop injection method meet the specifications set.

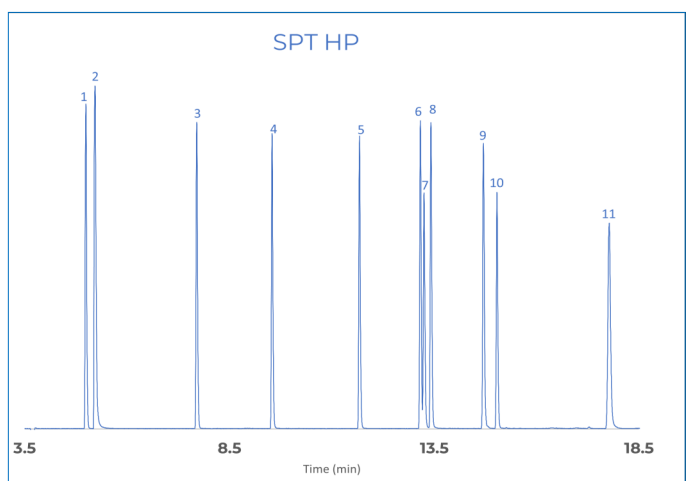


Figure 3. Chromatogram of a pressurised sulphur standard using the SPT.

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Figure 2 shows an example chromatogram of a pressurised sulphur standard using the sample loop. It shows (figure 3) that the pressurized SPT injection is slower, this is due to the SPT sampling time. Both methods show excellent resolution.

CONCLUSION

SCION Instruments provides an excellent flexible, robust custom solution for the low level analysis of sulphur in hydrogen. The SCION 456-GC or 8500 GC is equipped with a super inert injection, PFPD detector and special built in SPT.

The sample loop and SPT in combination with the possibility to inject above, at and below ambient samples gives this device the flexibility needed for every analysis.

This analyser is based on international standards NEN-ISO 21087 and ISO 14687 and meets all the requirements of these standards.

It is also possible to configure this analyser for various other matrices. Please contact our pre-sales experts for all the options.