

Analysis of Impurities in SF₆ Using the Agilent 490 Micro GC



Application Note

Micro GC, product quality control, specialty gases, sulfur hexafluoride

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Introduction

Sulfur hexafluoride (SF₆) is an inert, nontoxic, heavy, nonpolar gas. Due to its thermal stability and high dielectric strength, SF₆ is mainly used as an insulating medium for a wide range of high voltage electrical and electronic equipment. As a bulk gas it is generally transported as a liquefied compressed gas. The gas containers are spec-tested by the gas manufacturers for impurities. For recycling purposes, it is also required to know the impurities in the gas. Product quality control includes analysis of carbon tetrafluoride, sulfur dioxide, carbon dioxide, sulfur dioxide, oxygen, and nitrogen.

Instrumentation Setup and Sample Results

For this application note, an Agilent 490 Micro GC (p/n G3581A) equipped with a 10 m PoraPLOT Q column channel (option number X64) and 10 m MolSieve 5A column channel (option number X81) were used. Table 1 shows the instrument settings applied.

Table 1. Agilent 490 Micro GC Instrument Parameters

	10 m PPQ	10 m MS5A
Injection time	40 ms	40 ms
Backflush time	–	4.9 seconds
Column temperature	70 °C	70 °C
Carrier gas	Helium, 200 kpa	Helium, 150 kpa



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A chromatogram for SF₆ bulk gas sample with a concentration of larger than 99 % shows baseline separation for carbon tetrafluoride (0.19 %), carbon dioxide (100 ppm), and sulfur dioxide (0.19 %) from the SF₆ matrix peak and composite air peak (Figure 1). Fast quality control is provided by the Agilent 490 Micro GC as the total run time for the isothermal analysis in the PPQ channel was just 90 seconds.

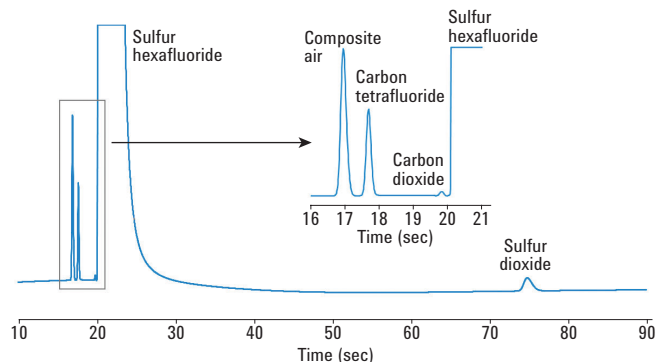


Figure 1. Gas chromatogram for an SF₆ bulk gas sample, run on an Agilent 490 Micro GC.

Excellent repeatability for 10 consecutive runs was obtained for this application. Repeatability for peak area was measured at 0.2 %RSD for 100 ppm carbon dioxide, and between 0.05 and 0.07 %RSD for the other compounds (0.2 % level). An overlay of five replicates, shown in Figure 2, clearly highlights the consistent results acquired by the Agilent 490 Micro GC.

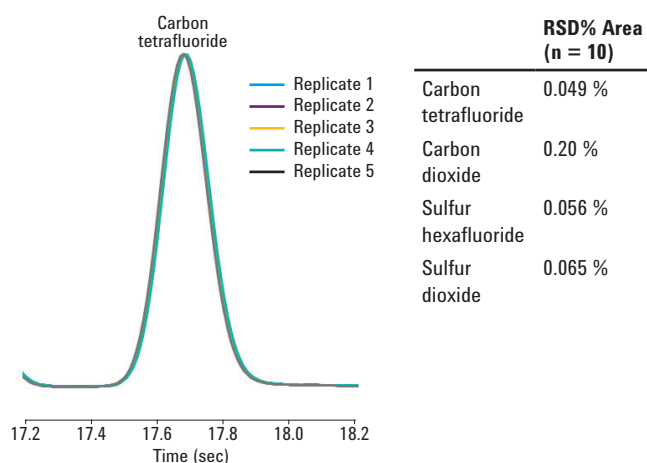


Figure 2. Repeatability of five replicates of carbon tetrafluoride, run on an Agilent 490 Micro GC.

Interested in Additional Compounds

For a full characterization of its impurities, the SF₆ sample was simultaneously analyzed on a second channel equipped with an Agilent Molecular Sieve 5A column. This column channel was able to separate oxygen and nitrogen for individual reporting. Figure 3 shows an example of low ppm levels of oxygen and nitrogen. The SF₆ from the matrix is retained on the channel's PoraBOND Q precolumn, and backflushed to vent to prevent disturbing the subsequent runs.

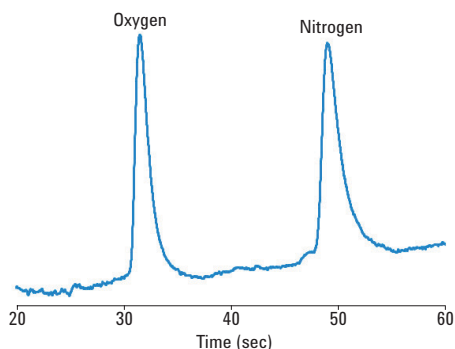


Figure 3. Separation of gas impurities using an Agilent Molecular Sieve 5A column.

Conclusion

The Agilent 490 Micro GC is a rugged, compact, and portable lab-quality gas analysis platform. When specialty gas quality control is critical, count on this fifth generation micro gas chromatograph.

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