

# APPLICATION NOTE

## Sulfur-hexafluoride (SF<sub>6</sub>) Purity Analysis Using INFICON 3000 Micro GC

### ABSTRACT

An SF<sub>6</sub> purity analysis method is developed in this application. PLOT Q and GasPro columns are suitable for the analysis of contaminants in SF<sub>6</sub>. On the GasPro channel, sulfur compounds are detected and the total analysis time is less than 2 minutes.

### INTRODUCTION

SF<sub>6</sub> circuit breakers operate to switch electric circuits and equipment in and out of the system. These circuit breakers are filled with compressed sulfur-hexafluoride gas, which is a dielectric used in high-voltage electrical equipment as an insulator and/or arc-quenching medium; the gas also interrupts the current flow when the contacts are open. SF<sub>6</sub> gas is expensive and has been designated as a greenhouse gas by the EPA.

A reliable field method is important to assess whether reclaimed SF<sub>6</sub> is acceptable for continued use as in-service gas in high-voltage equipment thus preventing failures, extending equipment life, reducing maintenance costs, and increasing personnel safety.

In this application, a method was developed using the INFICON 3000 Micro GC to accurately determine concentrations of impurities and decomposition products in SF<sub>6</sub> to ensure reliable operation of electrical equipment.

### EXPERIMENTAL

An INFICON 3000 Micro GC with two-channel configuration: PLOT Q (8 m × 0.32 mm) and GasPro (10 m × 0.32 mm) was used.

The SF<sub>6</sub> sample was provided by Hebei Electric Power Research Institute.

The chromatographic conditions for the two channels are shown in [Table 1](#).

**Table 1 Analytical Conditions of Micro GC**

Channel	PLOT Q	GasPro
Sample inlet temperature (°C)	80	80
Injector temperature (°C)	80	80
Column temperature (°C)	60	60
Inject time (ms)	100	100
Column pressure (psi)	20	20

Note: 1 psi = 6.894757293 kPa

### RESULTS

The PLOT Q channel and the GasPro channel are both suitable for the purity analysis of SF<sub>6</sub>. [Figure 1a](#) and [1b](#) show the chromatograms obtained from these two columns.

[Figure 1c](#) is a zoomed-out window of [Figure 1b](#) from the time range of 1.0 to 2.6 minutes. An unknown sulfur compound is detected in the GasPro channel. The total analysis time is less than 2 minutes, providing excellent cycle time. The peak area repeatability (shown by RSD, n = 6) of these two channels are shown in [Table 2](#). The detection limits of this method are approximately 20 ppm, which meets the user requirement for contaminant analysis in SF<sub>6</sub>.

**Table 2 The Repeatability of Two Channels**

	Air	CF4	SF6	CO2
RSD (n = 5)	(%)	(%)	(%)	(%)
PLOT Q	2.80	0.19	0.16	0.98
GasPro	3.19	0.68	0.12	

**Figure 1 Chromatograms in PLOT Q (a) and GasPro (b and c) channels.**