

## Instant, Comprehensive, and Sensitive Airborne Molecular Contaminant (AMC) Analysis Using SIFT-MS

### Key Benefits

Reduce lost product and equipment damage through instant AMC emission detection

A single analytical tool for chemically diverse compounds

High selectivity and sensitivity

Simple operation and integration

Low maintenance



The high sensitivity, high selectivity, real-time analysis, and low maintenance requirements of Syft Technologies' SIFT-MS solution provides reliable and rapid detection of diverse AMCs, minimizing damage to equipment and product.

Airborne molecular contaminants (AMCs) cause major product quality issues in modern semiconductor fabrication, even at very low levels (part-per-billion by volume (ppbv) concentrations and below). Currently, multiple different tools are used to detect certain classes of AMCs with varying degrees of effectiveness.

Selected ion flow tube mass spectrometry (SIFT-MS) is a unique analytical tool that provides comprehensive, high-sensitivity detection of volatile organic and semivolatile organic compounds (VOCs and SVOCs), and inorganic gases (including HCl, HF, and SO<sub>x</sub>) within seconds. As a single, comprehensive tool providing rapid analysis, SIFT-MS yields great economic benefit because it detects and identifies issues faster, resulting in reduced product losses.

Figure 1 shows continuous monitoring data obtained for selected, chemically diverse AMCs at a semiconductor fab in Eastern China in early 2016. In Figure 1(a), the data show that sub-ppbv concentrations are readily detected using SIFT-MS, confirming that AMC levels are such that product quality will not be compromised. Events such as frequent opening of doors to uncontrolled areas (Figure 1(b)) or cleaning (Figure 1(c)), can have drastic

and sudden effects on air quality and subsequently on product quality and yield.

Cleanroom air quality can vary dramatically over short time-periods and traditional time-averaged methods for analyzing cleanroom air result in delayed responses to these events, or can miss them entirely. The high temporal resolution provided by SIFT-MS means that air quality issues are detected rapidly compared to traditional techniques (Figure 2), significantly reducing equipment damage and maintenance, and cutting production losses.

SIFT-MS instruments are also readily integrated into multiple-point sampling systems, enabling wider production coverage by one analytical tool. For example, more compounds can be analyzed twelve times as frequently at twice the number of locations compared to thermal desorption-gas chromatography-mass spectrometry (TD-GC-MS).

### Experimental Method\*

Sample: Fab air (direct analysis; no preconcentration)

Accessories:

- Sample tubing provided by customer
- Diaphragm sampling pump

\* Air drawn past the instrument inlet at about 4 L min. Residence time in tube ~3 seconds.

### SIFT-MS Analysis

Instrument	Voice200ultra
Inlet type	High performance integrated with existing sampling infrastructure
Sample flow	25 sccm
Analysis type	Selected Ion Mode (SIM)
Reagent ions	H <sub>3</sub> O <sup>+</sup> , NO <sup>+</sup> , O <sub>2</sub> <sup>+</sup>
Compounds	Aromatic hydrocarbons and oxygenated, nitrogenated, and perfluoro species
Detection limits	Typically <0.1 pptv for 5-second measurement
Analysis time	Continuous; reporting every 6 minutes

### Further Reading

Syft brochure *Semiconductor Industry Solutions*

Syft application note *Real-Time Ambient Air Monitoring Campaigns Using Syft SIFT-MS*

Syft datasheet *Voice200ultra*

Syft datasheet *Dual-Polarity Ion Source*

Syft datasheet *Syft Multi-Port Inlet 14*

B.J. Prince et al. (2010), "Application of [SIFT-MS] to real-time atmospheric monitoring", *Rapid Commun. Mass Spectrom.* **24**, 1763.

V.S. Langford, et al. (2014), "Rapid monitoring of volatile organic compounds: a comparison between gas chromatography/mass spectrometry and [SIFT-MS]", *Rapid Commun. Mass Spectrom.* **28**, 10.

Figure 1. Fab AMC monitoring data when (a) air quality is well controlled, (b) air quality is degraded through ingress of volatiles from an adjoining room, and (c) equipment cleaning has recently been performed.

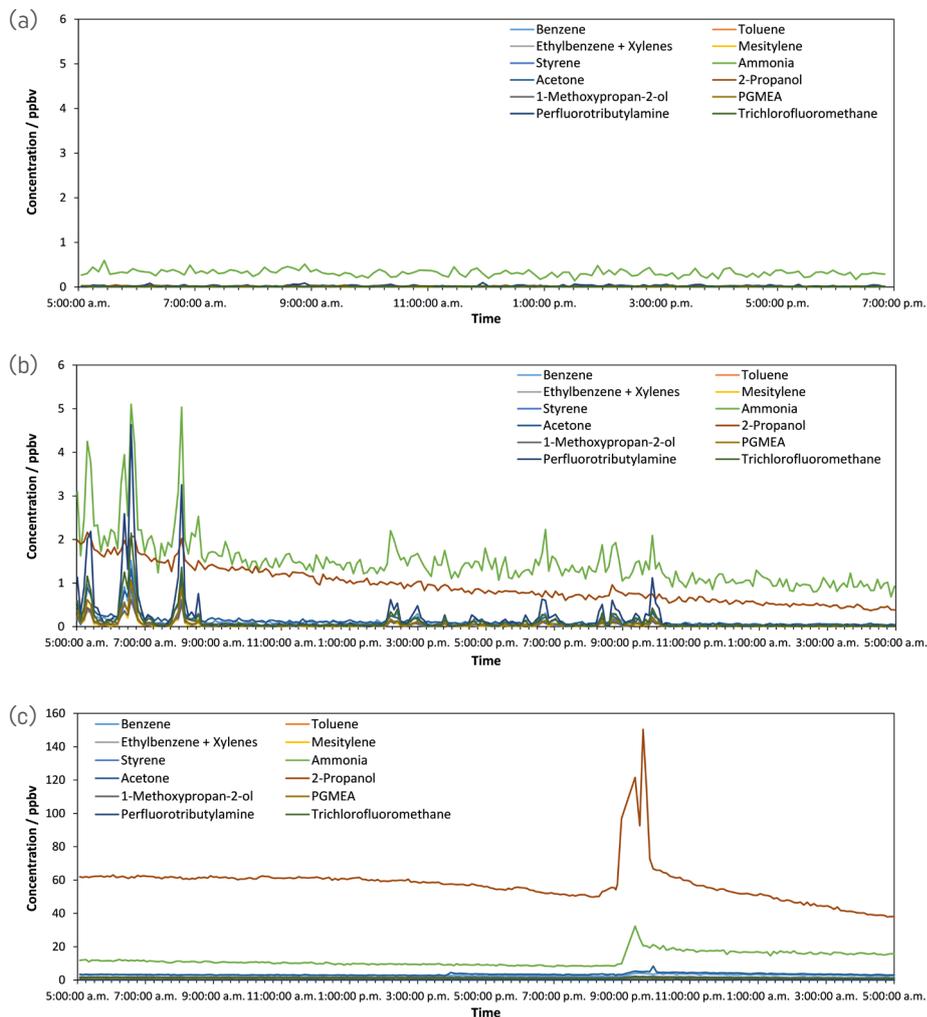
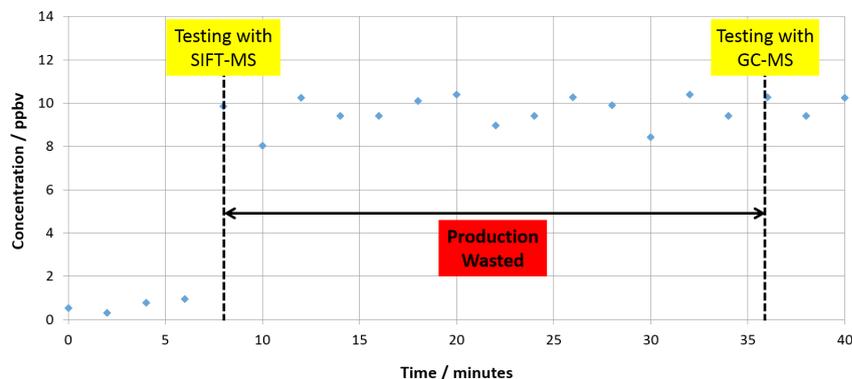


Figure 2. Detect and address air quality problems quickly by applying SIFT-MS.



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