



AMC Monitoring



Challenge

Airborne Molecular Contamination (AMC) is a general term for existing molecular contaminations in clean room environments. These compounds belong to very different groups with very different mechanisms of damage.

AMC is a concern for any high technology manufacturing process, especially in the microelectronic industry and is getting more and more in the focus of interest. AMC-contaminations may cause adverse effects on production tools and consequently increase costs for high-tech companies. These airborne contaminants cause expensive, yield-reducing and quality degrading problems such as film and trace corrosion, T-topping, bridging and unwanted doping of silicon.

Contaminations as chemical films or layers, sometimes as thin as a single molecule can alter electrical, optical, and physical properties of the product surfaces. In addition to damaging the final product, these chemical films can damage or impair costly optics and other tools used in the manufacturing process.

Monitoring of AMCs with an Ion Mobility Spectrometer (IMS) can help to reduce or eliminate the costs associated with this contamination. This includes monitoring of acids, bases, ammonia and organic compounds in a continuously operating gas analyzer.

Solution

IMS is an atmospheric pressure, time of flight detection technique. The sensitivity, selectivity, and speed of response make the technique superior in many aspects compared to other monitoring methods. The industry-proof spectrometer design allows using these advantages in 24/7 stand-alone operation. IUT Technologies' IMS units are designed for long term, continuous measurements with little or no maintenance and few consumables. The electronics are completely solid-state without moving parts or optics to require alignment.

IUT's IMS-Analyzer is capable of detecting and quantifying substances like these in the required ppb concentration level. The coupling of a gas chromatographic pre-separation prior to the high sensitive IMS technology provides an analyzing performance, where compounds like AMC's can be measured and quantified with outstanding sensitivity, repeatability within cycle times of minutes.

IUT is building and calibrating each device to the specific needs of the customer. Therefore it is possible to modify an existing application or develop a new application to further strengthen the process and reduce failures in production, e.g. the measurement of Borontrichloride or Borontrifluoride which are also often used at semiconductor production.

Substance Class	Target Substances	Formula	CAS #	LOD [ppbv]	range [ppbv]
Total Acids	Sulphur dioxide	SO ₂	7446-09-5	< 0.1	0 - 50
	Hydrogen chloride	HCl	7647-01-0		
	Hydrogen Fluoride	HF	7664-39-3		
	Nitrogen Oxide	NO ₂	10102-44-0		
	Bromine	Br ₂	7726-95-6		
	Chlorine	Cl ₂	7782-50-5		
	Total			< 0.1	0 - 300
Ammonia	Ammonia	NH ₃	7664-41-7	< 0.1	0 - 100
Total Amines / Total Bases	Dimethylamine	C ₂ H ₇ N	124-40-3	< 0.1	0 - 100
	Butylamine	C ₄ H ₁₁ N	109-73-9		
	Triethylamine	C ₆ H ₁₅ N	121-44-8		
	NMP	C ₅ H ₉ NO	872-50-4		
Total Solvents / Organics	Acetone	C ₃ H ₆ O	67-64-1	< 0.1	0 - 50
	Isopropylalcohol	C ₃ H ₈ O	67-63-0		
	PGME	C ₄ H ₁₀ O ₂	1320-67-8		
	PGMEA	C ₆ H ₁₂ O ₃	108-65-6		
	Ethyl lactate	C ₅ H ₁₀ O ₃	97-64-3		
	HMDS	C ₆ H ₁₉ NSi ₂	999-97-3		
	Total			< 0.1	0 - 300
Dopant Gases	Arsine	AsH ₃	7784-42-1	< 1.0	0 - 500
	Phosphine	PH ₃	7803-51-2	< 1.0	0 - 500
	Boron Trichlororide	BCl ₃	10294-34-5	1.5	0 - 250



Specifications

Airborne Molecular Contaminations

Description	Continuous process control monitoring for AMC's, CE certified
Principle of Operation	IMS with gaschromatographic pre-separation (GC-IMS)

Operating Specification

Operating ambient Temperature	Portable Housing:	-10 °C - 50 °C	(+14 °F - 122 °F)
	19" Housing:	15 °C - 30 °C	(+59 °F - 86 °F)
	NEMA 4X Housing:	-40 °C - 50 °C	(-40 °F - 122 °F)
Output	Stationary:	Integrated graph. display, 4 - 20 mA loop, 2 alarm relay, 1 fault relay, 1 RS 232	
	Portable:	Integrated graph. display, USB	
Maintenance Rate	Recommended 1x yearly service; scrubber change after arrangement (10 - 30 min operation)		

Analyzer Physical Specification

Dimensions	Portable Housing:	280 (W) x 100 (H) x 280 mm (D)	(11 x 3.9 x 11 inch)
	19" Housing:	483 (W) x 135 (H) x 420 mm (D)	(19 x 5.3 x 16.5 inch)
	NEMA 4X Housing:	500 (W) x 500 (H) x 210 mm (D)	(19.7 x 19.7 x 8.3 inch)
Weight	Portable Housing:	7 kg	(15.5 lbs)
	19" Housing:	10 kg	(22.0 lbs)
	NEMA 4X Housing:	18 kg	(40.0 lbs)

Utility Requirements

Power supply	230 (115) VAC; 3 (5) A; 50 (60) Hz		
Avg. power consump.	Portable: 16 W (Battery);	19": 33.6 W	NEMA 4X: 40.7 W
Peak power consump.	Portable: 56 W (Charging);	19": 51.6 W	NEMA 4X: 250.2 W
Intake Flow	250 - 300 ml/min at atmospheric pressure (self-priming)		
Sample Exhaust	± 3.5 kPa (0.5 psi) (max.) at atmospheric pressure		

Features

- Patented IMS-Technology
- Measurements possible at low ppb to ppm range
- Long-term-stability and reliability
- Solid-state electronics and few moving parts
- Low Maintenance Time - High Up Time
- No vacuum pumps and carrier gas required