Airborne Molecular Contamination (AMC)

and Cleanroom Materials Analysis

High precision manufacturing of semiconductors, photovoltaics, and OLEDs require an ultra-clean environment. Micro-contaminants in cleanroom air such as process spills, operators, cleanroom consumables, and construction materials are often identified as a root cause of elevated AMC. When left undetected, they could adversely affect critical surfaces impacting yield and device performance.

AMC is classified based on SEMI standard F21-1016 distinguishing molecular acids, bases, condensable organics, dopants, and metals that can modify the electrical properties of semiconductor materials. Contamination level requirements for the industry are suggested by the ITRS and IRDS roadmaps; however, as technology node varies from Fab to Fab, it is crucial for each individual Fab to establish process tolerance or control limits and monitor AMC.

A comprehensive AMC testing portfolio is available to support qualification and monitoring of cleanroom construction materials, cleanroom consumables, cleanroom environments, environment inside inspection tools, gas distribution system, and requalification of cleanroom environment after disaster
recovery cleanup.

TABLE 1: DIRECT & INDIRECT AMC ANALYSIS

	COLLECTION METHODS	ANALYSIS TECHNIQUES	CONTAMINANTS	SAMPLE TYPES
DIRECT AMC TESTING	Direct sample collection using impinger method	Collected impurities from air sampling are analyzed by Ion Chromatography	Anions/cations Organic acids	Cleanroom air, tool chamber, & compressed gases
	Direct sample collection using impinger method	Collected impurities from air sampling are analyzed by ICP-MS	Trace metals Dopants (B, P, As)	Cleanroom air, tool chamber, & compressed gases
	Direct sample collection using Tenox tubes	VOCs captured into Tenax tube are analyzed by ATD GC-MS	Volatile organics	Cleanroom air, tool chamber, & compressed gases
INDIRECT AMC TESTING	Witness wafers/ substrates	Wafer/substrate desorption followed by ATD GC-MS	Volatile organics	Cleanroom air & tool environment Witness wafers/coupons
	Witness wafers/ substrates	VPD ICP-MS or Controlled Liquid Phase Extraction™ ICP-MS	Trace metals	Witness wafers/ substrates

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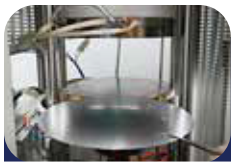
CHEMTRACE MR3000 AIR & COMPRESSED INERT GAS SAMPLER



VOLATILE ORGANICS AIR & COMPRESSED INERT GAS SAMPLER



WAFER/ COUPON DESORBER



AUTOMATIC THERMAL DESORBER

TABLE 2: UCT CHEMTRACE ANALYTICAL SERVICES & SUPPORT GUIDELINE FOR AMC

AMC & CLEANROOM TESTING GUIDELINE	UCT CHEMTRACE ANALYTICAL SERVICES & SUPPORT
Cleanroom pre-construction	Construction material screening & selection · Paints, walls, floor tiles, HEPA/ULPA filters, curtains, gel sealants, potting compounds, air handling systems, etc. Supplier qualification · Vendor comparison & selection
Cleanroom post-construction	Cleanroom certification, qualification, & monitoring · Cleanroom environment Cleanroom consumables & supplier qualifications & monitoring · Packaging materials, bags, wipes, gloves, etc. Tool environment baselining & qualification · Litho & inspection tools Gas distribution system qualification & monitoring · Compressed dry air (CDA), compressed inert gas lines
Disaster recovery	Re-qualification of cleanroom environments

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