

Analytical Services ASML™ Equipment and Environmental Testing

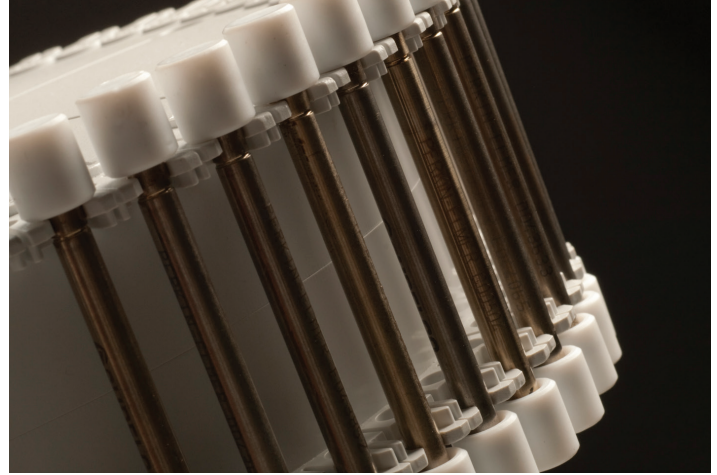
*Validate ASML stepper/scanner
environments with confidence*

Entegris Analytical Services is the leader in the measurement of airborne molecular contamination (AMC) for semiconductor cleanrooms, photolithography applications, and OEM compliance.

Based on more than 30 years of service and chemical filter development, Analytical Services is one of more than 30 Global Entegris Labs and provides state-of-the-art AMC analysis for ASML™ tool environment compliance to ensure confident operation of DUV scanners and their chemical filter and purifier systems.

APPLICATIONS

Following the "See It. Control It." paradigm, Entegris Analytical Services naturally complements our market-leading OEM chemical filtration and purification systems and a broad suite of products for comprehensive contamination control solutions. The service provides measurements for ASML's filter monitor and installation requirements manual (IRM) specifications and supply gas purifier validation.



FEATURES & BENEFITS

OEM approved service	<p>In-depth knowledge of applications and OEM roadmaps</p> <p>Data support discussions with OEM on IRM, filter lifetime and lens warranty issues</p>
Fastest AMC sampling service	<p>In and out of the cleanroom within one work shift</p> <p>Most AMC classes sampled at low ppt levels in four hours</p>
ISO/IEC 17025 accredited services—a competence standard for testing laboratories	<p>Confidence in data and detection limits</p> <ul style="list-style-type: none">On-site sample operators trained and certified for sampling – no customer involvement necessaryDetection limits are statistically evaluated at 99% confidenceInter-laboratory comparisons and traceable standards ensure highest accuracy
AMC filter and applications expertise	<p>Service complements a comprehensive suite of Entegris contamination control solutions and enables development of customized products</p> <p>Technical discussion and consultation enables most effective contamination control solutions</p>



SPECIFICATIONS

AMC CLASS	ANALYTES	SAMPLE TRAPS	ANALYTICAL METHOD
Acids/anions	Fluoride (F ⁻), chloride (Cl ⁻), bromide (Br ⁻), nitrate (NO ₃ ⁻), nitrite (NO ₂ ⁻), sulfate (SO ₄ ²⁻), sulfite (SO ₃ ²⁻), phosphate (PO ₄ ³⁻), acetate (CH ₃ COO ⁻), formate (HCOO ⁻)	DI water impingers or dry adsorbent traps	Ion chromatography (IC)
Bases/cations	Ammonium (NH ₄ ⁺ , NH ₃), amines (R ₃ -N)	DI water impingers or dry adsorbent traps	Ion chromatography (IC)
HMW organics/refractories¹	Nonvolatile (condensable) organic compounds with a boiling point greater than 150°C and/or molecular weight greater than 120 g/mol. Entegris Analytical Services reports all compounds less volatile than 2,2,5-trimethylhexane.	Tenax [®] GR or TruTOC [™] Entegris traps	Gas chromatography/mass spectrometry with automated thermal desorption (GC/MS-ATD)
LMW organics/refractories^{1, 2}	Volatile organic compounds with boiling point and molecular weight lower than those of HMW organics. Entegris Analytical Services reports compounds higher than IPA and up to 2,2,5-trimethylhexane.	TruTOC [™] Entegris traps	GC/MS-ATD
Refractory compounds	Organic chemicals (LMW or HMW) with atoms other than C, H, N and O. For example: silicon-, halogen-, sulfur- and phosphorous- and metal-containing compounds.	Tenax [®] GR or TruTOC [™] Entegris traps	GC/MS-ATD
LMW silicon³	TMS, HMDSO, D3	Entegris proprietary sampling trap	GCMS/liquid micro-extraction (LME)

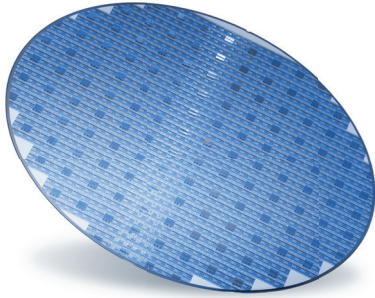
Physical Specifications

Sample time	4 hours, plus 30 minutes each for setup and break-down Supply gas testing requires 24 hours of purging of sample port and line prior to sampling
Equipment	Battery-operated, customized equipment Materials with proprietary manufacturing, cleaning and coatings
Reporting limits	0.1 ppb for filter monitor and IRM specifications 10 ppt for XCDA [®] /N ₂ purifier validation

¹Refractory compounds are those containing elements other than C, H, N and O; for example: Si, Al, B, P, S, F, Cl, Br, I, Fe, Sn.

²Upon request, Entegris provides this separate method (using TruTOC Entegris trap) for the measurement of LMW organic compounds, because it is more accurate than using Tenax GR traps. Both methods are approved by ASML.

³Upon request, Entegris provides this separate method for the measurement of TMS, HMDSO and D3, because they cannot be consistently trapped with or recovered from other sample traps.



ORDERING INFORMATION

Part number	Service	Sample port	Reporting limit	Typical frequency
ESI005403-03	ASML compliance IRM specification Acids Bases HMW and LMW organics and refractories	Filter cabinet outlet, ambient cleanroom, or filter cabinet inlet	0.1 ppb	Filter cabinet outlet: every 6 months Ambient cleanroom or filter cabinet inlet: every 2 months
ESI005403-04	ASML compliance IRM specification Acids Bases LMW, HMW organics, refractories, and LMW silicon (TMS, HMDSO, and D3)	Filter cabinet outlet, ambient cleanroom, or filter cabinet inlet	0.1 ppb	Filter cabinet outlet: every 6 months Ambient cleanroom or filter cabinet inlet: every 2 months.
ESI005403-05	ASML compliance, XCDA/N ₂ purifier validation Acids Bases HMW organics/refractories	XCDA or N ₂ purifier outlet	10 ppt	As needed

Did you know?

- Entegris provides annual measurement programs, automatically scheduled as required.
- ASML does not require the validation of supply gas purifiers, only enforces the specification.
- Even though accepted by ASML, Analytical Services does not recommend using Tenax GR for LMW organic and refractory AMC. Tenax GR does not capture LMW organics quantitatively, or provide consistent recovery for TMS. AMC concentrations may be underestimated by as much as 100X.
- A combination of carbon-containing traps and thermal desorption does not work for the analysis of TMS, see Lobert et al., [Proc. of SPIE, Vol. 7272, 727222-1, 2009.](#)
- Reporting limits are OEM-imposed and are not the same as analytical method detection limits. Lower reporting limits may be requested for specific applications.

ANALYTICAL DATA REPORT

Summary Table of Results:

Sample Location	Total bases ¹	Of which is ammonium (NH ₄ ⁺)	Total acids ²	Of which is sulfate (SO ₄ ²⁻)	Total organics (as toluene)	Of which are refractory compounds ³ (as toluene)	Moisture content (H ₂ O)	Total acids for filter monitor ⁴	Total organics for filter monitor ⁵ (as toluene)
All results in ppbV									
Filter outlet tool XYZ-02	< 0.04	< 0.04	0.2	< 0.01	< 0.01	< 0.01	< 100	< 0.01	< 0.01
Control Blank	< 0.04	< 0.04	< 0.01						

¹ Differences between total bases and ammonium-only are due to the presence of other bases such as amines.

² Total acids includes organic acids (acetic and formic acids)

³ Refractory compounds are those containing atoms other than C, H, N and O (for example, Si, P, B, S, halogens, met

⁴ This total does not include acetic and formic acids. This number should be used for filter performance calculations (A

⁵ This total only includes condensable compounds (2,2,5 trimethylhexane and higher, see notes on page 2). This numt

Operator: rcp

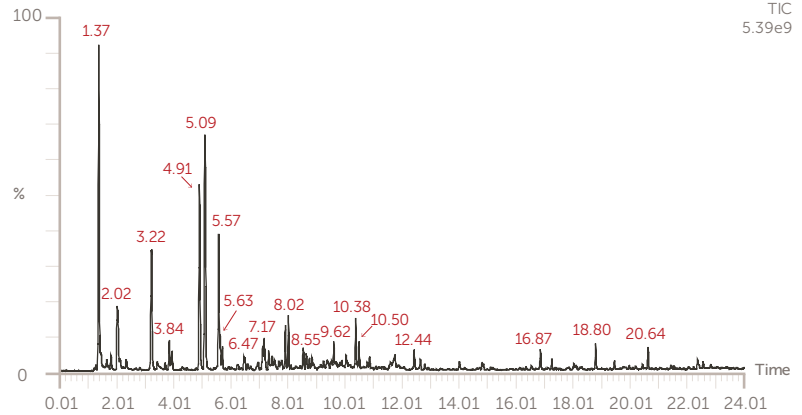
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