



ANALYTICAL SERVICES STANDARD/NON-COMPLIANCE TESTING

Support your cleanroom operation with analytical expertise

Overview

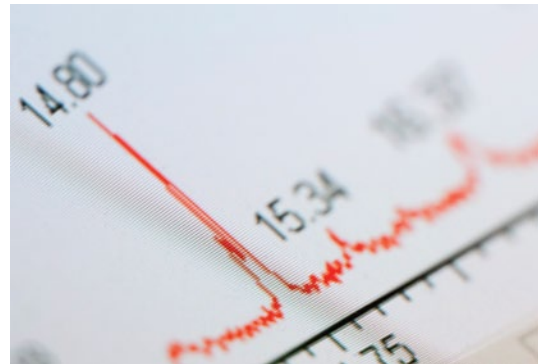
Entegris Analytical Services is the leader in the measurement of airborne molecular contamination (AMC) for semiconductor clean rooms, photolithography applications and OEM compliance.

Based on more than 20 years of service and chemical filter development, Analytical Services is one of 17 Entegris Global Labs and provides state-of-the-art AMC analysis for a variety of applications to ensure confident operation of photo-lithography and other high-technology cleanroom environments.



Applications

Following the “See It. Control It.” paradigm, Entegris Analytical Services naturally complements Entegris’ market-leading chemical filtration and purification systems and a broad suite of products for comprehensive contamination control solutions. The service provides measurements for tool validation, contamination events, troubleshooting, materials outgassing, product validation and other cleanroom applications.



Features and Benefits

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

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	Ion chromatography (IC)
Bases/cations	Ammonium (NH ₄ ⁺ , NH ₃), amines (R ₃ -N); Na ⁺ , K ⁺ , Li ⁺ , Ca ²⁺ , Mg ²⁺ provided on request	DI water impingers	Ion chromatography (IC)
HMW organics/refractories ¹	Nonvolatile organic compounds with a retention of 2,2,5-trimethylhexane or higher. This includes refractory compounds in that range (except D3).	Tenax® TA	Gas chromatography/mass spectrometry with automated thermal desorption (GC/MS-ATD)
LMW organics/refractories ¹	Volatile organic compounds higher than IPA and up to 2,2,5-trimethylhexane. This includes refractory compounds in that range (except TMS, HMDSO).	Carbotrap™ 300	GC/MS-ATD
LMW silicon	Low molecular weight silicon compounds: TMS, HMDSO, D3	Anasorb® CSC	GCMS/liquid micro-extraction (LME)
Moisture	H ₂ O	Online monitors	Cavity ring-down spectroscopy (CRDS)
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	For acids and bases, see separate list; DLs are typically less than 0.1 ppb For organic compounds: 10 ppt For moisture: 10 ppb or less (inquire)		

¹ Refractory compounds are those containing Si, Al, B, P, S, F, Cl, Br, I, Fe, Sn and other metals.



Detection Limits

Peak-to-noise ratios are not suitable to determine detection limits for chromatographic measurements. Entegris Analytical Services employs the Hubaux-Vos statistical method with 99% confidence to determine detection limits (similar to SEMI® C10-0299). Analytical Services distinguishes between three types of limits:

- Instrument Detection Limit (IDL) is the minimum concentration that can be statistically distinguished from zero.
- Method Detection Limit (MDL) is the minimum concentration that can be distinguished from the IDL and the minimum that should be reported. It is usually ~2x IDL.
- Reporting Limit (RL) is an artificial limit usually defined by compliance requirements, such as those of scanner/stepper manufacturers. Ideally, the RL should not be lower than the MDL.
- Detection limits lower than those shown in the table may be available upon request.

Anions (Acids)

Analyte	MDL (ppt)
Acetate	20
Bromide	10
Chloride	10
Fluoride	30
Formate	20
Nitrate	10
Nitrite	10
Phosphate	10
Sulfate, sulfite	10

Cations (Bases)

Analyte	MDL (ppt)
Ammonium	40
Lithium	10
Sodium	10
Potassium	10
Magnesium	10
Calcium	10
Amines	100

Organics (including refractories and LMW Si)

Analyte	MDL (ppt)
As toluene	10
As LMW Si	10

ANALYTICAL DATA REPORT

Summary Table – ppbV:

Sample Location	Total acids	Total bases	Total HMW organics (as toluene)	Total LMW organics (as toluene)	Total LMW Silicon	Total Moisture (H ₂ O)
Cabinet, Inlet. Note: E1250, S/N 1234.	0.5					
Outgasing: Materials evaluation, system component	< 0.1					
Control Blank	< 0.1					

Any difference between total bases and ammonium is due to the presence of

Summary Table – µg/m³:

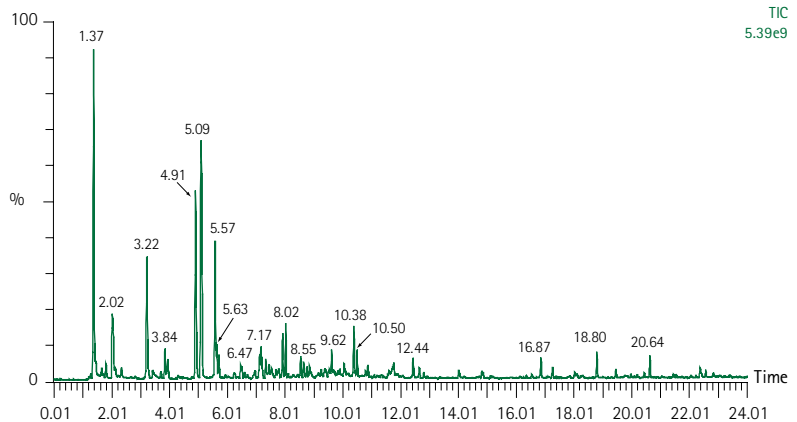
Sample Location	Total acids
Cabinet, Inlet. Note: E1250, S/N 1234.	1.0
Outgasing: Materials evaluation, system component	< RL
Control Blank	< RL

Any difference between total bases and ammonium is due to the presence of

Operator: rcp
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Scan EI+
TIC
5.39e9



Ordering Information

Non-compliance services

Part Number	Service	Comments
ESI005404-01	AMC report, acids, bases, HMW organics	-03, -04, -06 combined
ESI005404-02	AMC report, ammonia only	
ESI005404-03	AMC report, acids only	
ESI005404-04	AMC report, bases only	Ammonia and amines
ESI005404-05	AMC report, total organic content only (no speciation)	2,2,5-TMH and up
ESI005404-06	AMC report, high MW organics (speciated and TOC)	2,2,5-TMH and up
ESI005404-08	AMC report, low MW organics (speciated and TOC)	~IPA to 2,2,5-TMH
ESI005404-10	AMC report, sulfates	SO ₂ , SO ₃ , SO ₃ ²⁻ , SO ₄ ²⁻
ESI005404-11	AMC report, acids and bases	-03 and -04 combined
ESI005404-14	AMC report, low MW silicon	TMS, HMDSO, D3
ESI005404-15	AMC report, HMW organics and LMW silicon	-06 and -14 combined
ESI005404-16	AMC report, acids, bases, HMW organics, LMW silicon	-01 and -14 combined
ESI005404-17	AMC report, acids, bases, HMW and LMW organics	-01 and -08 combined
ESI005404-18	AMC report, acids, bases, HMW and LMW organics, LMW silicon	-14 and -17 combined
ESI005404-19	AMC report, HMW organics on Tenax GR	
ESI005404-20	AMC report, HMW and LMW organics	-06 and -08 combined
ESI005404-21	AMC report, moisture 10 ppb – 1000 ppm	
ESI005404-22	AMC report, moisture in NH ₃ 15 ppb – 10 ppm	

Part Number	Specialty Services	Comments
ESI005491-01	Specialty services, as per custom quote	Consult sales
ESI005491-02	Sample operator training (2 days at Entegris)	Limitations apply

Did You Know?

- Entegris provides annual measurement programs, automatically scheduled as required.
- Even though many labs use Tenax GR, Analytical Services does not recommend using Tenax GR for LMW organic and refractory AMC. Tenax GR does not capture LMW organics quantitatively and does not provide repeatable recovery for TMS. Underestimation of AMC by as much as 100× may result.
- 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.

For More Information

Please call your Regional Customer Service Center today to learn what Entegris can do for you. Visit www.entegris.com and select the Customer Service link for the center nearest you.

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