

ENSURE RELIABILITY, SAFETY, AND PERFORMANCE  
WITH **GAS ANALYSIS**



EAG  
Laboratories



## Why Choose Eurofins EAG for Gas Analysis Testing?

Eurofins EAG Laboratories (EAG) offers a suite of Gas Analysis services that ensure a product's safety, integrity, reliability, and performance. Regardless of if you are putting your product into a human body, space, or into a building we can help. EAG offers unmatched gas analysis capabilities and analytical expertise, a unique range of in-house techniques and instruments, and fast, flexible problem solving.

### Experience and Scientific Excellence

- EAG has over 40 years experience in gas analysis. From a single analytical support partner, clients gain expertise in fine leak testing, residual gas analysis, material outgassing characterization, Thermal gas analysis, and instrumental gas analysis.
- EAG offers scientific excellence with a large number of Ph.D.'s on staff. Our clients have direct access to our expertise in supporting project development, lot validation, failure analysis, and monitoring your manufacturing processes.

### Reliable Support and Short Turnaround

- With a strong focus on communication and responsiveness, EAG provides the short turnaround timelines. Clients also gain efficiency from our equipment redundancy and consultative approach.

### Instrument Diversity and Risk Mitigation

- EAG has the most diverse instrument group with location redundancy to mitigate risk. We have multiple versions of key instruments used for gas analysis and are committed to consistently growing capacity through capital investment.
- EAG reduces risk for manufacturers and users needing compliance support or facing safety challenges. All gas analysis is performed at our ISO 17025 certified lab in Syracuse NY.
- The Syracuse lab also has DLA suitability to perform MIL-STD 883/750 TM 1018 internal water vapor content testing using our Residual Gas Analysis (RGA) technique. Working with our lab in Santa Clara and LA we also offer several other DLA suitable techniques for QML and QPL parts qualifications.
- By utilizing EAG's expertise in gas analysis testing, clients can confidently assess their products safety, integrity, reliability, and performance.



## Residual Gas Analysis

Residual Gas Analysis (RGA) is a test that determines the gas mixture inside hermetically sealed devices. In order to eliminate failures in microelectronic components the internal gas composition of the component must be known. MIL-STD 883 & MIL-STD 750, Method 1018 is the accepted specification for internal gas analysis. Residual Gas Analysis (RGA) is used to quantitatively measure the primary and trace gases inside hermetic devices. This gas content, particularly moisture concentration, can cause long-term reliability problems.

RGA is ideally suited for process development, sealing quality control, studying long-term outgassing of the enclosed materials inside the components, and for product qualification and has recently taken off as one of the validation tests used for implantable medical devices.

EAG has the technical expertise to identify the origin of the problems caused by internal gasses and advise for corrective actions.

- Why should you do an RGA test
  - Investigate causes for higher concentrations of moisture and other chemically active gases
  - Sealing gas validation
  - Getter performance validation
  - Gas purity validation
  - Process monitoring
  - Process development
  - Product validation and qualification for Medical and MIL-STD products
- Reporting of identified preselected gasses in
  - Nitrogen
  - Oxygen
  - Argon
  - Carbon Dioxide
  - Carbon Monoxide
  - Moisture
  - Hydrogen
  - Helium
  - Fluorocarbon
  - Methane
  - Ammonia
  - Additional scan for 1-140 amu
- Why choose EAG for RGA testing
  - DLA suitability to perform MIL-STD 883/750 TM 1018
  - Only one of two commercial labs in the country that are DLA suitable to perform this test
  - Commercial RGA testing is also available when deviation from the TM1018 are required
  - State of the art data acquisition and reporting



## Evolved Gas Analysis

Evolved Gas Analysis (EGA) is an innovative test method for monitoring trace amounts of gas molecules that can evolve from samples when heated in an Ultra-High Vacuum (UHV) condition above room temperature. This analysis can be primarily used to determine: (1) The composition of the evolved gases (2) the concentration of the evolved gases (3) and, the evolution profile with respect to heating temperature and total gas release. This information is vital for quality control, failure analysis or establishing protocol for a manufacturing process.

Why should you use EGA?

- Comparative Study: good vs. bad study
- Wafer level failure analysis
- Confirming quality of UHV grade cleaning for SS parts
- Profiling gas release with respect to temperature and total gas pressure
- Failure analysis for hermetic packages
- Getter efficiency inside a vacuum environment
- Direct gas analysis
- Characterizing evolved gases from solid samples

## Why Choose EAG for Your Materials Outgassing EGA?

This technique was specially developed to provide a solution for a customer trying to understand what gasses were being released from their product when heated to a certain temperature. Our scientists worked with the customer and simulated the exact heating process in a laboratory setting to survey the gas species in their product. This is now a technique used routinely to profile the gas release with respect to temperature, perform failure analysis for hermetic packages, determine outgassing rates for metals, and to investigate material worthiness for use under UHV conditions. Our lab offers flexible sampling fixtures to accommodate various types of samples (solids, powders, and gas).

## Thermal Gas Analysis (TGA)

Thermogravimetric, or thermal, analysis (TGA or TG) measures changes in sample weight in a controlled thermal environment as a function of temperature and time. The changes in sample weight (mass) can be a result of alterations in chemical or physical properties and can be detected to a fraction of a microgram. TGA is useful for investigating thermal stability of solid or liquid materials under conditions of ramping temperature in an inert gas atmosphere or in an oxidizing atmosphere. TGA can also be conducted at constant temperature to evaluate thermal stability of materials over a specific time period.

TGA-MS (Thermogravimetric analysis–Mass Spectrometry) and TGA-FTIR (Thermogravimetric Analysis–Fourier Transfer Infrared Spectroscopy) services are also available.

TGA with hyphenated technologies such as infrared (IR) and/or mass spectrometry (MS) is specialized in investigating real time outgassing behaviors of materials, in the temporal/temperature regimes of interest. These outgassing studies will tell you if your materials are safe, if they could effect the reliability of your product.

### Ideal Uses of Thermal Analysis including TGA, TGA-MS and TGA-FTIR

- Survey analysis of hazardous outgassing
- Residual volatiles such as moisture, organic solvents, monomers
- Characterization of new or unknown materials
- Product deformation
- Failure analysis
- Thermal Stability/degradation
- Vaporization or sublimation
- Loss in drying
- Residue/filler content
- Decomposition kinetics
- Outgassing of synthetic polymers
- New product validation





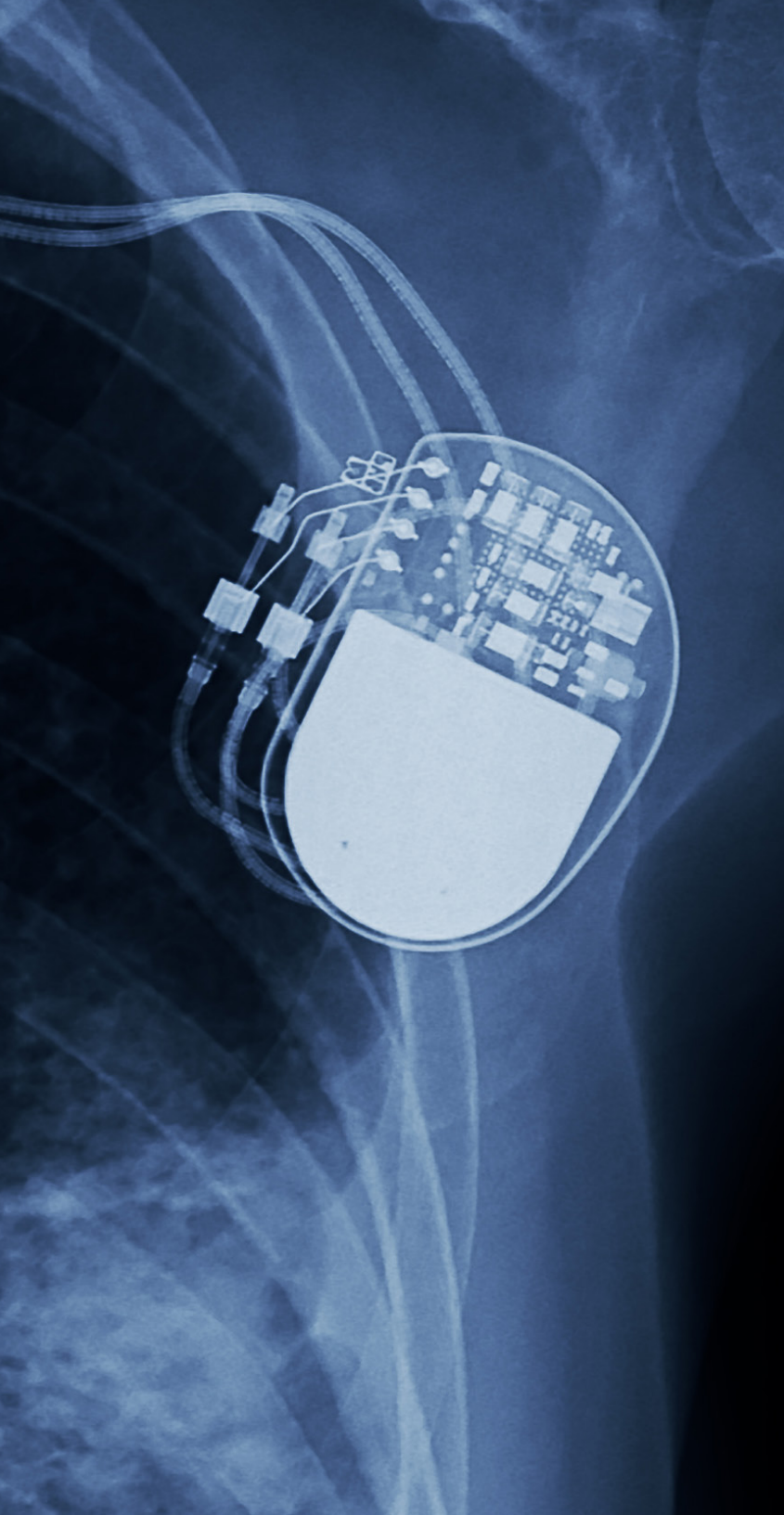
## Cumulative Helium Leak Detection (CHLD)

Cumulative Helium Leak Detection (CHLD) can detect helium leaks as small as  $4.0 \times 10^{-14}$  atm-cc/sec. It is one of the most sensitive leak testing methods available today. The process combines an ultra-high vacuum chamber with a programmable mass spectrometer and cryogenic ultra-high vacuum to detect and identify gases that escape from the device under test, usually helium.

CHLD combines Fine and Gross Leak into a single test performed in two phases. Gross leaks are indicated by an immediate large displacement of the He signal and are determined within the first few seconds of the test. If no helium has leaked out of the device under test, the pressure will fall to zero and then the package is known to not have a 'gross' leak and the gross leak test is completed. The next phase of the test is the fine leak stage, and the mass spectrometer is activated between the test chamber and the pump.

CHLD is a single leak testing system for sealed devices which combines the Gross Leak and Fine Leak into one test.

- CHLD Testing Advantages
  - Highly sensitive for the smallest devices
  - Combines Fine and Gross leak into one test
  - Eliminates the use of fluorocarbons and Kr85
  - Has the ability to leak test for other gasses in addition to helium
  - Non-Destructive test
  - Allows for non-destructive re-testing
  
- The Best Applications for CHLD
  - Implantable Medical Devices
    - Small cavity devices
    - Pacemakers
    - Cochlear implants
    - Spinal stimulators
    - Silicon-rubber encased devices
    - Pressurized gas reservoirs
    - Can safely test fully assembled medical devices
  - High Reliability Electronics
    - Devices requiring long-term hermeticity, space applications, and/or satellites
    - Multi-chip modules
    - Semiconductors





## Instrumental Gas Analysis (IGA)

The term "Instrumental Gas Analysis" includes such methods as combustion, inert gas fusion, and hot extraction for determination of gas-forming elements (C, H, N, O, and S) present in solid materials from ppm to % levels. A high temperature furnace is used to rapidly heat the sample and thereby convert certain elements into volatile forms in order to separate, detect and measure them.

### Why is this important?

It is essential to have a survey of chemical purity to achieve desirable mechanical properties and reliability of the complex architecture of the product. IGA can accomplish this by:

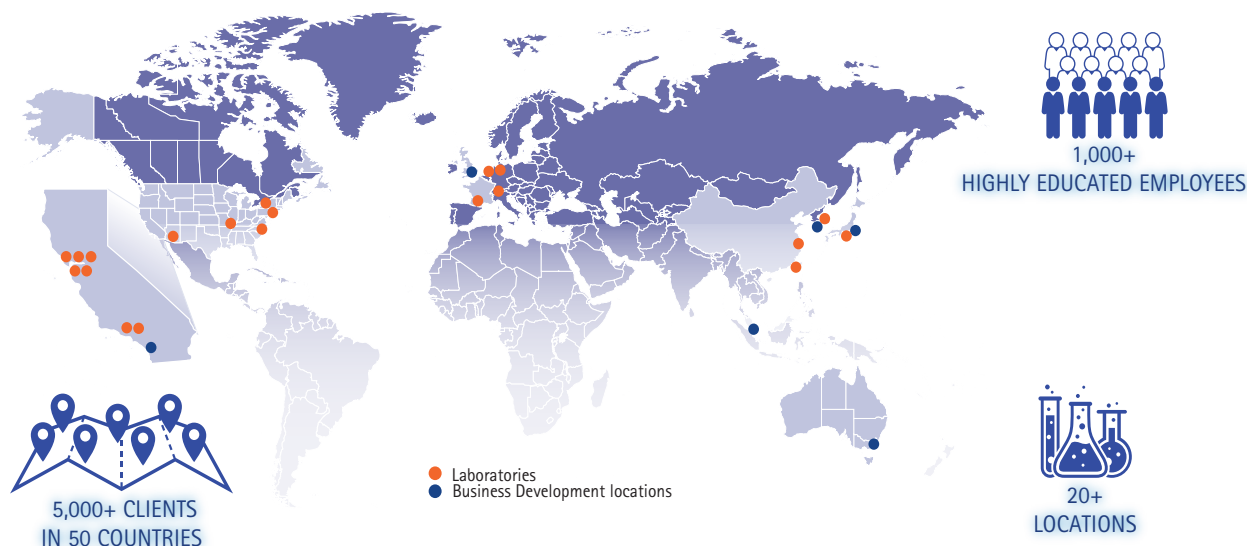
- Accurate C, H, O, N and S measurements from ppm to weight % in solids to determine the purity of a sample
- Fractional Gas analysis to quantify H,O, and N released from various bonding chemistries and chemical environments
- Surface, free, organic, inorganic carbon differentiation in unknown samples.
- Differentiate surface and bulk concentrations of H, O, and N
- Free carbon analysis

### IGA Strengths

- Mature technique for high precision measurement of H
- Less complex and minimal sample preparation
- High throughput (20-40 mins/sample)
- Well-established technique for steel industry
- Can provide H and O environment information (surface or bulk) using temperature programs and reactions agents

### IGA Services at Eurofins EAG

IGA testing can be divided into two major categories: The well-established testing where standard ASTM test methods are used to analyze conventional samples (e.g. steel, titanium alloys, and refractory metals) and client-specific testing methods for unconventional samples (e.g. non-porous samples, battery electrodes) developed by highly experienced scientists going beyond standardized ASTM test methods. At Eurofins EAG, four state-of-the-art laboratories provide fast accurate IGA services worldwide. Our Syracuse, NY, Toulouse, France, Eindhoven, Netherlands, and Shanghai, China facilities are operating daily under our well-monitored quality system.



## About Eurofins EAG Laboratories

When it comes to understanding the physical structure, performance, chemical properties and composition of materials, no other scientific services company offers the breadth of experience, diversity of analytical techniques or technical ingenuity of Eurofins EAG Laboratories. We don't just perform testing, we drive commercial success—through thoughtfully designed investigations, technically superior analyses, and expert interpretation of data.

We deliver multi-disciplinary, problem-solving expertise to help our customers accelerate innovation, ensure quality and safety, and protect intellectual property. Whether you are seeking to reduce time-to-market, solve manufacturing problems or ensure regulatory compliance, turn to Eurofins EAG. We know how to bring the power of science to every phase of your product lifecycle.

- 20+ facilities located in the US, Europe, and Asia
- 2,500+ instruments
- 600+ highly-educated employees
- Serving more than 4,000 clients worldwide
- Revenue sourced from more than 50 countries

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## Complete Lifecycle of Services

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ASSURANCE

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SUPPORT

 FAILURE  
ANALYSIS

 REGULATORY  
COMPLIANCE

 MANUFACTURING &  
SUPPLY CHAIN SUPPORT

 CONSULTING &  
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