ADVANCED MICROANALYTICAL

Advanced Microanalysis & Materials Science

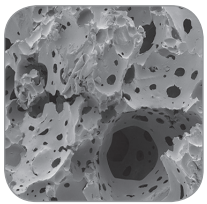
Advanced Environmental Testing
Forensic IAQ
High Tech Manufacturing
Electronics & Semiconductors
Research & Development Support

Nano-Materials
Non-Destructive Testing
Failure Analysis
Air, Water, & Power Industry Support and more…

Advanced MicroAnalytical
50A Northwestern Drive, Unit #4
Salem, NH 03079
Toll Free: 877-605-6662
Phone: 603-898-7074
www.advancedmicroanalytical.com

Table of Contents

Advanced MicroAnalytical

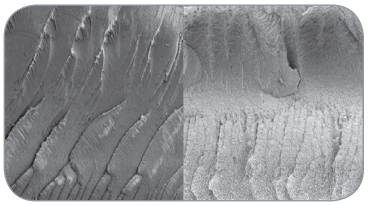


Advanced MicroAnalytical offers in-depth scientific support for a wide range of industries and sample types. Our staff and analytical capabilities are primed to provide leading edge support for a wide range of industries, including manufacturing, micro-electronics, nanofabrication, aerospace and defense, environmental engineering – as well as many others. Advanced MicroAnalytical is located in the hub of technology on the East Coast just north of Boston, MA, in Salem NH, this location means that Advanced MicroAnalytical is uniquely positioned to take advantage of the vast analytical resources the area has to offer.

At Advanced MicroAnalytical we provide solutions to complex problems involving materials analysis from the identification of unknown materials to product viability and quality control on a vast array of sample sources and types that goes beyond merely generating high quality data. Our goal is to provide you with a source of responsive, personalized analytical services to overcome your technical challenges and put you on the path to success.

We are dedicated to providing you and your business with critical insight and knowledge that is essential in the modern era. We provide the testing services and analytical tools for comprehensive understanding of your materials and projects. Our services range from advanced microscopy analysis of nanotechnology to compositional and functional analysis of large manufactured systems. At Advanced MicroAnalytical, our commitment is to serving as a valued analytical partner to our clients. We offer unmatched analysis, testing, and service to assist you in your business, environmental, and research challenges.

Comparative Testing



In some system critical applications, the combination of bulk properties and gross composition of materials used in engineering or manufacturing is key importance. Chemical composition, grade of alloy, as well as the workmanship used in the assembly or construction of a product can have a significant impact on the final product.

Advanced MicroAnalytical has the analytical expertise and range of services to allow for a wide variety of materials and devices to be inspected, analyzed, and compared to desired specifications. Our Materials science division and chemistry analytical labs allow for bulk composition of raw materials, as well as specific assemblies of manufactured products to be examined for chemical composition, using ICP, NMR, XRF, Raman and IR spectroscopy, and more.

Direct analysis of manufactured materials, by using physical and tribological methods, as well as non-destructive radiological imaging, CSAM, and functional analysis are available. Devices using complex assembly and fine components, such as assembled PCB or semiconductor devices can be examined and compared to desired specifications.

Whether it be an exercise in simple validation to confirm that a trusted manufacturing partner is maintaining their quality control, or a comprehensive program designed to examine the quality of incoming materials batches, comparative analysis is an increasingly common requirement in modern manufacturing. Between increases in the sale and distribution of counterfeit goods, the increase of rapidly outsourced alternate material sources, tighter tolerances and precision in manufactured goods, maintaining strict control on materials can be imperative. Our analytical services can give you the confidence and information you need to remain competitive in a complex engineering world.

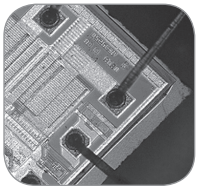
Compositional Analysis

Advanced MicroAnalytical is a leader in providing wide-ranging analytical support to diverse clients. Questions regarding material composition, whether in a known or unknown material are one of the most common needs for clients across almost all industries. Sometimes contaminants infiltrate manufacturing processes, environmental investigation can identify pockets of unexpected material, or a shipment of goods might be covered in a mysterious foreign material when it arrives at the destination.

Advanced MicroAnalytical is dedicated to providing clients valuable answers and insight, not just blind data. Our clients can find a responsive, helpful partner in answering their compositional analysis needs. With our network of laboratories and diverse scientific staff, Advanced MicroAnalytical can find the right mix of testing and informational resources to assist you identify or quantify the compositional information of interest to you. From correlation between composition and intrinsic properties through thermal and mechanical properties through DMA, TGA, MFI, or tribo-mechanical properties, many complex mixtures can be indirectly identified. Nondestructive or minimally destructive techniques, such as surface GD-OES, XRF, XRD, and spectroscopic techniques can give detailed information on some or all of the components in a material. Complex mixtures can be analyzed through the use of chromatography and chemical digestion using LC-MS, ICP-MS, GC-MS and NMR.

Advanced MicroAnalytical's ability to pair the right analytical resource with experienced scientists from many disciplines allows us to offer clients unmatched quality and precision of service. From quick fact finding requests on the gross composition of a material, to detailed engagements like reverse engineering or DFSS variation factor analysis, call Advanced MicroAnalytical (AMA) today to learn how our resources can be leveraged to assist you with your project.

DPA (Destructive Physical Analysis)



In manufacturing every step or process that a device or product goes through increases the value and function of the device, but also has the potential to introduce issues from improper assembly, inadequate or contaminated materials, or processing. With the increasing number of contract manufacturing arrangements, foreign outsourcing of parts, and shrinking tolerances in the final products, the number of ways in which a small variation in assembling methodology or quality can impact the final part has increased significantly.

In an ideal world, real time monitoring during manufacture should be able to limit issues but it's often extremely fine details that lie on the interior of the finished product that can make the largest impact on the final results. There are a number of features that can only be revealed by disassembling or dissecting the final product. One of the most common means to perform this type of analysis is with cross-sections, supporting the sample with high hardness epoxy and cutting through the sample with a diamond saw. Using precision abrasives and polishing materials, a flat section through a given area of interest is then revealed, allowing for microscopic analysis of the interaction between different components in the sample. In the case of even more sensitive or smaller samples, FIB sections can be prepared, allowing examination of sections on the order of several microns to be prepared, or – for the ultimate resolution, thin sections can be prepared for TEM analysis on the order of a single nm or smaller.

Advanced MicroAnalytical can provide DPA services in accordance with Mil-STD 883, Mil-STD 1580, Mil-STD 750, Mil-STD 202 as well as customized methods and testing to fit the requirements of your project.

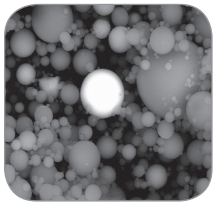
Engineering Support

Today's rapidly increasing pace of design and manufacture in the high tech manufacturing world means engineers are more frequently being called on to assist with all stages of the design, prototyping, and manufacturing cycle. Where traditionally engineers were almost always single discipline designers, in a modern work flow, it's common for engineers to have to switch roles between electrical and mechanical, perform manufacturing engineering support, or rapidly redesign in response to client demands. With ever increasing competition, pressure can often mount to drive ever more rapid development which puts a strain on internal analysis capacity, which can grind the whole process to a halt.

Advanced MicroAnalytical has decades of experience in supporting modern engineering efforts. While our laboratories are characterized by an extremely wide range of available analytical tools, we take special pride in the knowledge and professionalism of our staff of scientists – whose experience allows our company to work hand in hand as a partner to support client efforts. Our materials analysis capabilities range from large scale mechanical testing on concrete and steel composite members designed to carry tons down to tensile measurement of individual nanowires or ceramic micro particles. Our chemical analysis capabilities allow us to perform performance testing for wear or anti-microbial properties on finished samples, or perform compositional analysis to determine any degradation products present in a wide variety of polymer composites. We can provide support ranging from same day analysis on many samples, or provide logistic and planning support for a long term project lasting months through an entire product development process.

With Advanced MicroAnalytical providing detailed, customized testing support, your engineering projects can be better informed, and more accurately planned. Contracting with Advance MicroAnalytical allows you to roll the many advantages of having an in house testing laboratory facility, without having to shoulder the expense of outfitting an internal laboratory.

Environmental Monitoring



Evaluating the quality of the air, water and soil around buildings and industry can be a complex endeavor. While environmental regulations have established many best practices in the field of environmental compliance, regulations often don't fully reflect the concerns that can be created when construction and or industry begins to intrude on their surrounding environments. While there are a number of well-developed protocols and regulations, many of which either dictate or infer the testing and monitoring protocols necessary, there can be numerous cases where standardized test methodologies do not address concerns on the edge of established practices – or as is increasingly the case, a new industry or operation not well considered by existing regulations has raised cause for potential concern.

Advanced MicroAnalytical has years of experience assisting both environmental engineering professionals and members of the community in determining the proper methodology to monitor evolving changes. Common applications can include examination of bulk PM 10 or 2.5 filters for specific types of materials that might be generated from an industrial source, examination of residues from a stack filter or scrubber at a powerplant, or examination of micro-particles in a water bed that might be selectively capturing compounds of interest. Our analytical techniques can include inorganic chemical analysis, mineral identification and speciation, organic compound analysis through either spectroscopic or chromatography methods, and precision micro-analysis.

When new industries develop, especially in areas where there are undeveloped areas, or perhaps residential areas, there are often concerns about how that industry can impact the surrounding environment. By engaging with Advanced MicroAnalytical, you can gain a better understanding of the surrounding environment, can create an environmental monitoring plan, where you can manage your own operation better, as well as manage the expectations and concerns of those living in that environment.

Failure Analysis

It is almost unheard of for any manufactured part or device to maintain true 100% reliability. Eventually, everything is going to break, fail, or fall short of desired functionality. Understanding the reason behind these failures can make the difference between learning and improving a product to stand out amongst competitors, or potentially missing important clues that could indicate larger potential problems lurking below the surface. With the support and expertise of Advanced MicroAnalytical at your disposal, you can be assured that you can extract every scrap of valuable information from failures, and put that information to good use.

Advanced MicroAnalytical has a broad scientific staff operating throughout our materials science division to assist in diverse failure analysis investigations. We have a comprehensive suite of mechanical testing capabilities that allow us to simulate strains and stresses on materials and compare forced failure to field failure units. These tests can also usually be performed under a variety of adverse environmental conditions such as elevated temperatures, humidity or caustic salt spray. We can perform traditional fractography inspection, using many microscopy techniques. Non-destructive testing can be used to image interior faults and fractures, with high resolution X-ray CT, CSAM and similar techniques. Using both precision sectioning, and more advanced nano-scale techniques, the interior features of devices and parts can be revealed for further examination of both the morphology of any failures, and also the chemical and electrical properties of the material.

Advanced MicroAnalytical has the experience, breadth of services and understanding of the manufacturing and product development community to serve as a trusted partner in providing engineering staff with the information necessary to determine the root cause of failures.

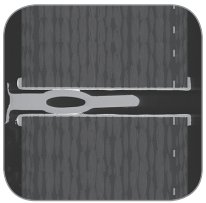
Fire Investigative/Combustion Byproduct Analysis

At Advanced MicroAnalytical we use state of the art techniques for the investigation of residues from fires. The results can be used to determine the extent of impact of fire residues throughout the structure. Advanced MicroAnalytical offers a comprehensive suite of testing services for combustion byproducts, from simple presence or absence analysis through potential sourcing analysis using advanced chemical and microscopic techniques.

Residues from fire can have a significant impact on respiratory health of those that dwell with structures that have been exposed to combustion byproducts. Testing can be done after a fire event in order to determine what areas might have been impacted, or the testing can be used during or after a cleaning or remediation in order to guide professionals in their remediation efforts. Various analysis levels are available and customized analysis is also available with the CBP Investigative testing. We offer a number of standard tests for investigators who are looking only for specific types of information, but recommend our new, CBP Investigative Method to cover the widest possible range of applications with a new, innovative reporting format and customized results tailored to your needs.

NEW! CBP Investigative: Forensic approach to the analysis of fire residues including optical microscopy, scanning electron microscopy and/or transmission electron microscopy for the purposes of evaluation including interpretation of results of findings as to source and relative impact of combustion related particles within the structure. With this analysis, there is no need to pre-select levels of testing based on what you expect to see at the sample site, the right testing will be used to get you the most information possible. Additional information about potential corrosive or reactive ash gathered from pH measurement. More detailed, representative data and reporting allows for better understanding of the nature and spread of CBP materials.

Inspection Services



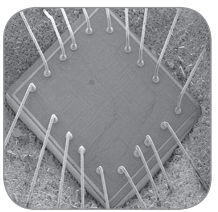
Independent third party inspection of high tech manufactured goods and electronics are critical in maintaining the reputation and bottom line of your company. Costly returns and complaints from clients can be avoided and caught before products go out when the right analysis is used prior to product shipping or even during production.

Fortunately Advanced MicroAnalytical is here to help with comprehensive inspection services for high tech manufacturing and the electronics community. We are capable of bringing the full range of analysis methodologies available as industry standards, as well as providing deeply customized analysis packages and ongoing support services. We offer a full range of non-destructive and destructive inspection methods including Visual Inspection, X-Ray, 3D X-Ray CT, XRF, CSAM, SEM/EDS, Dye & Pry etc. to verify composition, workmanship, and potential internal failure modes as well as reduce returns for defective product and address any potential non-compliance issues.

When non-compliance or defects are detected we also offer full DPA and device decapsulation/dissection as well to allow for higher level detail of solder bonds, wire assembly, and component level internal quality on electronics packages. Advanced MicroAnalytical also offers surface analysis, sub-micron die inspection, and full sub-transistor FIB-SEM and TEM analysis for the times when issues crop up on an individual die component.

Limit your defective and costly returns and disruptions to production by engaging with Advanced MicroAnalytical. Maintain your hard earned reputation with your client base with standard inspection and customized verification services completed with care and accuracy.

Integrated Circuit Support



The design and manufacture of integrated circuit containing devices is a massive industry, reflecting hundreds of millions of devices manufactured throughout the year. Many of these devices are relatively simple consisting of a few components on a small board. However, as customers continually strive for more feature rich devices and increasingly robust or flexible packages, it often isn't enough for a device to be competently designed. Current consumer demands means more often it needs to consume less power, have built in diagnostics and anti-counterfeiting features, and survive extreme environments. As more and more devices are piled onto shrinking board footprints, and more and more transistors piled onto die surfaces, the complexities of creating robust functional designs as well as the number of potential points of failures begin to mount up.

Thankfully, Advanced MicroAnalytical Analytical has a proven track record of offering comprehensive scientific support services throughout the electronics manufacturing community. Advanced MicroAnalytical has a diverse staff of experienced scientists that can offer solutions to customers with needs from design and prototyping support through end user failure analysis. We are capable of bringing the full range of analysis methodologies available as industry standards, as well as providing deeply customized analysis packages and ongoing support services. We offer a full range of non-destructive inspection methods including X-Ray, X-Ray CT, XRF, CSAM etc. to verify composition, assembly quality, and possible internal failure modes. We also offer full DPA and device de-capsulation/dissection to allow for higher level detail of solder bonds, wire assembly, and component level internal quality. Advanced MicroAnalytical also offers surface analysis, sub-micron die inspection, and full sub-transistor FIB-SEM and TEM analysis for the times when issues crop up on an individual die component.

Materials Characterization Lab Services

Materials characterization covers a vast array of processes and analytical techniques. The techniques required for characterization are dependent upon the type of material, sample composition, condition, form, and maybe most importantly what information is required. At Advanced MicroAnalytical Analytical, Inc. we listen to our clients and our experience will help ensure we know your process and material, so we can match the right technique and method to your project. The following is a partial list of instrumentation and techniques that are available at Advanced MicroAnalytical for materials characterization and analysis:

Microscopy: Optical Microscopy, Transmission Electron Microscopy, Scanning Electron Microscopy -EDS, Specialized Sample Preparation: FIB, Cryo-Microtome.

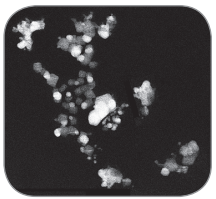
Chemical Analysis: XRD, WD-XRF, Fourier Transform Infrared Microscope; Micro FTIR, Gas Chromatographs, Carbon, Nitrogen, Sulfur, Hydrogen Analyzers, ICP, ICP-MS, IC, LC-MS, LC-MS/MS, HPLC, Metals Speciation, Mercury Analyzer.

Thermal Analysis: Differential Scanning Calorimeter, TGA, DMA

Non-Destructive: Real Time Magnified X-ray imaging, High Resolution X-ray film imaging, X-ray CT, CSAM, Portable XRF, and XRF-Film Thickness

Additional Testing Capabilities: EDM machining, Cryo-Microtome, Environmental Chambers, Heat-treating Furnaces, Zeta Potential Analyzer, Dual Beam FIB, EBSD/EBSD mapping, Serial block tomography imaging, Tensile stage real-time analysis of strain/compression in SEM, XPS, TEM, Surface Profile/3D reconstruction, Micro Raman, AFM.

Nano-Materials and Nano-Particle Testing Lab



Nanomaterials are steadily becoming a ubiquitous part of engineering, from everyday consumer electronics, to advanced therapy drug delivery systems. The size and properties of these materials present unique opportunities for engineers seeking to create new materials to push the boundaries of material, chemical, and electrical engineering. The size and properties of these materials require specialized instrumentation and expertise. Exposure to these materials is becoming a growing concern for the health of those who work within the field. Characterization of fallout from these products for size ranges and composition is needed to start to assess the safety risks. Often, the properties of these particles raise unique environmental and health concerns, often in cases where the science is still developing about these materials.

With all their benefits, and concerns, nano-sized particles present a unique challenge for characterization simply due to their size range (1nm to 100nm). Their small size can necessitate the use of special imaging and testing techniques - available at Advanced MicroAnalytical, Inc.

Advanced MicroAnalytical has a number of techniques for working with nanomaterials, from special preparation techniques, like cryo-microtoming, FIB (focused ion beam) sectioning, FESEM imaging and elemental analysis, and atomic lattice resolution HR-STEM analysis for particles and thin sections. Our experience with these materials allows our scientists to anticipate concerns and challenges to get you the best data on even challenging materials types. Nanoparticles present unique opportunities and challenges in both manufacturing and analysis, and we are here to assist you with attention to the smallest details.

Non-Destructive Testing

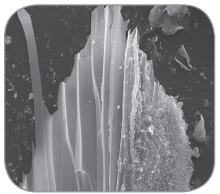
There are times when performing materials analysis requires the highest amount of sensitivity, and all other considerations are irrelevant. While sometimes a complete breakdown of the device or sample can give you the most information sometimes reducing the sample to component atoms isn't a viable alternative. Frequently failures may only be present due to an interaction between components, but often it simply isn't acceptable for the sample to be altered at all, let alone destroyed. Unique, one of a kind failures, prototypes (either from manufacturing, or for reverse engineering purposes) or samples that are likely to come under legal scrutiny are all examples of samples where any alteration is unacceptable.

For those clients that need to maintain the integrity of their device or sample, Advanced MicroAnalytical offers a variety of completely non-destructive analysis options. Examination of the exterior of samples can be undertaken using a number of micro-analysis methods, including optical microscopy, DIC, polarized reflectance microscopy, and SEM. This allows for features from mm to microns to be documented without destroying the sample. Even interior structures are capable of being examined, with realtime radiographic inspection services, micro-X-ray CT, and scanning acoustic microscopy, (CSAM). Using fluorescence, IR and Raman spectroscopy, organic features and details on the surface of the sample can be chemically analyzed, and a combination of XRF and EDS or Raman can highlight inorganic features.

Our experienced scientific staff expert in the use of our advanced instrumentation, are familiar with the concerns of clients when it comes to maintaining the sanctity of sample integrity. Our staff will keep you apprised of the results, maintain the contiguity of sample associated records, and return the sample to you in the same state it was submitted. When you work with AMA, you can be sure we will help guide you to the appropriate techniques for your application, ensuring you get the best non-destructive data possible, and next stages of analysis should more disruptive techniques become necessary.

Particle Testing-Particulate MicroAnalysis (PMA)

What is in your dust? The buildup of dust and residues is an age old problem that isn't isolated to any one locale or type of environment. Any indoor environment, from small private homes, through large multi-tenant buildings, right on up through massive industrial complexes will at one point or another find some dust or debris building up in one place or another. Frequently this dust is just a side effect of people living in an enclosed space, creating dust from themselves and from their surroundings. But there are times when there might be a concern....



Advanced MicroAnalytical provides a number of services using comprehensive micro-analysis methods in an effort to address these concerns, bringing insight and analysis in a manner that accounts for clients with a range of experience levels so they can easily understand what the findings mean for their unique application. Using a range of microscopy methods, ranging from optical to spectral imaging, fluorescence, and electron microscopy, our team of analysts can examine all of the varying components of any dust or residue samples.

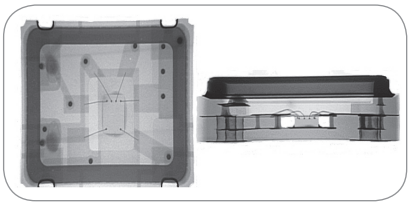
Using chemical analysis methods such as micro IR, Raman, or x-ray spectroscopy, individual particles or aggregates can be identified. Finally, the relative compositional breakdown of materials in the sample can be presented in order to allow for comparison of the breakdown of materials compared to local standards, or to chart migration of a particular component from a known source. All of this information provides the client with the information to assess if there is anything present at the site that warrants concern or further analysis, as well as how the dust residues reflect evidence of known material sources or unwanted air intrusion.

Product Development R&D

Ongoing development efforts are often complicated, multi-phase efforts. Multiple departments or researchers with different disciplines often need to interact in order to drive forward progress on a new product. Developing new materials and new devices can frequently involve new techniques on the edge of a company's core competency. In many cases, there is a significant amount of experimentation required for a single stage of development. In an ideal case, theory and modeling of the appropriate principals would allow a company to get to a functional early stage prototype relatively quickly. However, especially with semiconductor devices, composites, and other materials that exhibit strongly non-linear behavior, there can be a large amount of unexpected variation. The problems don't evaporate, but simply reappear with new concerns once a process begins scaling into full manufacturing.

In any kind of R&D effort, the key to maximizing progress and minimizing dead ends is having the right information. Analytical services provided by AMA can provide your company or research group with the best information in a responsive, affordable manner. AMA's staff of scientists has decades of experience working with high-tech engineering efforts in many industries. We have the capacity to perform detailed material analysis in a wholly co-operative manner. We are accustomed to working with diverse engineering staff from our clients' teams on tight turn-around schedules, often performing testing on a same-day basis when the need arises. We can also work with clients, not only allowing for clients to either sit in and witness analysis in person or through remote internet connectivity – but also are experienced in offering co-operative support to help ensure that our service offerings can complement your ongoing work every step of the way. Contact AMA, so we can speak to you about your ongoing projects, and determine how we can best assist your development efforts.

Product/Process Validation



Manufacturing operations are constantly locked into a struggle to increase not only the quality of parts, but also the speed and reliability with which they can be made. Similarly, there are constantly competing interests that are striving to lower costs and better manage lead time. Unfortunately, these interests often work at cross-purposes. In today's manufacturing environment maintaining a firm hold on quality of your products throughout the process is critical to your company's reputation and profitability.

With our experienced and knowledgeable engineering staff, AMA can support your quality and process analysis needs. We are capable of providing a wide variety of services, offering a range of services, from bulk material composition verification, purity analysis, identification of trace contaminants, and comparative dimensional and intrinsic property analysis on even complex devices. We have years of experience in assisting companies with even the most complex multi-phase DOE type experiments, allowing for clients to have confidence in their analysis. Our laboratories are familiar with numerous quality standards, from JDEC, ISO, DOD, ISS, for many analysis methods.

When validating the quality and reliability of your product is of the highest concern, your guarantee can only be as good as your ability to monitor the individual quality parameters of your process. With AMA by your side, you have an industry leader in analytical testing providing proven, independent third party support for your validation efforts.

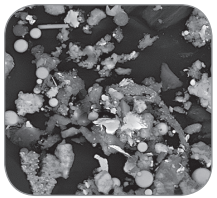
Quality Assurance

Ensuring high standards in internal quality assurance efforts can be daunting. Relying solely upon data from suppliers can turning problematic if there are no internal and external checks undertaken from an outside independent contract lab. While there are often excellent internal metrics in place for well understood products, when an unexpected issue pops up it may not be an issue that the existing QA department is equipped to handle. Alternately, a change in equipment, methodology, or raw materials might create enough variables that tracking any change in the final product back to one source can be challenging. In order to get a better handle on the range of possible issues facing a QA engineer it's often necessary to have access to a wide range of investigative tools.

AMA has a nationwide network of laboratories with experienced scientists dedicated to providing supporting analysis for your QA efforts. With a rigorous nationwide quality program, we understand the need for tight controls and constant oversight of our laboratory practices. We are well accustomed to providing services ranging from long-term quality validation analysis to support your efforts all the way through handling one time, emergency analysis. We offer not only the high sensitivity of full chemical analysis and material deformulations, but also have options for non-destructive testing, allowing for 100% inspection and return of your product to full service. We have decades of experience with a host of standardized tests and can help navigate through the regulatory processes required within your specialization. Because we have experience with the manufacturing, pharmaceutical, food, and medical device fields, we understand how crucial it can be to get answers quickly. And when a production line is shut down waiting for guidance, AMA can offer expedited analysis to support those efforts.

AMA can assist you with a full range of analysis options, chemical, structural, electrical, microscopic and thermo-mechanical – AMA can offer you the services you need at a price that won't put too undue a strain on the bottom line.

Unknown Material Identification

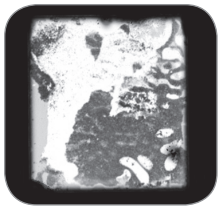
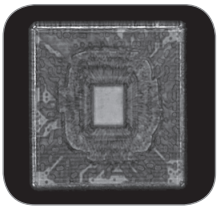
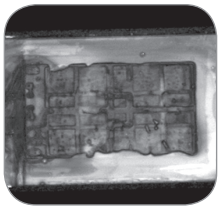


Getting an idea of the composition of a truly unknown material is a common need, yet complex problem. Environmental engineers and property owners are often faced with unexplained residues or deposits of material in soil or around previous construction that is either poorly documented, or completely unexplained. Even when efforts are made to tightly control all phases of a supply chain and manufacturing process, contaminant residues can be found forming inclusions in manufacturing applications, or unknown materials can be found in or on source materials and supplies. These are only some of the applications where identifying some mysterious material is of great concern. Unfortunately, despite how easy and glamorous movie and television laboratory testing looks, accurately determining the composition of a truly unknown material is a challenging process. There isn't a magical single test that tells you what a material is, and picking the wrong or too specific sort of test can yield no practical value, as well as consume time, money, and some of the sample – which may be in limited quantity.

Overcoming these challenges, especially given the nuances presented by different sample environments and client needs is a specialty of Advanced MicroAnalytical. Our laboratories has a wide range of staff scientists and technicians whose diverse expertise can be applied to your challenges. Because we have access to a number of state of the art laboratory facilities, as well as decades of experience in testing applications, we are able to serve as a valued resource, combining our testing acumen to get our clients the answers they need, greatly reducing wasted time and money associated with inapplicable tests.

We can perform a variety of bulk chemical analysis using spectroscopy and chromatography methods, functional, physical and electronic testing, and a wide range of micro-analysis methods which allow us to determine the nature and composition of almost any material you can submit.

Scanning Acoustic Microscopy (CSAM)

Scanning Acoustic Microscopy (CSAM) is a non-invasive technique used to non-destructively inspect for construction details, defects or the integrity of an optically opaque solid sample, component, material or structure. The Acoustic Microscope can be utilized as an aid in failure analysis, research & development, QC, reliability or process control by identifying sub surface delamination, voids, cracks, bond lines or seal issues in various materials. Typical applications are microelectronics, encapsulated devices, bonded wafers and materials, lid seal and more. At Advanced MicroAnalytical we use CSAM in concert with other techniques and instrumentation to give us diagnostic flexibility and for use with project analysis on samples where minimally invasive or nondestructive techniques are required.

Electron Back-scatter Diffraction (EBSD)

While chemical analysis to determine the gross composition of a sample is often very useful in materials science and related application, it is common that variations in the microstructure of materials can have as much or more of an impact on properties of interest than the chemistry of the bulk sample. Electron Backscatter diffraction is a powerful technique AMA employs to investigate down into the sub-micron details about crystalline phases in a solid sample. The intrinsic wave characteristics of an electron beam are utilized to image the faint, destructive interference bands that are created in backscattered electrons in a certain geometry. The images of these interference patterns can be analyzed to determine not only crystal geometry, but orientation on a sub-micron scale. This allows for grain size, orientation, association, and deformation (among other properties) to be mapped and analyzed, in two or three dimensional data sets. This data can often be directly interfaced with property modeling and simulation analysis to gain unprecedented insight for materials properties.

The orientation and association of grains in alloys and metal parts can often have significant impact on strength, magnetic properties, and hardness. Ceramics are diverse and can have radically different properties with different grain sizes, sintering effects, and degrees of crystallinity – including piezoelectric or magnetically active ceramic compounds. Even composites, crystalline polymers, and petrographic analysis all benefit from additional information about the crystalline properties of the bulk material on the micro-scale. AMA is prepared to assist its customers with analysis on the cutting edge for their complex materials analysis needs, adding EBSD to a complete set of crystallography tools to inform and highlight important properties.

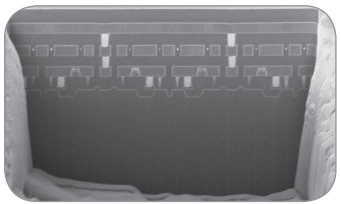
Energy Dispersive X-Ray Spectroscopy (EDS/EDX)

EDS serves as one of the most versatile analytical tools available for general materials analysis. EDS is an elemental spectroscopy technique, which goes hand in hand with electron microscopy. Founded in order to provide quality electron microscopy analysis, Advanced MicroAnalytical has decades of experience in applying EDS analysis to a host of samples. EDS captures and analyzes the characteristic x-rays generated from any material when the intrinsic electron structure in that matter is impacted by a high energy electron beam. Excitation and relaxation of the electrons in the sample generate x-rays, which have discrete energies determined by the orbital structure of each element present in the sample. This allows for a fast, effective and precise analysis to determine the elemental composition of any material that can be imaged in an electron microscope in a non-destructive manner. Because of the speed of analysis and the variety of materials that can be tested, EDS allows the scientists at AMA to add value and insight to a broad variety of samples.

Elemental Mapping

By processing these spectra, the relative intensity of spectral features associated with a number of elements of interest can be translated into computed colorization layers, which color codes the electron photomicrograph signifying layers and sites of elemental compositional information in your sample. Using this technique, complex systems of precipitates, minerals, composite materials, or laminates can be examined using the chemical information about the materials to create another dimension of insight. Elemental mapping leverages the compositional precision inherent in techniques such as EDS microanalysis and combines it with high resolution imaging to present complex data in an accessible, visually striking format that assists AMA's clients by communicating complex information in an efficient and compelling manner. Elemental mapping is based on compiling extremely specific elemental composition data across an area of a sample. This is typically done in an SEM or TEM using EDS analysis. A high resolution image of the area of interest is collected along with the EDS data, and the two are correlated. For every pixel in the digital image collected, a complete elemental spectrum is also collected.

Focused Ion Beam SEM (FIB-SEM)



Dual beam FIB-FESEM instruments are a tool gaining increasing adoption in manufacturing, process development,and failure analysis due to their versatility and precision. The use of a focused ion beam (FIB) creates a very finely focused beam of ions from a reservoir source that can be rastered, focused, and controlled with electrostatic deflectors and lenses. While different ion sources are available for specialty applications, Gallium is a common ion used in these instruments. While the ions can be scanned over a sample surface to image the material with secondary electron generation, similar to an SEM, the larger mass of the ions impacts the surface with a much larger amount of energy than electrons from an SEM source. This provides a means by which the sample can be altered, shaped, prepared, and then analyzed for a host of purposes. Samples can be cut, cross-sections can be created, and through the use of injected gas precursors, materials can be deposited on the sample to create controlled structures or create patterned conductive paths to edit or alter micro-circuitry.

The addition of a high resolution SEM column along with the FIB creates a uniquely powerful analytical platform. Samples can be mounted, sectioned, probed, and imaged all in a very rapid, precise analytical time frame. The advantage of high magnification of the FE-SEM, good material contrast, and low voltage imaging performance allow for very fine structures in composite materials to be examined. The use of an electron beam also allows for additional analytical techniques, including EDS, EBSD, and BSE imaging. This imaging precision also allows for easy preparation of extremely thin, precise TEM section samples in a variety of materials.

Gas Chromatography (GC/GC-MS)

Gas Chromatography (GC) – GC is a commonly used separation technique in analytical chemistry for organic compounds that can be vaporized without being decomposed or rearranged. The gaseous compounds in the mobile phase which is an inert carrier gas interact with a stationary phase, generally a polymer that coats the wall of a column, to allow the compounds to elute at different times. The column is located in an oven where the temperature of the gas in the column is programmed to control the rate of partitioning of the compounds between mobile and stationary phases. The qualitative identification and quantitative measurement of the compounds are determined as they elute (retention time) onto a selective or non-selective detector specific to the class of organic compounds of interest. Typical detectors that are used in environmental chemistry for the determinative measurement of analytes are Electron Capture Detector (ECD) for organochlorine pesticides and PCBs, and Flame Ionization Detector (FID) for non-halogenated volatile organics.

Gas Chromatography/Mass Spectrometry (GC/MS) – GC/MS utilizes the same separation techniques as described in GC whereby a sample is introduced into the GC system, vaporized and the compounds being retained on the stationary phase. The compounds elute from the column at different times based on their affinity to the stationary phase into the mass spectrometer (MS) where the MS will break down each compound into ionized fragments. These fragments are detected using their mass-to-charge ratio. The most common form of ionization is electron ionization (EI) where the compounds are bombarded with free electrons to fragment them. Commonly used mass spectrometer detectors are quadrupole mass spectrometers and ion trap mass spectrometers.

Depth Profiling (GD-OES) Depth Profiling

GD-OES depth profiling is a surface analysis technique that provides the information about the distribution and concentration of elements along the depth from surface in a solid or multi-layer material. Such information is often critical in understanding and controlling of the surface or substrate properties of the material or products.

Examples of GD-OES depth profiling analysis include the oxidation of the super-alloys, plating layer characterization on steels, characterization of multiple layers in semiconductor devices or materials.

Hardness/Micro-hardness Testing

Material hardness is a critical measurement for both durability and functionality. At Advanced MicroAnalytical we can provide you with answers regarding material hardness on a variety of materials and scale of materials. From bulk material techniques, like Knoop, Vickers, and Rockwell hardness to nanoscale indentation techniques with SEM imaging. We can assist in research and development and quality control on bulk metals, ceramics, polymers and composites on devices ranging from printed circuit boards and mems devices and more. Contact the lab to see how hardness measurement can impact your materials or failure analysis project.

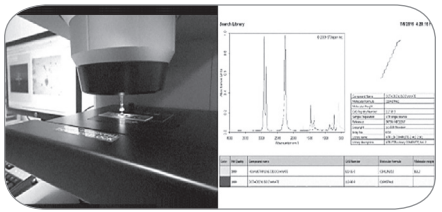
ICP-MS & ICP-OES

Inductively Coupled Plasma Mass Spectrometry (ICP-MS) – ICP-MS utilizes the same flame technique as described in ICP-OES whereby a prepared sample is aspirated continuously into an inductively coupled, argon plasma discharge and ionized at high temperature. Once converted into ions, they are brought into the mass spectrometer where they are focused by electrostatic lenses where they are separated by their mass-to-charge ratio which allows the ICP-MS to supply isotopic information of each element of interest. The quantitative concentration of an element is determined through calibration of the detector with known concentrations of standards on the basis of the separated ions respective mass-to-charge ratio as they are received by the detector with an ion signal that is proportional to the concentration.

Inductively Coupled Plasma Optical Emission Spectroscopy (ICP – OES) ICP-OES is also known as ICP-AES (atomic emission spectroscopy) is a flame technique used to determine trace elements in prepared samples. Argon gas flows through an ICP torch is ignited and ionized in an electromagnetic field where a high temperature plasma of approximately 7000 K is generated. An appropriately prepared sample is aspirated (i.e. nebulized) continuously into this inductively coupled, argon-plasma discharge where the excitation temperatures can reach approximately 7,000 K. The elements (atoms) of interest reach an excited state and will emit energy in the form of light upon their return to the ground state at wavelengths characteristic of each specific element. The intensity of light emission is measured at each specific wavelength and compared to previously measured intensities of known concentrations of the elements. The concentration of each element is computed by interpolation along the calibration lines established.

ICP-Analysis has low detection limits for chemical determination, making it a useful tool for quality control applications, contamination analysis and more.

Micro-FTIR



FTIR is a spectroscopy technique that is typically used to determine the functional structure of organic chemicals. Using this technique, samples are analyzed with a broad frequency spectrum of infra-red light. This beam spans the energies of most vibrations that occur in organic molecules. Structural information about the chemical bonds is derived from analyzing the patterns of wavelengths absorbed by the sample. When exposed to the infrared light spectrum a sample's molecules selectively absorb radiation of specific wavelengths that correspond to vibrational excitation modes specific to the sample's structure. Analysis of the spectrum created by these selective absorptions allows for a fingerprint of the materials present in a sample to be determined – allowing for a qualitative identification of different classes of materials, or with standards, a means for quantitative analysis of a single, known compound.

Identification and analysis can be done on a wide range of materials from solids and powders to liquids. Trace measurement of contaminants can be analyzed using special preparation techniques. Samples or contaminants as small as 5 microns can be analyzed through the use of an ATR crystal attached to a microscope. Spectral mapping can be used on larger areas to determine the distribution of compounds, consistency of composition, or to chart alterations to a material in layers or in a mixture. FTIR is a useful investigative analytical technique frequently employed on unknown samples or when it is critical to trace contamination or changes in sample composition.

Micro-Raman Spectroscopy

Raman spectroscopy offers a wide range of molecular and material structural information, and in combination with a high magnification optical microscope, offers a unique suite of analysis capabilities for Advanced MicroAnalytical's team of experienced scientists. Raman spectroscopy detects the very faint spectrum of light frequencies that are created when a high intensity source of light interacts with a sample. These low intensity spectral features are caused by the mobilization of electrons across bonds in the sample, consuming some of the primary input energy in creating polarization, and the emitting a lower energy photon. Because it is typically electron polarizability across molecular bonds that is measured, Raman is often used to provide similar molecular structural information to IR spectroscopy, though with differences based on light-sample interaction.

While Raman can often give similar information to FTIR analysis, the two are very complementary, with Raman showing some strong advantages. The use of optical frequencies both reduces the interaction volume with the sample compared to IR wavelengths, as well as decreases the line width in obtained spectral features. This allows for much smaller residues or features to be examined, as well as allows for fine shifts in peak energy to inform phenomena such as lattice strain or intermolecular bonding dynamics. Raman is also not strongly impacted by the presence of water, allowing for easier analysis of proteins, biological compounds or solutions. With the use of surface enhancement substrates, Raman can also be used to detect very small sample volumes, often achieving sensitivity down to the single digits of molecules. With the capability to determine not only molecular spectra of complex organic samples, but also investigate inorganic structural properties on a micro-scale, micro Raman spectroscopy tools give Advanced Microanalytical's breadth of analytical staff an additional tool to assist you with your challenging samples and problems. Call us so we can assist you with your needs.

Nuclear Magnetic Resonance (NMR)

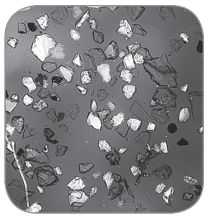
NMR can be used to identify the chemical composition and structure of various organic and inorganic molecules both in liquid and solid state. NMR experiments are specific to the magnetic properties of various atomic nuclei and their relation to other nuclei in a molecular environment. Reconstruction and interpretation of this information can be used to determine not only the identification of a compound but also the 2 & 3 dimensional structure as well. Some of the common nuclei examined include ^{1}H, ^{13}C, ^{29}Sl, ^{31}P, etc.

Common applications for NMR include:

- Chemical identification/verification
- Chemical synthesis analysis and support
- Quality control
- Research & Development
- Structural Characterization

Optical Microscopy

Optical microscopy analysis forms the basis of almost any sound forensic investigation. The ability to highlight specific materials or particles of interest quickly and with minimal preparation makes optical analysis a 'go to' first step for a host of different applications. In addition to the ease of use and wide range of sample types that can be analyzed, optical analysis is able to achieve a wide range of magnification, from 10x-1000x or more, providing an analyst with a readily available means of analyzing a large area quickly.

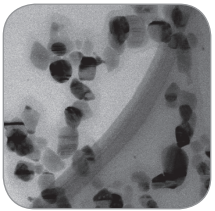


Among the most common applications for this analysis are comparison of physical dimension and manufacturing techniques, detection and identification of contaminant or incident particles, and examination of multiple phases in complex mixtures or manufactured materials. At Advanced MicroAnalytical we have an array of optical microscopy techniques on hand to help assist with your investigation.

Those techniques include:

- Polarized Light Microscopy
- Epi-Fluorescence
- Brightfield & Darkfield Imaging
- Digital Image Analysis
- Normarski /Differential Interference Contrast Microscopy

Particle Size Distribution Analysis (PSA/PSD)

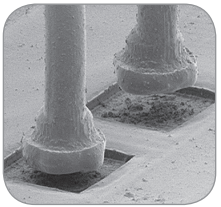


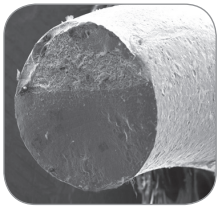
The size and properties of these materials are critical factors in determining how materials work together, what effect they may have on air quality and their appropriateness for use. For engineers seeking to create new materials, for quality control of size critical products for understanding how unknown dust can affect the heath and comfort of people in an enclosed environment Advanced MicroAnalytical offers the latest in particle size analysis and distribution form particles all the way from the nano scale and beyond.

At Advanced MicroAnalytical we can provide you with a complete package of image analysis solutions for feature and particle size measurement. We have analysis packages as simple as overall size distribution to volume and concentration measurements of multiple materials in different media and multiple methodologies.

Effective engineering and planning requires material knowledge and sizing. We have special instrumentation and expertise requisite for the analysis of materials all the way down to the nanoscale. We work directly with process engineers and research & development teams and IAQ and Environmental Engineers to provide size characterization solutions on a myriad of sample types and matrixes, whether it is bulk particulate, mixed unknown materials, or embedded and composite materials. Advanced MicroAnalytical puts the power of advanced microanalysis to work for you.

Physical/Mechanical Testing Services





Advanced MicroAnalytical offers a broad range of mechanical testing services through EMSL Analytical's material science division in NJ. Testing capabilities include compression, tensile, torsion, fatigue, low and high temperature testing, creep and stress rupture, Charpy and Izod impact, abrasion, Rockwell hardness and micro-indentation hardness, etc.

Advanced MicroAnalytical has equipment ranging from the like of very small load capacity of SEM in-situ tensile/compression stage or wire bond pull testers, to the high load capacity universal testing machine that can apply a quarter million lbf on a sample. Collectively, staff members in the Materials Science Division possess extensive experience in the mechanical testing of metals, ceramics, polymers, electronics packaging, composites, and construction materials.

Scanning Electron Microscopy (SEM)

Scanning electron microscopy is one of the most versatile and often used instrumentation techniques in modern materials science, microanalysis, and investigative applications. SEM analysis provides detailed, high resolution imaging capabilities at a very wide range of magnifications from 10x to 1Mx magnification on a diverse and large group of sample types. This flexibility, as well as the dynamic, high depth of field images obtained with this analysis makes it a go-to method to gain structural insight on wide range of sample types.

By generating an electron beam, and the focusing, directing, rastering the beam across the surface of the sample, electrons are either displaced or scattered from the material in the sample in a very limited area. Collecting these electrons allows for an image of the sample to be captured, showing the surface of the sample at a magnification controlled by the size of the scanned area. Because electrons are being used, the microscope can easily image features and materials that are smaller than the physical resolution limit of light, making the use of this tool for high magnification examination a natural fit. Additionally, by examining the geometry and energy of scattering and varying the accelerating voltage of the scanning beam, information about the material properties of the imaged sample can be obtained. The small spot size, precise control, and unique material interactions allow for an SEM to be combined with a full spectrum of incorporated specialized detectors, that do everything from chemical analysis, provide crystallographic data, or measure structural or optical properties of the selected sample.

While SEM is a standard staple of many physical sciences including metallurgy, ceramics, polymer science, and petrography, the experienced scientific staff at Advanced MicroAnalytical can utilize this impressive analytical capability across many disciplines. We frequently use SEM to support R&D or engineering failure analysis, use it for high specificity and customized environmental or IAQ analysis on your samples, perform forensic or comparative testing, or design custom materials analysis testing protocols for specific industries.

Surface Profiling

Advanced MicroAnalytical offers a broad range of mechanical testing services through EMSL Analytical's material science division in NJ. Testing capabilities include compression, tensile, torsion, fatigue, low and high temperature testing, creep and stress rupture, Charpy and Izod impact, abrasion, Rockwell hardness and micro-indentation hardness, etc.

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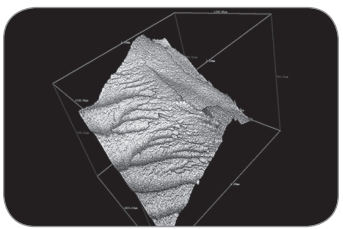
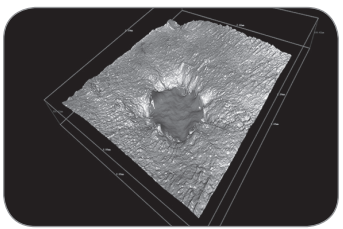
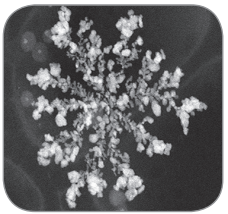




Transmission Electron Microscopy Services (TEM)

Electron microscopy analysis — which includes transmission electron microscopy (TEM) with energy-dispersive X-ray analysis (EDX) and scanning electron microscopy (SEM) with EDX — can provide direct observation of microstructural features on a surface, at an interface and inside a bulk material. At Advanced MicroAnalytical, our instrumentation includes TEM's, SEM's, precision ion polisher, and cryo-ultramicrotome. This coupled with staff expertise in electron microscopy enable us to provide quick turnaround service.



TEM can be an appropriate choice for crystalline defect analysis. Knowledge of crystalline defects is important in predicting behavior and finding failure mechanisms for metallic and electronic materials. Defects such as voids, stacking faults, dislocations and loops can be revealed and analyzed using weak beam dark field imaging, trace analysis and other techniques.

TEM analysis can also be used in applications such as nanoparticle size distribution, phase transitions, strengthening mechanisms in metallic and ceramic materials, structure of polymers, identification of precipitates and dispersive particles, phase orientation relationships and thin film analysis.

An even wider range of applications utilizes SEM, partly because of the ease and less destructive nature of sample preparation. A few examples of SEM/EDX services include the identification of particles, fracture surface analysis, analysis of coatings, patterning and defect characterization of microelectronic devices and elemental distribution analysis.

X-ray Photoelectron Spectroscopy (XPS)

X-ray Photoelectron Spectroscopy is a valuable tool for surface science and chemical analysis of a wide variety of materials. XPS allows for a wide variety of elements to not only be identified and quantified, but for chemical state information regarding these elements in the sample to be determined. XPS bombards a vacuum stable sample with a concentrated beam of x-rays, allowing the interaction of the x-ray beam and the sample to liberate electrons from the sample. By correlating the energy of liberated electrons with known binding energies, the spectrum of electron energies gives quantitative and oxidation state information about the elements on the sample surface.

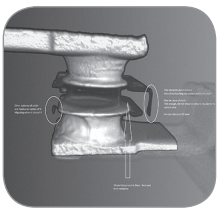
Because of the detailed oxidation state information XPS allows for very detailed information about the relative chemical environment in a sample. Because the electrons liberated from the sample need to migrate to the detector, this chemical information is only obtained from a very small volume of material at the surface of a sample. This allows for analysis that is very surface specific, leading to nm scale interaction with the surface, with a thin film sample orientation profile of 2nm easily achievable. Due to the extreme surface sensitivity, small amounts of contaminants can often interfere with the desired material, and so the instrument is equipped with an ion sputter gun for surface cleaning. With the proper alignment, samples can also be successively sputtered to perform analysis at varying depth, creating a depth resolved profile of composition. Analysis of depth profile, surface film analysis, work-function measurements, and surface mapping by composition are all possible with this technique.

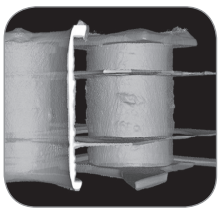
XPS is a preferred technique for thin film electronics. Examination of thin contaminants or surface poisoning is possible using the extreme sensitivity of the instrument, allowing for fine auto-oxidation layers or staining to be identified. Semi-conductors, organo-metallic polymers, composite materials, and all manner of metals and ceramic materials can be examined using XPS to both guide process and materials research, as well as determine root cause of material contamination or disruption.

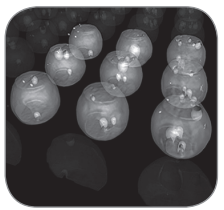
X-Ray Imaging/3D X-Ray CT

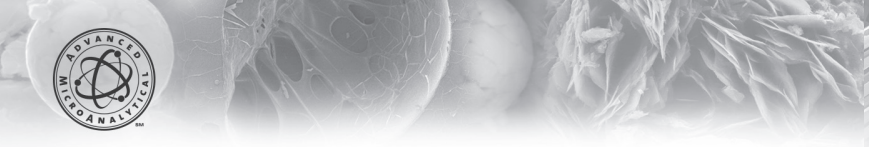
X-ray imaging is a well-known method for examining internal structural composition nondestructively. Everyone had had a medical X-Ray at some point in their life. The ability of x-rays to penetrate most materials, only being absorbed by relatively dense materials allows for the inside of a material to be examined without destroying or damaging the sample. While familiar to most in a medical setting, higher power x-rays are often used as an inspection tool to document internal structures and measure parts in a wide variety of industries. With the substantial range of magnifications possible with a modern industrial X-ray system, fine sub-millimeter wires in electronic devices as well as entire rotor blade assemblies or motors can be examined.

X-ray CT (Computed Tomography) is a more advanced technique that combines examination of a series of x-ray images projected through a single sample at varying angles to create a complete view of the sample. These images are then computationally back-projected to model a three dimensional representation of the original sample. This allows for all of the varying materials to be modeled and examined after the sample is scanned. With a high resolution micro-CT scanner and advanced software modeling features that are even less than five microns in size can be reliably examined and rendered.









X-ray Diffraction (XRD)

X-ray Diffraction (XRD) is a technique that is widely used in identification and characterization of crystalline materials. Crystalline material, due to the long-range order of the atoms or molecules in their structure, will generate unique diffraction patterns when irradiated with X-ray. Such pattern can be used for identifying the material/phases, or providing various information about the crystalline structure, defects, or purity of the material.

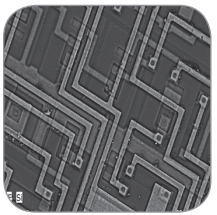
Examples of XRD application include identification of minerals (such as crystalline silica) or metals, and determining the concentrations of various crystalline components/phases through calibration or pattern fitting approaches.

X-Ray Fluorescence (XRF)

X-ray Fluorescence Spectrometry (XRF) provides elemental compositional analysis of bulk samples using a non-destructive elemental analysis technique. It can be used to analyze the elemental composition of liquids, solids and loose powders. XRF provides a combination of high accuracy, precision and brisk sample preparation that make it a preferred elemental analytical technique. The high range of sensitivity and typically non or minimally destructive analysis make XRF a highly useful tool for a wide variety of applications. Elements ranging in atomic number from Beryllium (Be) to Uranium (U) in the concentration range from 100 % down to the sub-parts per million (ppm)-level. With WD XRF (wavelength dispersive), available at Advanced MicroAnalytical there is greater resolution and less overlap between spectral bands crucial for elemental identification in complex samples.

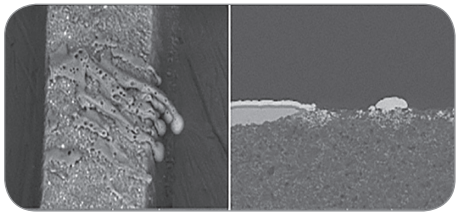
Whether you are simply analyzing bulk properties of a single sample or need to track changes in composition for quality control or research and development, XRF can provide precise elemental data for materials. This analysis finds broad use within most manufacturing industries, ranging from aerospace & defense to geology, ceramics and pigments, and even pharmaceutical applications. Advanced MicroAnalytical can provide you with expert advice and analysis for your XRF needs and projects.

Aerospace & Defense Analytical Testing Services



Engineering in the complex aerospace and defense industries calls for exacting analysis and careful consideration. Aerospace and military systems cover a wide range of electronic, mechanical, and advanced materials engineering, requiring any effective testing to cover multiple disciplines and testing methods including MIL-STD testing. Proper testing protocols need to be employed in pro-actively testing components and devices in these regimes. Not only do these devices need to handle long lifespans of service with complete reliability, but these devices are exposed to extreme conditions of temperature, pressure, and wear. Advanced MicroAnalytical is confident in our ability to handle multiple phases of analysis for reliability as well as research and development in these regulated industries. Our laboratory is primed to assist your company from simple single component investigations through heavily regulated reliability and QC monitoring programs with multiple overlapping specifications. Advanced MicroAnalytical familiarity with the standards and protocols for the aerospace, defense and aviation industries will help you navigate through the host of specifications for your engineering requirements.

Ceramics



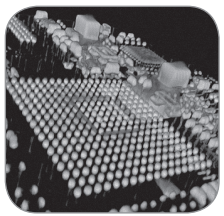
The field of ceramic engineering creates a vast number of different specialty materials, with applications designed to leverage the temperature resistance, high hardness or rigidity, porosity, or chemical properties of these materials. Inherently, the fusion of smaller, simple crystalline elements into a bulk material, the microstructure and crystalline properties of ceramics is critical. Microanalysis, chemical testing of ancestor materials, examination of crystalline orientation are all supported with Advanced MicroAnalytical's laboratory network. Our materials laboratory can assist with all your mechanical, chemical and structural needs, and remain invested in developing new capabilities to address unique challenges in piezo-electrics, catalyst supports, and additive laser sintering processes.

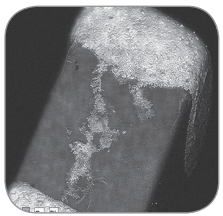
Construction & Engineering Testing Laboratory

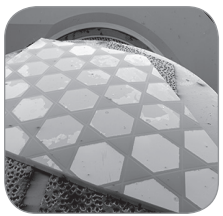
With modern construction practices, especially in government or industrial building design there can be complex and overlapping constraints and specifications on everything from masonry and structural cement materials to paint and coating thicknesses. Even after monitoring these factors during construction, ongoing physical plant concerns can often require directed analysis, to examine HVAC, building maintenance, or water system issues. In the unfortunate event of a failure, damage, or fire, these same structures need to be examined for fitness and causation. Advanced MicroAnalytical has the capacity to examine materials from varied construction through initial installation to final disposition to support engineering assessments of structure and base materials pursuant to our clients' needs.

Electronics & Semiconductor Testing Laboratory

Advanced MicroAnalytical provides manufacturing support and product development assistance for the electronics and semiconductor industry. With the increasing complexity, shrinking node sizes, and proliferation of widely separated micro-electronics assembly partners – products can be more difficult to design, manufacture, and troubleshoot. Advanced MicroAnalytical is your resource for product development support with tools like FIB FESEM and nondestructive testing techniques like, X-Ray, 3D X-Ray CT, and C-SAM. Advanced MicroAnalytical is positioned to assist with your project from all phases of the electronics industry pipeline – from fab-less design engineering groups through photo or e-beam lithography process troubleshooting or board level component assembly and mass manufacturing.







Environmental Analysis

Evaluating the quality of the air, water and soil around buildings and industry can be a complex endeavor. While environmental regulations have established many best practices in the field of environmental compliance, regulations often don't fully reflect the concerns that can be created when construction and or industry begins to intrude on their surrounding environments. While there are a number of well-developed protocols and regulations, many of which either dictate or infer the testing and monitoring protocols necessary, there can be numerous cases where standardized test methodologies do not address concerns on the edge of established practices – or as is increasingly the case, a new industry or operation not well considered by existing regulations has raised cause for potential concern.

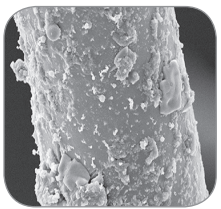
AMA has years of experience assisting both environmental engineering professionals and members of the community in determining the proper methodology to monitor evolving changes. With our ability to combine analytical services from traditional environmental chemistry disciplines, industrial hygiene, and advanced material science analysis, we can often tailor an analytical plan to meet your specific needs. Common applications can include examination of bulk PM 10 or 2.5 filters for specific types of materials that might be generated from an industrial source, examination of residues from a stack filter or scrubber at a powerplant, or examination of micro-particles in a water bed that might be selectively capturing compounds of interest. Our analytical techniques can include inorganic chemical analysis through ICP, AA and XRF, mineral identification and speciation, organic compound analysis through either spectroscopic or chromatography methods, and precision micro-analysis.

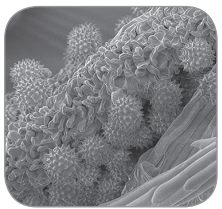
When new industries develop, especially in areas where there are undeveloped areas, or perhaps residential areas, there are often concerns about how that industry can impact the surrounding environment. In creating proactive testing and monitoring plans, officials in charge of potential source sites can fully grasp the impact they might have on the surrounding environment, and take the appropriate steps to minimize or eliminate that impact.

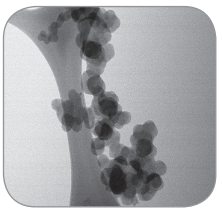
Indoor Air Quality Analysis (IAQ)

EMSL Analytical has over thirty years of experience in supporting the analysis of air and dust samples in traditional IAQ testing regimes, and is a nationally recognized leader in asbestos and mold testing applications. AMA also supports their clients with industry leading customized analysis services to assist with clients' needs that run outside of standard IAQ concerns.

Within the tightly sealed confines of today's modern housing and building construction indoor air environments can represent significant problems for residents. There are many potential sources of irritants and significant health risks out there, so it can be hard to pinpoint where the problems may lie with standard techniques designed to identify a single or single type of components. We take the time to listen to clients concerns and help answer the IAQ/IH questions with a considered investigative approach that allows us to address multiple types of components and sources and serve the client's needs with comprehensive analysis. The Particulate Micro Analysis (PMA) service utilizes this investigative approach to providing a comprehensive analysis of dust in the indoor environment.







Industrial Hygiene

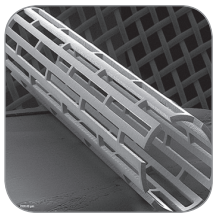
Evaluating the potential hazards of environmental exposure to workers across a multitude of industries and manufacturing specialties creates some unique challenges when one considers the breadth of different processes and byproducts from those processes that need to be monitored. The materials, environmental concerns, and engineering controls associated with a metal smelting facility are vastly different from those associated with a semi-conductor fabrication plant or pharmaceuticals facility.

Advanced MicroAnalytical's diverse group of experts can work with you at all phases of an IH investigation, from initial complaint onsite through sampling media and process support, all the way through the analysis and interpretation of the results. Our team can work with you to construct an analysis path that allows for the IH professional to have peace of mind that they are gaining the insight they need. Where specific targets are unknown, we can cast a wide net with our customized microanalysis services, using comprehensive techniques to help determine the best means for Advanced MicroAnalytical to assist you in your

Manufacturing Support

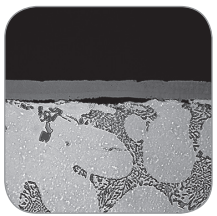
Once a product is researched, designed, and tested thoroughly for manufacture, many companies would like to believe that the hard work is done. However, manufacturing any product at scale can present new challenges that can be harder to handle than the initial design phase. Ensuring ongoing quality control, tracking down failures, or optimizing new processes or suppliers can be difficult propositions when faced with the pressures of ongoing manufacturing. EMSL has the experience and breadth of analysis capability to support a wide range of product manufacturing concerns. With our focus on customized microanalysis, we can detect changes, defects or inclusions in a manufactured part, and our chemical and bulk materials experience allows us to assist in determining the effect of process or supply side alterations.

Medical Devices Testing Services



Characterization and Analysis of medical devices and materials encompasses a diverse range of disciplines. Materials and devices must to be able to withstand the rigors of use and compatibility with other materials and environments and maintain the efficacy of those products. Medical devices and materials must be free of contaminants and analysis and sourcing of those contaminants is critical. AMA supports the industry with services ranging from Product Development & Research to Failure Analysis and Industrial Forensics, quality control and compatibility testing to contaminant identification across the sphere of materials that encompasses medical devices such as: Ceramics & Composites, Electronic Devices & Semiconductors, Metals & Alloys, Stent, Catheter, & Delivery Devices, Synthetic Biomaterials, Polymers & Coatings, Additive Manufacturing, Antimicrobial Surfaces & Coatings.

Metallurgical Testing Laboratory

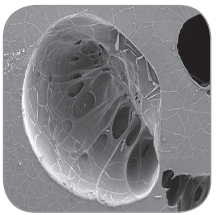


Metallic alloys offer some of the widest varieties of composition and physical properties to modern engineers. AMA has a many techniques available to support both traditional metallurgy and the needs for modern, biomedical, aerospace, or microelectronic metallurgical applications. Advanced MicroAnalytical possesses testing to verify or explore the properties of manufactured parts in mechanical testing and magnetic testing regimes, but also performs alloy verification, grain sizing, and surface and plating analysis. Advanced MicroAnalytical can assist you with projects from simple tensile testing through real time monitoring of plastic deformation with 3D EBSD.

Paint, Printing & Coatings Testing Lab

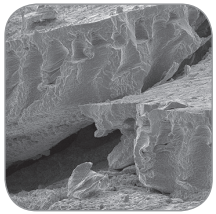
Treatment of surfaces can serve a number of different purposes, from cosmetic coloration, protecting the substrate from chemical or abrasive damage, or modifying the surface properties of the material to increase or remove friction or tack. Advanced MicroAnalytical offers services to test the bulk thermal and mechanical properties of coatings, (pre or post application). We provide micro-analytical examination of composition and construction of pigments, fillers, additives, and binders. Aging, outgassing, and wear studies can also be designed to answer questions about the long-term viability of coatings. Our specialty micro-analysis services can be tailored to answer whatever questions you may have about a wide variety of coating and paint materials.

Polymers Testing

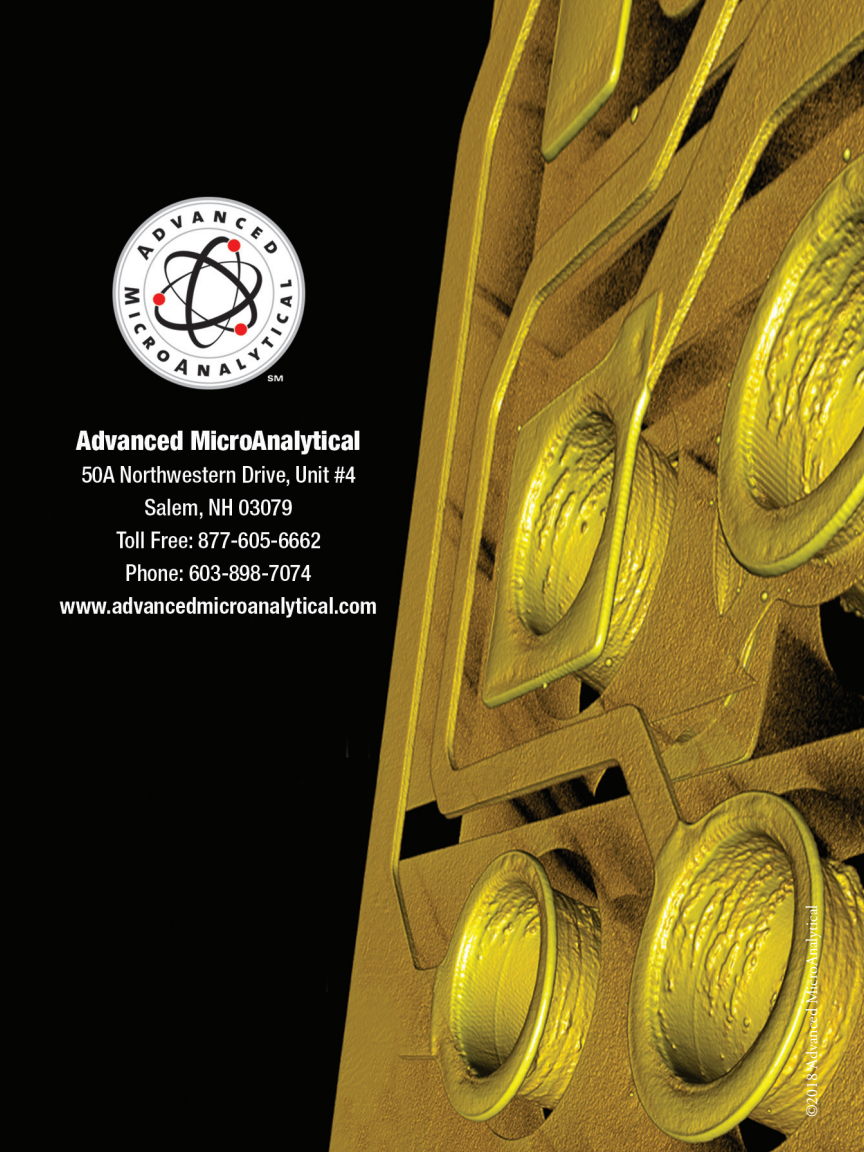


Engineering of materials using polymers requires knowledge of both the chemical properties and design of the materials used in the polymer system, as well as the physical properties of the manufactured product. Especially with modern engineered polymers, there can also be several other factors that require special attention including surface finish, coatings, and the presence of a number of different additives, both organic and inorganic. Advanced MicroAnalytical has the capacity to assist in polymer engineering challenges, from macroscale physical properties of bulk or large format polymer devices, through examination of dispersal and crystalline structure of the finest nano-particulate fillers or additives.

Water Filtration & Membrane Technologies Testing



Water treatment membranes and filter technologies comprise a very wide product space. From water reclamation from municipal water treatment or industrial process sources, to desalination, brackish water supply cleaning, or greywater treatment - water filtration can offer unique challenges. Advanced MicroAnalytical is versed in the challenges that hydro-engineers and chemists face in deploying these systems. From microanalysis of reverse osmosis fouling using the latest elemental imaging technology to complete analysis of influent and effluent water chemistry, our capability is your asset in handling complex problems in the industry. With over twenty years of analysis expertise in water engineering solutions, we can assist you in troubleshooting systems - from individual pilot studies to handling facilities with 10M+ gallon capacities.



Advanced MicroAnalytical
50A Northwestern Drive, Unit #4
Salem, NH 03079
Toll Free: 877-605-6662
Phone: 603-898-7074
www.advancedmicroanalytical.com