



NHML Mechanical Capabilities

Mechanical Testing

Mechanical testing is essential to all industries but especially manufacturers. This testing is the best way to ensure that your materials are performing to standard expectations, but more importantly your customers' expectations. Mechanical testing helps reveal the true mechanical properties of the material or assembly that is in question. Whether it is a compression test on a plastic housing, an adhesion test of a laminate assembly or a hardness test on gun parts, these tests are real usable data. This is the first step that many companies take in putting together a crucial design into practice or mass production. NHML tests are performed to ASTM standards or to our customers' specific procedures.

Applications:

- Failure Analysis
- QA Certification
- Verification of Certificates
- Weld Process/procedure qualification
- New product testing
- And so much more!

Types of Mechanical Testing and Analysis:

- Tensile Testing (Tension: yield strength, ultimate tensile strength, elongation, reduction in area)
- Torque testing
- Compression Testing
- Shear Strength
- Bend Test
- Load Testing
- Peel/Tear Strength Determination
- Flexural Strength & Modulus
- Insertion/Withdraw Force
- Hardness and Microhardness

Reverse Engineering

Reverse Engineering is commonly used to discover the technological principles of a variety of materials, devices and systems. This often requires disassembly of components and analyzing them and their functions in detail. The following questions can be answered through this particular type of testing:

What is the material, device or system made from?

We are able to identify the base material of products that are made from polymers, metals and alloys. If the product is a polymer, we would use the FTIR process, however, if the product is made out of metal or alloy, we would identify the material either by ICP spectroscopy or GDS.

How was it made?

We are able to analyze the hardness and microstructure of parts and materials. These 2 tests are useful in the determination of heat treatment an alloy may have received. Microscopic exams can also be used to determine if the part is a casting, forging and extrusion, or a machined product. As a supplement to the expected mechanical properties deduced from hardness and microstructure, it is sometimes possible to fabricate a tensile specimen from a finished part. Tensile testing a product/material can measure the UTS, max elongation and reduction in area. From these, one can determine Young's modulus, yield strength, strain hardening, tensile strength and ductility.

What supplemental treatments or coatings are present?

The surface of the part/material being analyzed would be examined by either EDS or FTIR spectroscopy to identify any coatings such as paints or plating. Metallographic cross sections can also be prepared to measure the thickness of any coatings that were detected. These cross sections can also reveal the presence of primer layers on painted parts along with multiple layers on plated parts.

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NHML Mechanical Capabilities

Metallography

NHML is able to characterize the microstructure of metals and alloys by metallography. Metallography in the most basic sense consists of the selection and preparation (sectioning, mounting, grinding, polishing, and etching) of specimens for microscopic examination. In some cases, metallographic techniques may also be applied to ceramic and polymer specimens. The appearance of the “microstructure” is a key to failure analysis. It is also used to better understand the material and its mechanical behavior. At NHML, laboratory techniques such as microscopy and spectroscopy are combined with a thorough knowledge of thermodynamics, engineering metallurgy, polymer chemistry and applied mechanics to understand and explain the behavior of materials.

A wide variety of material is available regarding the preparation of specimens for microscopic examination from a number of sources including the following :

- ASTM E3 - Preparation of Metallographic Specimens
- ASTM E7 - Standard Terminology Related to Metallography
- ASTM E112 - Grain Size Determination
- ASTM E340 - Microetching Metals and Alloys
- ASTM E45 - Determining Inclusion Content of Steels
- ASTM - E1268 Assessing the Degree of Banding or Orientation of Microstructures
- ASTM E407 - Microetching Metals and Alloys

Equipment used:

Most samples are sectioned using a band saw, diamond saw, or a water cooled abrasive saw.

Samples are mounted in epoxy and wet ground on successively finer grades of abrasive using manual or automatic laps.

Metallography Applications:

- Grain size determinations
- Microstructural classifications
- Inclusion content and rating
- Plating, coating or oxide thickness measurements
- Depth of surface imperfections or corrosion
- Case depth of a hardened layer
- Extent of decarburization of steels
- Examination of grain boundary precipitates
- Examination of the extent of cold working of the sample



NHML Mechanical/Chemical Capabilities

Failure Analysis

The purpose of a failure analysis is to determine the primary cause of a failure by the process of collecting and analyzing data. This service is to help enhance the quality of our client's products and like reverse engineering; failure analysis testing involves multiple analysis methods. It is the chemical and mechanical investigation into the primary cause that led to the failure of the product. We then provide the client with an insight to the solution of their problem. NHML can help provide the necessary information in order for our clients to improve their products' quality and compliance standards.

Here is a list of the techniques that are used at NHML when conducting failure analysis:

- Scanning Electron Microscopy (SEM)
- Energy Dispersive Spectroscopy (EDS)
- Differential Scanning Calorimeter (DSC)
- Mechanical Testing
- Metallography and Microscopy

***If at any point during the testing process you have questions or want updates, the NHML technicians and chemists performing the tests are the ones that you talk to.

Chemical Analysis

NHML offers a wide range of chemical analytical services, both qualitative and quantitative, for a variety of industries. These chemical analysis services include, but are not limited to, the following:

- Identification of plastics, ceramics, metals and alloys
- Identification of contaminants
- Qualification of carbon/sulfur content in metals
- Certification of material compositions
- Identifying the type of filler, plasticizer
- Melting point of materials
- pH and chloride testing
- Corrosion analysis
- Paint matching for automobile accidents
- And so much more!

NHML chemists and technicians are able to work with our clients during the testing process. We consider ourselves "Problem Solving Partners", as we understand that each and every sample is unique along with our client's requests. NHML works hard to troubleshoot and find a solution or provide insight to each individual problem. Whether it is an identification of an unknown substance or a simple ASTM certification, NHML is here to help.