

ACCELLENT METALLURGICAL LABORATORY CAPABILITIES

Collegeville PA & Salem VA

The Metallurgical Laboratories at the Accellent facilities in Collegeville, PA and Salem, VA are fully equipped laboratories set up for materials testing and evaluation. The lab's capabilities cover a wide range of functions including mechanical testing, metallographic evaluation, corrosion testing, failure analysis and scanning electron microscopy (SEM) and energy dispersive x-ray spectroscopy (EDS). In addition, other tests not performed directly by the laboratories, such as non-destructive testing, salt spray corrosion testing, and elevated temperature tensile testing can be supplied as needed.

MECHANICAL TESTING

Tensile Testing (Room Temperature) – ASTM A 370, ASTM E 8

- Ultimate tensile strength
- 0.2% and 0.5% offset yield strength
- Elongation @ 2", 1", 0.5", 0.25" and 4D gage lengths
- Cyclic tensile testing (hysteresis losses)

Hardness Testing

- Macrohardness testing (Rockwell) - both standard (Ra, Rb, Rc, etc.) and superficial (15T, 30T, 30N, etc.)
- Microhardness testing (DPH, Vickers)
- Hardness profiles
- Case depth determination

Tube Flare Testing

- Expansion over a 60° anvil
- Expansion over a 74° anvil

Tube Flattening Testing

- To any required "T" value

Nitinol Testing - Mechanical

- Tensile testing for UTS, upper plateau stress and Elongation. All strains are measured utilizing an extensometer at room or elevated temperature
- Cyclic testing for determination of permanent set and lower plateau stress

Nitinol Testing – Thermal

- Bend and free recovery testing for active transformations
- Differential Scanning Calorimetry for ingot transformations

Fatigue Testing

- Rotary beam fatigue testing for wires and cables
- "Bell-mouth" bend fatigue testing for wires, cables, and coils

Device Testing

Alternating bend fatigue testing
Pull strength (the load required to separate two or more components)
Break load (the load required to break an assembly)

NON-DESTRUCTIVE TESTING

Hydrostatic Pressure Testing

Up to 10,000 psi applied pressure
Burst testing (pressurized to failure) can also be performed on the lower strength materials such as copper and aluminum

Pneumatic Pressure Testing

Up to 1,000 psi applied pressure
Air under water
Nitrogen under water

Surface Finish

Quantitative RMS, Ra, or Rq measurements via a non-contact laser surface profilometer

Eddy Current Testing

Capability to detect defects down to 0.002"

METALLOGRAPHIC EVALUATION

Microstructural examination and evaluation
Grain size measurement (ASTM E 112)
Weld bead evaluation
Characterization of internal and surface contamination
Qualitative surface roughness determination
Tubing wall thickness measurements
Evaluation and measurement of surface and internal defects and discontinuities
Micro cleanliness determination and inclusion rating (ASTM E 45)
Alpha-case determination
Corrosion/oxidation evaluation
Examination for intergranular attack
Determination of susceptibility to stress corrosion and general or pitting corrosion
Preparation of potted Samples for examination of internal characteristics (e.g., electrical connectors, small machined or formed parts, small diameter tubing, etc.)

IMAGE ANALYSIS

Measurements for length, diameter, area, longest dimension, perimeter and percent of area
Measurement of plating or composite layer thickness
Measurement of defect length or depth

Grain size measurement
Determination of weld bead width and thickness

SCANNING ELECTRON MICROSCOPY (SEM) – LEO EVO 40 & ASPEX PSEM

Micro examination of features of interest at up to 200,000X magnification
Comparison of surface finishes and topographies
Fractography – Examination of fracture surfaces
Elemental differentiation through the use of backscatter emissions

ENERGY DISPERSIVE SPECTROSCOPY (EDS) – EDAX GENESIS & SIRIUS 10/2.8

Elemental bulk qualitative and quantitative chemical analysis
Electron probe microanalysis
Line scans
X-Ray mapping
Particle analysis
Microvoid size determination
Identification of foreign materials or corrosion products and possible sources

CORROSION TESTING

ASTM G 36 (stress corrosion cracking)
ASTM A 262, Practice “A” (susceptibility to corrosion)
ASTM A 967, Practices “A” and “D” (confirmation of passivation)
ASTM F 1089, Procedures 6.1 and 6.2 (resistance to corrosion)
AMS-STD-753, Test Methods 100, 102, and 103 (confirmation of passivation)
Immersion Testing (corrosion susceptibility in a specific environment)

ANALYSIS OF PRODUCT FAILURES AND CUSTOMER COMPLAINTS

Visual examination
Preparation of photographic record of failure/defect
Optical and electron optical microscopic evaluation
Metallurgical examination
Preparation of detailed reports including source of problem or cause of failure and, when applicable, provide corrective action.

CONSULTATION

Consult with raw material vendors to work out any technical issues regarding Accellent requirements and the product available from the vendor.
Consult with customers over any issues or concerns of a metallurgical nature regarding Accellent products. When appropriate, provide any additional technical support to the customer that they might require.
Provide consultation of a metallurgical/technical nature to the various companies and departments within the Accellent organization. This could include process or material development, cleaning issues, and fabrication procedures.

OUTSIDE SUPPORT

In addition to the capabilities described above the Collegeville Metallurgical Laboratory works closely with at least six other independent laboratories. These labs perform the

additional testing required to be able to provide complete analytical services both to the Accellent facilities and Accellent customers. Some of these procedures include:

- Complete or Interstitial Chemical analysis

- Elevated temperature tensile testing

- Stress-rupture testing

- Extended exposure elevated temperature corrosion testing (e.g., ASTM A 262, Practice E and Practice C)

- Potentiodynamic corrosion testing

- Non-destructive testing/evaluation (fluorescent penetrant and ultrasonic testing)

- Auger electron spectroscopy (AES)

- X-ray photon spectroscopy (XPS) for evaluation of cleanliness and surface layers