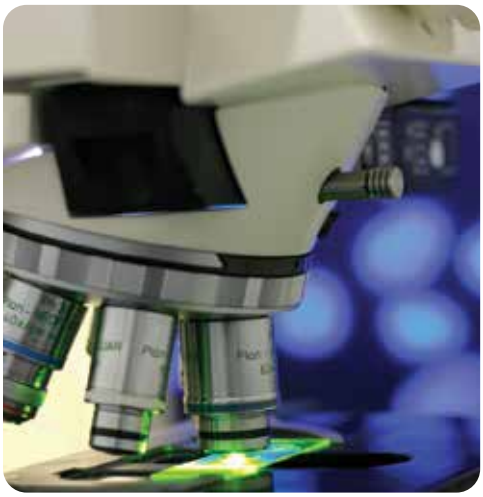
Structural Integrity Associates, Inc.®

METALLURGY LABORATORY SERVICES
& FAILURE ANALYSES



Structural Integrity is an industry leader in materials testing, condition assessment, and failure analysis. The metallurgical experts in our Materials Science Center, a state-of-the-art laboratory, in Austin, Texas, tackle the toughest industry problems related to material performance. Our services include characterizing the condition of existing materials, identifying damage mechanisms such as thermal degradation, creep, oxidation, corrosion, and fatigue, evaluating the root cause of failures, and reporting useful information for the ongoing use of components and materials remaining in operation.

SERVICES

FAILURE ANALYSIS

When a tube, pipe, turbine blade, or other important component fails, identifying the damage mechanism and cause of the failure is critical for developing remedial actions and preventing recurring failures. Our experienced metallurgists apply a variety of testing methods and their years of experience to reach accurate and useful conclusions.

LABORATORY TESTING CAPABILITIES

- Optical Metallography,
- Stereo and Digital Microscopy,
- Microstructural Analyses,
- Scale and Deposit Composition Analyses,
- Metal Chemical Analysis and Alloy Verification,
- Cryo-Cracking,
- In-place Metallography and Replication,
- Scanning Electron Microscopy,
- Energy Dispersive Spectroscopy,
- Fractography,
- Boiler Tube Deposit Loading,
- Weld/Weld Damage,
- Hardness Testing (Bulk, Microhardness),
- Material Property Testing

MICROSTRUCTURAL ANALYSIS

The condition of a component's microstructure can reveal information about fabrication and heat treatment, deterioration from damage mechanisms such as thermal aging, creep and embrittlement, or changes related to short-term failure events. Microstructural evaluation is completed by our experts using a metallographic microscope or performed using digital or scanning electron microscopes.

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FRACTOGRAPHY

Examination of fracture surfaces can help establish the cause of a fracture by providing information about the crack origin, the mode of propagation and age. Fractography is performed by visual examination, optical examination (stereomicroscope) and high magnifications using digital or scanning electron microscopes.

SCALE AND DEPOSIT ANALYSIS

Scale and deposit buildup reduces efficiency by acting as a barrier to heat transfer, promoting corrosion by allowing corrosive species to concentrate, or resulting from a corrosive attack. Our Lab uses energy dispersive X-ray spectroscopy in conjunction with scanning electron microscope examination to identify the elements present in bulk deposits or in situ (within pits and cracks).

CHEMICAL COMPOSITION ANALYSIS

We use quantitative chemical analysis to ensure component alloys meet the intended material specifications. For some alloys, like creep strength enhanced steels, trace elements creating a metallurgical risk factor or contributing to failure can also be identified.

HARDNESS TESTING

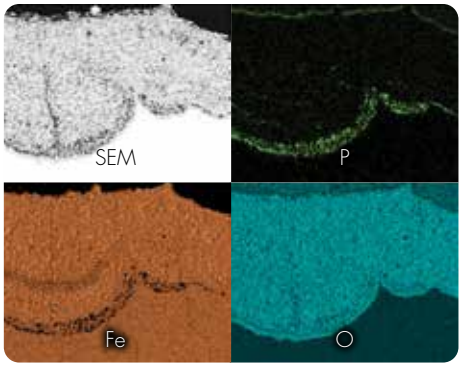
Obtaining hardness data is useful in assessing material condition, including evaluation of softening or microstructural transformation from overheating. Hardness values are also used to estimate tensile strength for most ferrous materials.

CRYO-CRACKING

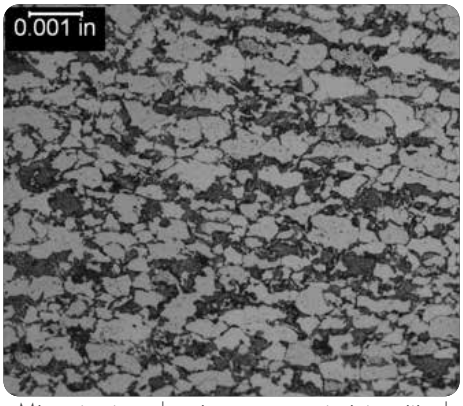
Cryo-cracking is a technique combing microstructural analysis and fractography evaluating the presence of incipient creep damage or other unique forms of damage. We employ this technique most commonly on plug samples from long-seam welds in high energy piping to verify NDE findings and help determine the remaining useful life.

IN-PLACE METALLOGRAPHY

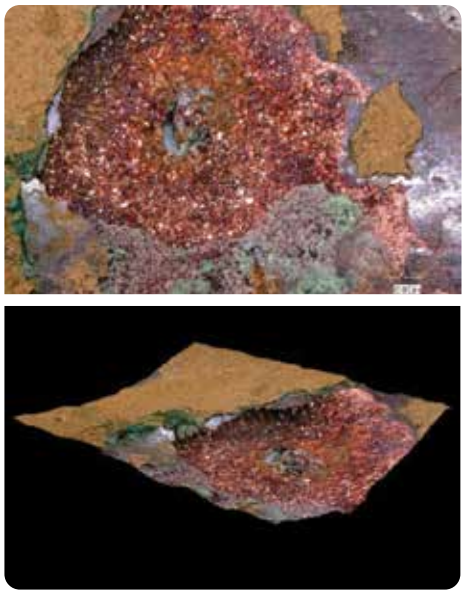
When examining large components that cannot be easily moved or when destructive sample preparation is difficult/not permissible, we use in-place metallography and replication for best results on a microstructural analysis.



SEM/EDS elemental mapping of deposits within a pitted/gouged area in a waterwall tube. Phosphorus is concentrated beneath the deposits



Microstructure showing exposure to intercritical temperatures, consisting of transformed pearlite in a ferrite matrix with a few grain boundary voids scattered throughout.



Two- and three-dimensional images of a copper heat exchanger tube that has been damaged from under-deposit corrosion (UDC).
The bottom image shows a region of damage surrounding a pinhole leak. The 3D image provides an idea of the depth of internal corrosion in the tube.