



MATERIALS DIAGNOSTIC FACILITY

Purpose:

To provide diagnostic and failure analysis of aerospace materials.

The MSFC Materials Diagnostic Facility is responsible for analysis of aerospace structural materials through diagnostic and failure analysis methods. Failure analysis requires an understanding of applied stress, internal material behavior, and environmental influences, as well as familiarity with strengthening mechanisms, microstructures, and material design consideration of materials characterization. This facility is one of the few locations in the world where such extensive capabilities are collected in one area. These complement each other and consist of the following disciplines:

ELECTRON OPTICS -- A variety of scanning and transmission electron microscopy equipment is used for high-magnification and high-resolution imaging of metallic and nonmetallic materials. The electron microscopes provide digital images at magnifications ranging from about 5x to as high as 1,000,000x. Bulk chemical analysis, from boron and higher in the periodic table, is conducted using energy dispersive X-ray analysis and wavelength dispersive X-ray analysis equipment. Equipment includes:

- Field Emission Scanning Electron Microscope
- Scanning Transmission Electron Microscope
- Environmental Scanning Electron Microscope
- Large Stage Scanning Electron Microscope
- Electron Probe Microanalyzer

SURFACE ANALYSIS -- Information from the outer few atomic layers is acquired by manipulating ions and electrons within an ultrahigh vacuum environment, using the principles of solid-state physics. Our equipment provides information on all elements and can analyze to a depth of about 3 nanometers. A compositional depth profile can be obtained by sputtering away layers of material during analysis. Equipment includes:

- Scanning Auger Microscope
- Electron Spectroscopy for Chemical Analysis
- Secondary Ion Mass Spectrometer

DIGITAL PHOTOGRAPHY -- Color and greyscale digital cameras are used for image acquisition and storage.

METALLOGRAPHIC LABORATORY -- A modern laboratory provides sample preparation and optical microscopy to characterize metallic and nonmetallic microstructures.

FAILURE ANALYSIS DATABASE -- MSFC has developed an on-line, NASA-wide failure analysis database for structural materials allowing access to information on thousands of failure analysis reports.

This facility is used to support all NASA projects other government agencies; universities; and industry.

POINT-OF-CONTACT:

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