Nonmetallic Material Mechanical Property Characterization Facility

Purpose:

To evaluate mechanical properties of nonmetallic materials for use on NASA projects.

The mechanical properties of materials are tested at cryogenic to elevated temperatures utilizing a variety of test machines. The resulting data provides information to engineers and designers on the mechanical behavior of materials in a number of environments. The facilities are used to support the Space Shuttle, the Space Station, and many other projects.

The test lab consists of six Instron and MTS test frames ranging from 5000 to 100,000 pound capability. All of the test machines have digital data acquisition systems capable of recording various inputs such as load, strain, time, etc. State-of-the-art software is utilized in data acquisition, reduction, and analysis. Internet connections facilitate the transfer of test data.

Through the use of ovens, furnaces, and cryostats testing is performed in extreme environments. The ovens are used to maintain a test specimen at constant elevated temperature. Thus, testing is performed in environments representative of the material's service temperature.

The test lab contains many of the fixtures required for ASTM standard test methods. Mechanical testing is performed on nonmetallic materials such as: polymers, composites, adhesives, coatings, films, and fibers. The data obtained are used to develop allowables for design, qualify materials for flight, and support manufacturing processes.

Instrumentation such as strain gages, linear voltage displacement transducers, extensometers, and video extensometers are used to make high resolution strain measurement possible. Thus, moduli can be determined from the extremes of high modulus carbon fiber composites to high elongation elastomers.

The facility also has two unique capabilities: (1) a fixture developed for tensile testing composites submersed in liquid nitrogen and (2) a programmable quartz lamp heater that can follow a specific heating profile during a test. The cryogenic tensile fixture was recently used for developing allowables for the X-34 composite liquid oxygen tank and is currently in use evaluating composite materials for microcracking. This new fixture/cryostat design has significantly reduced the time required to test composites at –320°F. The high temperature facility was recently used to develop allowables for the Solid rocket Booster (SRB) composite nose cap.

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