

Dynamic Testing Leads to Improved Fiber

The Challenge:

To Measure the Material

Properties of a Single Fiber

Background

The fiber industry is highly competitive and relies on innovation for new and improved products. Manufactured fibers are used in a wide variety of applications in modern apparel, home furnishings, medicine, aeronautics, energy, building construction, industrial belts, filters and more.

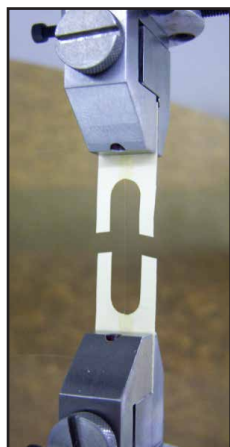
Fibers form the basis for today's high-tech composite materials that are inexorably replacing traditional materials in applications from artificial organs to super-absorbent diapers, to construction materials for aircraft, automobiles and space stations.

Customer demand for products that have higher load bearing capabilities and greater durability led to research at the Georgia Institute of Technology on the physical properties of individual fibers. The premise is, if you improve the individual fiber, you improve the finished product. The properties measured in this study will be used as a baseline for developing new and better fibers and fiber processing techniques.

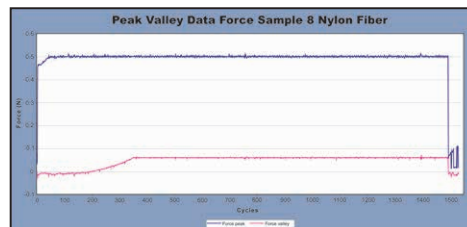
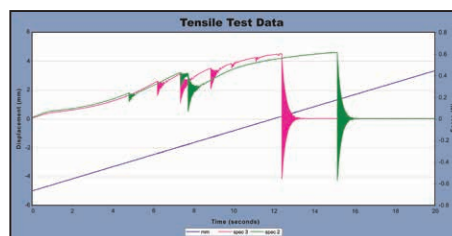
Meeting the Challenge

The ElectroForce® 3220 test instrument was chosen to test a series of nylon fibers 5 to 10 microns in diameter because of its outstanding precision and sensitivity for resolving forces and displacements. The standard system displacement transducer was used in conjunction with a 250 gram force transducer to provide optimal capacity and resolution.

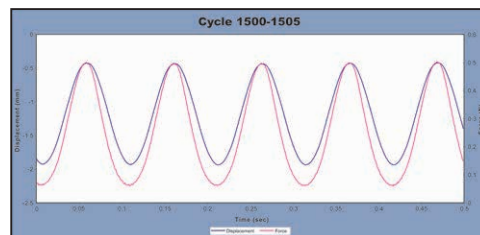
A single fiber was bonded to each sample card to provide alignment and prevent damage to the fiber during handling. The paper frame was cut just prior to testing after the specimen was installed.



The initial test was tension to failure. Multiple samples were used to determine the repeatability of the breaking force of 60 grams and to reduce the ringing in the data due to fiber pull-out through optimized specimen preparation and fixturing.



Next, a cyclic fatigue test was conducted at 10 Hz between 6 and 50 grams. Force control was optimized through the use of an advanced control technique.



This series of tests shows the ElectroForce 3220 instrument with advanced WinTest® control features is well-suited for determining the tensile and fatigue properties of individual fibers. This capability will allow the development of optimized materials for many different applications.