Mechanical Testing of Plastic, Rubber, Elastomer, and Composite Materials

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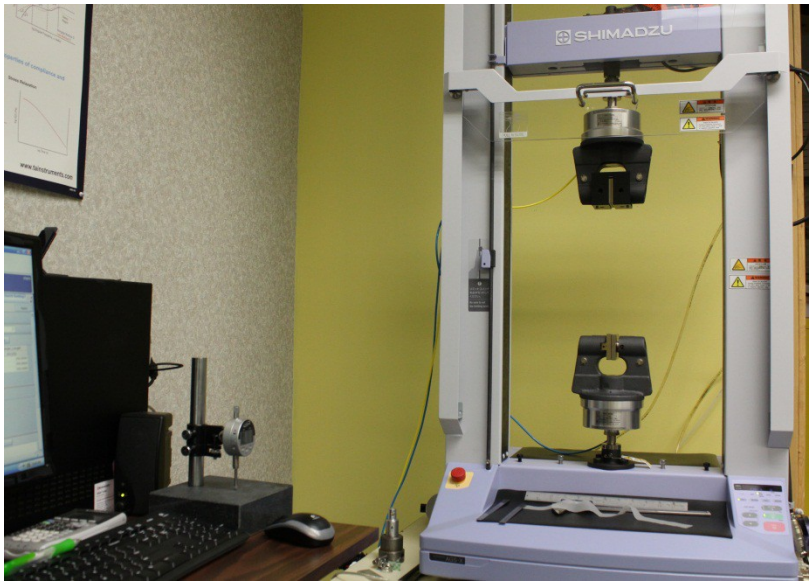
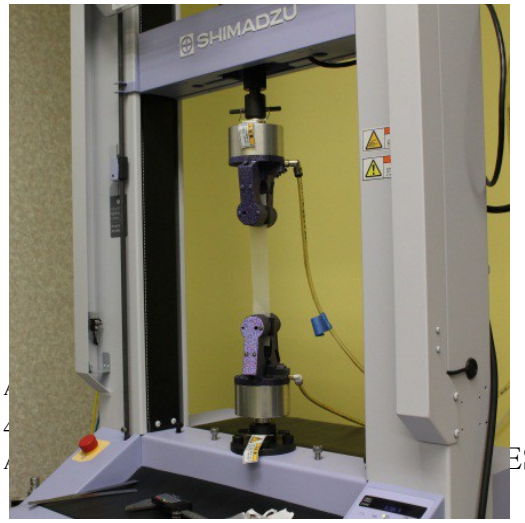
Associated Polymer Labs (APL) adds another electromechanical Universal Testing Machine (UTM) to the Mechanical Properties Testing Laboratory. The new Shimadzu AGS-X 500mm extended frame UTM is perfect for testing polymeric materials including plastics, rubbers, elastomers, and composites.



The Shimadzu AGS-X 10kN load frame with Trapezium Control Software allows the operator to stretch (tensile), bend (flexural), compress or squash (compression), or pull (shear) a specimen until it moves, yields or to the breaking point.

Tensile testing is performed in accordance with American Society for Testing and Materials (ASTM) Methods **D882**, **D638**, **D412**, **D1708** and other custom test methods designed to meet your requirements and needs. Tensile properties are key indicators of the strength of a material. Results from tensile testing include the yield point, tensile (Young's) modulus, tensile strength, elongation, break point, and toughness.

Flexural testing is performed in accordance with ASTM Method **D790** to measure the flexural modulus. Many brittle materials are flexed to the breaking point in order to measure the flexural strength. The test is stopped when the specimen reaches 5% deflection or the specimen breaks before 5% deflection is reached. The flexural test measures the force required to bend a beam at a specific rate. Flexural modulus is an indication of a material's stiffness when bent on a three-point apparatus. The three point bending fixture supports the specimen and the load is applied to the center by the loading nose producing three point bending at a specified rate. The main parts of this test are specimen depth (thickness), the support span, the speed of the loading, and the maximum deflection for the test.



Bending tests compliant with JIS/ASTM standards and deflection measurement during bending tests can be conducted to high precision. Various test specimen

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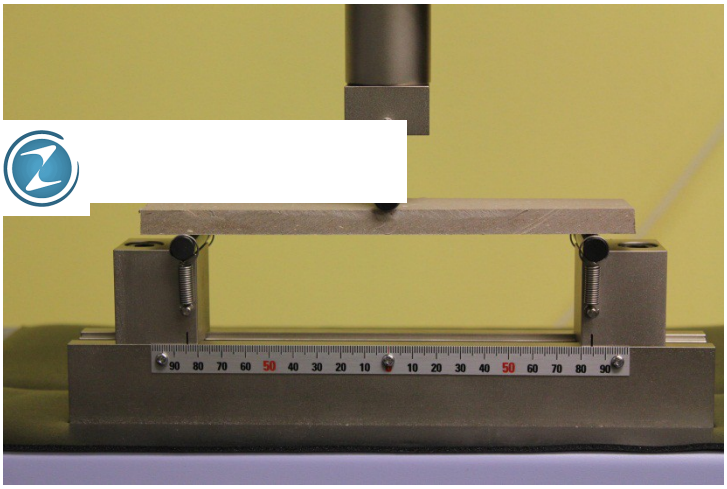
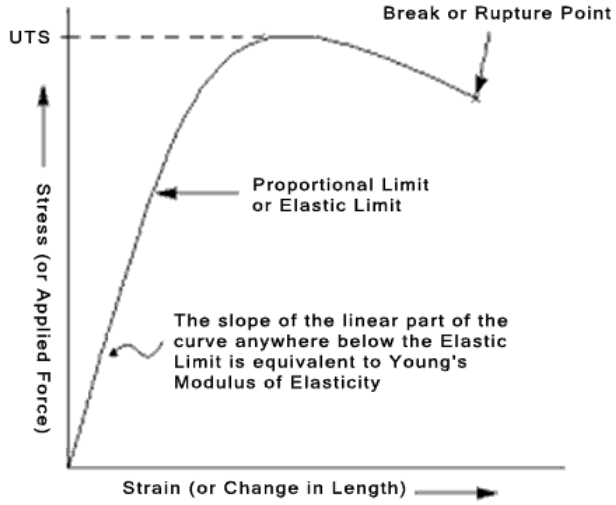


thicknesses can be accommodated by replacing the punch and supports of the bending jig, enabling compatibility with different types of standards.

Compression testing measures the compressive strength of rigid materials. Compressive strength data is useful in defining specifications that distinguish between different grades of a material and assessing the overall strength of different kinds of materials. Polyethylene, copolymers and polyurethane foams are cycle-tested to measure the amount of permanent deformation, elastic energy, and stress retention. The compression testing mode has many custom fixtures and probes designed to measure the strength required to push a button on a cell phone or to puncture test a laminate film or perform indentation measurements.

Shear testing measures the force per area (shear strength). Typical materials include plastics, films, adhesives, epoxy and composites.

A typical stress/strain curve is shown below:



The slope of the linear portion of the stress/strain curve is defined as the modulus of elasticity (Young's modulus). The UTS is the "Ultimate Strength" of the material, i.e. the maximum stress value. The

point at which the curve is no longer linear is called the proportional or elastic limit. The break (or rupture point) is indicated by the end of the stress-strain curve, where the tension is relieved because of the broken test sample.

Additional tests APL performs include the following:

ASTM D624 Tear Strength of Vulcanized Rubber and Thermoplastic Elastomers
ASTM D1894 Static and Kinetic Coefficients of Friction of Plastic Film and Sheeting
ASTM D1938 Trouser Tear
ASTM D2990 Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics
ASTM D5458 Peel Cling of Stretch Wrap Film
ASTM D5459 Cling Wrap, Machine Direction Elastic Recovery and Permanent Deformation and Stress Retention of Stretch Wrap Film
ASTM D5748 Protrusion Puncture Resistance of Stretch Wrap Film
Perf Strength of Protective Packaging, Film, Foam, Bubble Wrap, Inflatable Air Cushion
ASTM F1306 Slow Rate Penetration Resistance of Flexible Barrier Films and Laminates

Materials we have tested include the following:

Films (barrier, laminate, multilayer, blown film, cast film), Cling Wrap, and Barrier **Bubble Wrap**
Foams (urethane, polyethylene, polypropylene, crosslinked, UPES, styrene, and EPS)
Protective Packaging (food, frozen food, medical, sheet, molded, foam, laminated foam, plank, bubble wrap, void fill, loose fill, paper, inflatable packaging, air pillow, inflatable air cushion, air cushion packaging, green pillow, biodegradable, compostable (ASTM 6400), and green packaging.
Plastic Sheet (elastomer, rubber, TPO, TPU, flex PVC, polyolefin, corrugated, foam, composite and layered, core, rigid, and acrylic.
Composites, syntactic foam, synthetic lumber, and epoxies
O-rings, gaskets, and seals
Textiles (cloth, fabric, synthetic fibers, silk, and denim)

Basic Definitions used in tensile, compression, flexural, tear, peel, pull, and coefficient of friction test methods.

Load – the amount of force applied to the specimen
Stroke or extension – the amount of specimen or fixture travel
Stress – force per unit area from the initial specimen dimensions
Strain –the ratio of the extension divided by the initial specimen length.
Modulus – measured in the elastic region as the slope from the stress versus strain graph.

Young's modulus is calculated by dividing the stress by the strain.

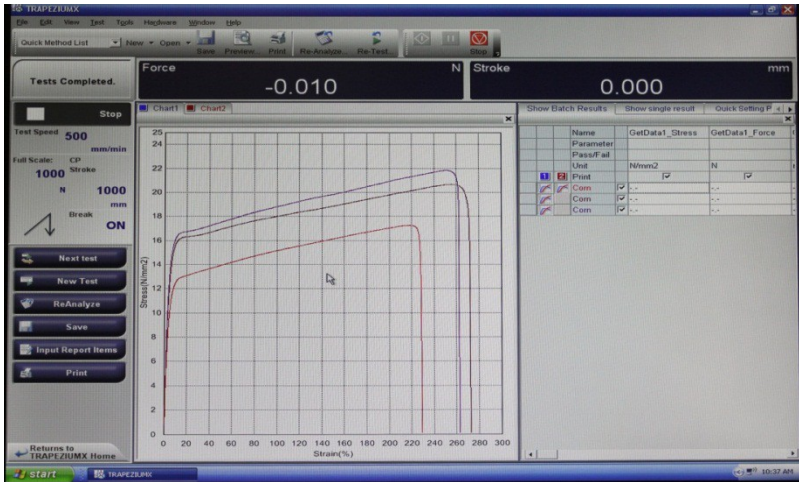
Yield Point – most plastics have a yield point after passing through the elastic region into the plastic region.

Break Point – when the specimen finally breaks and the load returns to zero. Sometimes this is the maximum stroke or extension point.

Maximum Stress - the ultimate strength of the material.

Toughness or Energy – this is the area under the stress versus strain curve.

Tensile Strength - a measure of the ability of a material to withstand a longitudinal stress, expressed as the greatest stress that the material can stand without breaking.



APL has **four (4)** universal testing machines ranging in capacity of 1 newton to 50kN load and frames with 1.5 meter extension for elastomers, rubbers and films. APL Labs has a prompt turnaround time. We provide testing from a single sample to thousands. We offer a QC program with standard or custom tests. If you would like more information about how universal testing machines can measure your product's mechanical properties and discover how Associated Polymer Labs can help your organization call us at 518-290-6804 or send us an email at info@testplastic.com.

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