INSTRON

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Welcome to the December 2005 issue of the Instron® Materials Testing Accessories e-newsletter

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Material Properties Feature: Plain strain in sheet materials

Introduction to Accessories Newsletter

The purpose of this new Instron communication feature is to provide the customer with new product or application information and articles of interest to materials testing. It will feature new product releases, applications articles and details on Instron product promotions. The newsletter will also act as a one-stop information centre allowing you access to the many different Instron products and support.

We would be delighted if you provided us with feedback or an interesting story in regards to materials testing using the link at the base of the newsletter.

Product Feature: Non-contacting Video Extensometry

Measurement of strain during material testing is traditionally carried out using some form of contacting strain measurement device.

While providing accurate measurement in many applications, contacting extensometers can have an adverse effect on test results.

Non-contacting extensometry offers many benefits over traditional contacting devices including:

- No influence on the test specimen
- No problems with knife-edge slip
- No errors due to inertia of moving parts
- No moving parts eliminate errors due to wear
- No possibility of damage due to energy release at failure
- Can be used with environmental chambers over a wider temperature range

Principle of Operation

A high resolution digital camera and advanced real-time image processing are used to make precise strain measurements on material test samples. High performance is matched by an ergonomic design that allows easy set-up and provides very good operator access to the test area.

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Related Links

- FREE Accessory Catalog
- Sign up for other Instron newsletters

Future Events

- MDM West Anaheim California USA Jan 31st to Feb. 2nd, 2006
- PlasIndia New Delhi India 9-14th Feb. 2006
- Arablab Dubai UAE 13-16th Feb. 2006
- Cisile Beijing China 9th-11th March, 2006
- HISPACK Fira Barcelona Spain 27th-31st March, 2006
- Plaspol10th International Fair of Plastics Processing Kielce Poland 30 May - 2 June, 2006

Strain is measured by tracking contrasting gauge marks placed on the specimen. The gauge marks can be in the form of dots or lines and they can be applied to the specimen by a variety of methods. Marking pens and target applicators are available as options.

The video image captured by the digital camera is transferred via an IEEE 1394 (Firewire) interface to the PC. Real time image processing algorithms running on the PC then locate the centers of the two gauge marks (or up to four marks if a transverse strain option is installed).

Specimen strain is then calculated from the mark separation at the start of the test (gauge length) and the current mark separations. Tracking the center of the mark eliminates possible errors caused by stretching of the marks at high elongations.

Gauge length is automatically measured before the beginning of each test and used for strain calculation, eliminating errors introduced by inaccurate specimen marking.

Two versions of the extensometer are available; Standard Video Extensometer (SVE) and Advanced Video Extensometer (AVE). The AVE offers greater accuracy for tests on rigid materials such as metals and composites and is also available with a transverse measurement option for r-value determination on sheet metals. Both extensometers are fully supported by Bluehill® software. Wizards allow easy set-up and calibration. Operators can calibrate the extensometer, enable and disable its use, and optionally define the area of interest to be measured. Once set-up is complete, acquisition of the marks defining the gauge length and the measurement of strain starts automatically when the test is started.

Application Range

- Non-contacting strain measurement on a wide range of materials and specimen types including plastics, metals, textiles, paper, thin sheet, foil, wire.
- Type of Loading: Tensile, compression, flexure static only. Not suitable for high cycle dynamic fatigue tests.
- Specimen shapes: Round and flat specimens with or without shoulder tab ends

For further details and product specifications please follow the links below.
2663-821 AVE, 2663-822 SVE

Materials Properties Feature: Plastic Strain in sheet metals

Forming of metal

Forming of metal sheet within industry is widespread, providing customers with products from automotive panels to drink cans. Some processes can be very simple, a flashing for the building industry may just require a sheet of aluminium to be bent in two positions along its length, but other processes can be very complex like deep drawing of component parts.

Mechanical properties

Mechanical properties of the material, directly influences its formability. Formability is a measure of how much deformation a material can resist before suffering fracture or excessive thinning.

Calculating the extent to which a material can deform is required to enable designers to produce a repeatable forming operation. Material properties important to formability are Ultimate Tensile Strength, Yield Strength, Modulus, Elongation, Strain Hardening and the Plastic Strain Ratio. All of these properties can be determined by performing a tensile test on the material in question. Tensile tests are not the only way of determining material properties related to formability of sheet metals. Other tests include Hardness, Flexure, Erichsen Cupping tests, Hole Expansion or Burst tests.

Orientation sensitive

Most metal forming processes involve the bulk material being subject to multi-directional deformation. In many cases material is rolled to provide the raw material for the forming process. The rolled material is anisotropic (having properties that differ in differing orientations) so it is important to apply tensile tests in more than one direction.

Plastic strain ratio

Plastic strain ratio (r) is the ratio of true strain that occurs in the width direction perpendicular to the applied stress and in the (thickness) plane of the sheet. It is very difficult to measure the reduction in thickness with precision and in practice the relationship between length and width strain is measured and the r-value derived mathematically. The plastic strain ratio is widely used as a measure of the ability of sheet metal to resist deformation when subject to tensile or compressive loading in the plane of the sheet. This ability to resist thickening or thinning is important is important in manufacturing of deep drawn products like gas bottles and cylinders. The r-value is considered to be a measure of sheet metal drawability.

Instron solutions

At Instron we have developed testing machines and extensometers to enable sheet metal fabricators to evaluate and predict the formability of their products and hence improve their process. To see the latest technology for sheet metal testing, please follow the links below.

Links to Solutions

- Non-contacting methods for strain measurement on sheet metal including value. AVE – non-contact video extensometer
- Software for (general) sheet metal testing, Bluehill2 software. Metals testing – Bluehill Metals Tension Test Application.

The Metals Tension Test Application provides test control and result calculations required for most metals tension testing requirements. Test control functionality includes pre-cycling, pre-loading, up to three test ramps with automatic changeover at user specified values, hysteresis reversal , selectable control modes and test end/break detection control. Available test results and calculations include tensile strength, non-proportional elongation, "r " and "n ", modulus, yield, break, pre-set point detection, peak values, reduction in area, and YPE.

High Resolution Digital Automatic Biaxial Extensometer

The HRD automatic extensometer is ideal for metallic specimens including thin foils. It is available with a transverse measurement option for r-value determination. This option allows testing to conform to ISO 10113 and ASTM E

517. The extensometer is fully automatic with gauge length setting, arm closure and opening etc controlled via the system software. The HRD features a servo follower to measure specimen strain without any significant drag forces.

Manual Transverse Extensometers For 'r' Values

The 2640-010 series transverse extensometer is designed to measure average transverse gauge length and strain with single channel output. Average transverse strain can be measured over a range of widths. It is suitable for 'R&N' testing on sheet metals with an appropriate axial extensometer.

Other Fixtures For Sheet Metal Testing.

The Erichsen test fixture illustrated is used for evaluating the ductility of metallic sheet including steel, copper and alloy materials. The fixture induces biaxial stretching of a constrained test specimen. The specimen is deformed at a specified rate until the load drops due to either necking or fracture.

For more information on Accessories

Please submit an online request or call us at
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Are you testing something a little different? Do you think more people should know about it? Would you like to submit an article for possible publication in the Instron accessories newsletter? If so please submit your story.

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