Analysis and Evaluation Instruments for Electronic Devices

Support for Product Evaluation and Quality Control of Electronic Components

Testing Instruments for Electronic Devices
Multipurpose Micro-analysis Instrument

**Electron Probe Microanalyzer**

**EPMA-1600 Series**

With a simple mouse operations, the EPMA-1600 determines the microstructure composition of electric and electronic materials across the micron, submicron, and nanometer ranges.

- Analysis of micron-order foreign matter to identify impurities and determine their shape and quantity
- Identification of nonuniformities and segregation in large-scale distributions up to 90 mm x 90 mm
- Continuous, unattended analysis of multiple samples

**Cu Migration between PCB Patterns**

![Cu Migration between PCB Patterns](image)

**Analysis of LED Eutectic Bonding Plating Layer**

![Analysis of LED Eutectic Bonding Plating Layer](image)

The EPMA-1610, with its high-resolution CeBix electron gun, shows the structure of the fine plating layer in an LED eutectic mount. An Sn plating layer is applied to the Ag layer and it can be seen that Sn from the plating layer contaminates the Ag layer. The thickness of the Mo layer is approximately 0.4 µm.

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**Investigates Elemental Depth Concentration Profiles of Thin Film**

**High-speed Depth Profiler**

**GDSL-9950**

The GDSL-9950 measures the element profile of thin films using glow discharge. Ideal for composition distribution evaluation and quality control of thin films in semiconductors, hard disks, steel and other raw materials during the production and plating processes.

- Analysis to a depth of 1 µm in just one minute
- RF-Glow discharge permits the analysis of insulators
- Qualitative analysis in the depth profile of hydrogen concentration

**Analysis of Impurity Elements in a TiN/SiO2 Film**

![Analysis of Impurity Elements in a TiN/SiO2 Film](image)
Nano-scale 3-D measurements and material measurements

Scanning Probe Microscope

SPM-9500J3

Scanning probe microscope (SPM) is the name given to instruments that create high-magnification images of the 3-D topography by scanning the surface with a small probe. A typical SPM is the atomic force microscope (AFM), which offers the following features:

- Simple, high-magnification images in atmospheric air
- Non-conductive samples can be observed without any pre-treatment
- Accurate sample height measurements
- Measurement of other physical quantities in addition to height, including surface potential, magnetic force, viscosity, and elasticity

Offers high-resolution images form x100 - x1,000,000 times magnification of the sample surface topography of metals, semiconductors, ceramics, organic matter, polymers, or biological samples, in air and without the need for coating or other pretreatment. The extremely high resolution in the sample height direction permits accurate measurements of the sample surface roughness.

This is a thin MBE-grown film of In 0.7Ga0.3As showing quantum dots on a 2 degrees-off GaAs (100) substrate. The AFM image provides a unique way to obtain the density, shape and ordering of such structures, which is an important information to optoelectronics.

(Courtesy of M.J. da Silva and Prof. A.A. Quivy, University of Sao Paulo)

From 'SEM observations' to 'EDS Analysys'

Electron Microscope

SUPERSCAN SSX-550

The SUPERSCAN SSX-550 is an SEM plus EDS combined system that provides the user with an operation environment comfortably integrated from SEM observation to EDS analysis.

- Integral SEM-EDS in a compact package
- Shimadzu’s unique SEM-EDS compiler system allows smooth operations for both analysis and observation on a single monitor.
- Intuitive icons are functionally located to allow even beginners to immediately operate the instrument.
Investigates Nanometer-order Surface Contamination  
X-ray photoelectron Spectroscopy (ESCA)  
**ESCA-3400**

This instrument irradiates a solid surface with soft X-rays and measures the bond energy of the photoelectrons emitted. As the photoelectrons are emitted from a depth of a few nanometers, the information obtained is from a layer close to the absolute solid surface.

- Understanding the chemical bond status aids root cause analysis.
- Permits analysis of extremely small areas (approx. 30 μm dia.) on the sample surface (AXIS-HSi)
- Individual mappings by surface status, such as oxidized and non-oxidized areas (AXIS-HSi)

(Product handled by KRATOS Analytical a wholly owned subsidiary of Shimadzu Corporation.)

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**Investigating the Cause of Discoloration of a Stainless-steel Surface**

**ESCA Map of Oxygen, Metallic Iron, and Iron Oxide (Fe2O3)**

[Image of ESCA Map with Normal and Discolored areas]


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Identification of organic matter adhering to the surface of IC chips, hard disks, or LCDs

**FTIR Microscope System**

**IRPrestige-21**

An infrared microscope is the most effective method of identifying foreign matter, such as raw materials used in the production process and dust from the atmosphere, particularly organic matter. The transmission, reflection, or ATR method can be selected to suit the shape of the foreign matter and the type of substrate it adheres to. The foreign matter in the diagram to the right exhibits the characteristic peak of an amide compound, suggesting a biological origin, such as a skin fragment.
The newly designed optical system of these instruments achieves high-sensitivity, high-resolution analysis with measured diameter of 50 µm. They permit the microanalysis of electronic components and substrates and of foreign matter in foods, which were previously difficult to analyze due to insufficient energy resolution and spatial resolution.

- Shimadzu's unique, patented polycapillary X-ray focusing lens irradiates only a minute, 50 µm-diameter area of the sample with high-intensity X-rays to achieve sensitive, high-resolution analysis.
- Permits analysis of elements from light elements to heavy elements (µEDX-1300: Na to U; µEDX-1200,1400: Al to U) in atmospheric air (patent pending)
- Dual CCD cameras (high- and low-magnification) allow easy designation of the measurement position and analysis while viewing an image of the sample.
- Analysis, quantitative analysis, standardless FP quantitation, thin-film FP measurements of film composition and film thickness, and BG-FP polymer film thickness measurements are included as standard.
- World-first incorporation in a micro X-ray fluorescence spectrometer of an automatic changeover mechanism for five types of primary X-ray filter eliminates undesirable characteristic X rays from the X-ray tube and improves the S/N ratio.
- Automatically maps multiple elements simultaneously. High-speed mapping acquires images rapidly. Optional transmission observation unit allows the simultaneous measurement of transmission X-ray images.
- Electronically cooled, high counting-rate detector achieves high-accuracy measurements without liquid nitrogen. (µEDX-1400)

Europe is reinforcing its regulations (WEEE and RoHS) controlling toxic substances (e.g. Cd, Pb, Cr6, Hg, PBB, and PBDE) in electrical and electronic components. Some nations have already started tightening their controls, including the Netherlands (Cd), Germany (Hg, As, Cd), and Denmark (Pb). The European Standard EN1122 (Cd Quantitation in Plastics) and the U.S. EPA designate ICP emission spectrometry, ICP mass spectrometry, and atomic absorption spectrometry for tests of these substances.

These industry world-standard instruments support the European regulations controlling toxic substances in electrical and electronic components. They offer quick and easy screening of toxic heavy metals – such as Cd, Pb, and Hg – without the need for tedious pretreatment. They also handle defect analysis and simultaneous film-composition and film-thickness measurements.
For the Evaluation of Thermal Degradation and Heat Resistance and the Characterization of Liquid Crystals

**Thermal Analyzer**

**DSC-60**
Differential Scanning Calorimeter

**DTG-60(H)**
Simultaneous DTA-TG

**DSC-60**
Temperature range: -140 to +600°C
Measuring range: ±40 mW

**DTG-60/DTG-60(H)**
Temperature range: room temperature to 1100°C/1500°C (60H)
Measuring range: ±500 mg (TG)
±1000 mV (DTA)

**PDLC Liquid-crystal Particle Measurement System**

**SALD-7001**

The SALD-7001 irradiates laser light on the liquid-crystal particles in PDLC (polymer dispersion liquid crystal) and detects the generated diffracted and scattered light intensity distribution patterns to determine the particle size distribution of the liquid-crystal particles.

**DSC measurement of liquid crystal material (azoxyanisole)**

**TG-DTA measurement of epoxy resin**

**Particle size distribution**
Measuring range: 0.015 to 280 μm
Clean rooms demand control of trace organic compounds as well as inorganic particles. Identification and quantitation of trace organic matter helps identify the contamination source.

Gas Chromatograph-Mass Spectrometer

**GCMS-QP2010**
Curie Point Headspace Sampler System

The increased sophistication of electronic devices brings with it demands to control organic compounds from clean-room construction materials, manufacturing equipment, and human bodies, in addition to controlling inorganic particles in the clean-room atmosphere. This system traps clean-room air in an adsorption tube and vaporizes and analyzes the trapped gases. It is useful for determining contamination sources and evaluating filters.

### Example of clean-room air analysis

The detected methoxyacetone, dichlorofluoromethane, and acetic acid originate from the vapors of solvents used in the clean room. The dimethyl silicon oligomer (n=5) at 12.7 minutes' retention time is thought to originate from a caulking material used in the construction of the clean room.

Measurement of trace organic compounds on silicon wafers

Gas Chromatograph-Mass Spectrometer

**GCMS-QP2010**
Curie Point Headspace Sampler System
(with solid sampler for silicon wafers)

The air in contact with silicon wafers contains organic compounds from construction materials, manufacturing equipment, and human bodies. This system presses an 8-inch silicon wafer against a heated plate and traps and analyzes the volatile gases generated from one face of the wafer.

### Example of analysis of a silicon wafer

It is assumed that the C12 (1-Dodecene), cyclic dimethyl siloxane (n=6), and dicarboxylic acid ester were generated from plastic parts, such as the wafer carrier.

Measurement of trace organic compounds on hard disks

Gas Chromatograph-Mass Spectrometer

**GCMS-QP2010**
Curie Point Headspace Sampler System
(with solid sampler for hard disks)

The air in contact with silicon wafers contains organic compounds from construction materials, manufacturing equipment, and human bodies. This system presses an 8-inch silicon wafer against a heated plate and traps and analyzes the volatile gases generated from one face of the wafer.

### Example of analysis of a hard disk platen

This example shows the analysis of a hard disk platen used to expand data storage capacity, after it was removed from the hard-disk drive. The analysis detected silicon-based compounds assumed to originate from the motor and bearing lubricants, and ester-phthalate and paraffin-based hydrocarbons thought to originate from the magnetic heads.
During the semiconductor manufacturing process, trace metals adhering to the wafer surface are generally washed off with ultra-pure water or reagents. High-sensitivity furnace atomizing atomic absorption spectrophotometry is an ideal technique to measure the trace metals in ultra-pure water.

With this method, the measurement sensitivity increases as the volume of injected sample increases. The diagram below shows an example of Fe measurement using the AA-6300G. It achieved approximately 0.02 ppb Fe measurements with 100 mL injected sample volume.

With increasing semiconductor integration, chemicals in the clean room environment can lead to defects in semiconductor devices. Consequently, ambient gas analyzers are used for semiconductor quality control and management of the clean room environment.

There are no restrictions when choosing mobile phase conditions, no worrying about competing ions or pH. Selection and adjustment of conditions can be made on a sample or analyte basis. The high degree of flexibility of this non-suppressed system allows the analysis of various ions without peak broadening outside the column.
Highly selective CO₂ measurements using highly sensitive NDIR analysis and powerful oxidation through a combination of peroxy, UV, and heating achieve high-sensitivity measurement of trace TOC. Can be combined with an autosampler containing large-capacity (125 mL), hermetically sealed sample vials.

The semiconductor manufacturing process includes washing with ultra-pure water, as residual strong acid ions on the surface of components can cause problems such as metal corrosion. The analysis of the ions in this cleaning water plays an extremely important role in quality control. Such analysis requires the detection of ions to part-per-trillion (ppt) level. The high-sensitivity suppressor-type ion chromatograph meets these requirements.

Ultra-pure water management
High-sensitivity Lab-use
Total Organic Carbon Analyzer
TOC-Vws/wp

Managing recovered water
On-line Total Organic Carbon Analyzer
TOC-4100

This single instrument can manage both raw water and purified water. It can be set to measure the TOC of recovered water or the trace TOC of recovered purified water, which contain acid, alkali, or salts.
Quantitation of Phosphorus and Boron in Silicon Wafers

Fourier Transform Infrared Spectrophotometer

Simultaneous Quantitation by PLS (Partial Least Squares) Quantitation Software

An Si-O stretching vibration peak at 1100 cm\(^{-1}\) is observed in the transmission IR spectrum of a silicon wafer containing phosphorus and boron dopants. Conversely, the small P-O stretching vibration peak that should be apparent at 1330 cm\(^{-1}\) is superimposed over the B-O band centered around 1390 cm\(^{-1}\), making the simultaneous quantitation of phosphorus and boron difficult. However, as shown in the table, simultaneous quantitation is possible using Fourier transform infrared spectrophotometer PLS quantitation calculation software, which is based on the Partial Least-Squares (PLS) method that was developed from Principal Component Analysis (PCA). (The table shows a comparison with inductively coupled plasma spectrometry on wafer samples dissolved in acid.)

This method can predict the wafer thickness of the silicon wafer sample.

### Table 1 PLS I Quantitation Calculation Results

<table>
<thead>
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<th>Concentration of Phosphorus (wt%)</th>
<th>Concentration of Boron (wt%)</th>
<th>Concentration of Silicon (wt%)</th>
<th>Thickness (Å)</th>
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<th>Actual</th>
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This disk checker uses high-sensitivity reflection analysis to conduct sensitive measurements of thin films adhering to highly reflective surfaces. Highly sensitive reflection analysis at a 70° angle of incidence can measure the thickness of a fluorine-based lubricating oil of the order of several nanometers.

### Film-thickness measurement using specular reflection

To measure the thickness of semiconductor epitaxial layers, this method uses the interference pattern between the light reflected from the surface of the epitaxial layer and the light transmitted through the epitaxial layer and reflected from the substrate.
Wide Wavelength Range Permits Measurement of Solid Samples, Including Semiconductors and New Materials
High-sensitivity Measurements in Ultraviolet, Visible, and Infrared Ranges
Self-recording UV-VIS-NIR Spectrophotometer
UV-3150

Evaluation of transmission characteristics of polarizing films*
Mounting a rotary film holder in the sample chamber allows sample rotation and installation of a polarizer. A range of holders is available to suit the size and thickness of the sample and the direction of rotation. (S101-760, 889, 0019)

Measurement of LEDs, semiconductor lasers, and other light-emitting devices*
The Emission Spectrum Analyzer uses an optical fiber method to make relative measurements of the spectra of semiconductor lasers and backlit LCDs.

MPC-3100 Multipurpose Large-sample Compartment and Integrating Sphere Further Extend the Variety of Measurements

MPC-3100

Evaluation of glass for semiconductor photomasks*
The Multiple Position Transmission / Reflectance Analyzer for Glass measures the transmittance and reflectance of glass materials used for semiconductor photomasks. Measurements can be conducted across an entire area measuring approximately 15 x 15 cm to determine positional discrepancies.

Evaluation of LCD window materials*
The Variable Angle Transmittance / Reflectometance Attachment measures the transmittance and reflectance of window materials by varying the angle of light incidence. The attachment can evaluate the effectiveness of the window material non-glare processing by measuring the angular distributions of the transmitted scattered light and specular and diffuse reflected light.

Evaluation of polarized beam splitter characteristics*
The Polarized Beam Splitter 45˚ Specular Reflectometry Attachment and Transmittance Attachment can measure the 45˚ specular reflectance and transmittance of the target polarized beam splitter without replacing it. (EAUD-0239) ASR Specular Reflectometry Attachments are available for measurements at 5˚, 12˚, 30˚, and 45˚. Attachments for measurements at 14˚, 22.5˚, 43˚, 46.5˚, and 52˚ are also available by special order. (S101-796/700)

Film-thickness measurement
The film thickness is determined from the film refractive index and the angle of incidence, which are, in turn, determined from the fringe spacing in the interference pattern of the spectra resulting from the film thickness, obtained using the 12˚ Specular Reflectance Attachment. Software is available for film-thickness measurements.

*Made to order after discussing the specifications with the customer.
Non-destructive X-ray Testing Instruments

Non-destructive, high-magnification X-ray internal imaging
Range of models to handle various sample sizes and analysis and evaluation aims
Excellent performance, functions, and operability

Internal Failure Analysis, Reliability Analysis, Surface Mounting Technology Analysis

Microfocus X-ray TV System

SMX Series

World-standard 0.4-micron Microfocus

SMX-160LT

- Permits extremely high-magnification and high-resolution imaging
- High-rigidity, high-accuracy table with intelligent control permits highly accurate positioning
- Tiltable receiver achieves inclined images at high magnification
- 2,000-hour extremely long filament life

High-magnification, High-resolution Imaging at 1 µm Focus

SMX-160GT

- Monitor displays internal images at approximately 1,800x magnification, at 1µm microfocus
- Receiver tiltable up to 60° with respect to the X-ray irradiation axis achieves inclined images at high magnification
- Combination with a rotating sample table (360° reversible rotation) allows imaging from a variety of positions
- Non-enclosure type X-ray tube allows replacement of the filament only, greatly reducing running costs

General-purpose Instruments for Easy, High-magnification Imaging

SMX-100/-130

- Magnification from 3x to 200x (up to 800x with image processing)
- SMX-100/-130 instruments achieve top performance in their class (7 µm, 5 µm, 8µm, respectively) to produce sharp, high-magnification images and general-purpose application

Image Navigation
An overall image of the sample is displayed automatically. Select the part of the image for zoom-in display.
The permanent display of the overall image ensures that areas of interest cannot be missed.

Data Filing
Imaging conditions can be registered for subsequent recall and setup, ensuring that different operators always obtain an identical image.
Applications of the SMX Series

Copper and aluminum multilayer thin-film structure
0.4 µm-thick copper foil becomes gradually thinner toward the periphery

Interior of a rotary switch
Magnification shows the gap between the contacts

Interior of an LED
Clearly reveals the contact between the element and wire

Cracks in solder spheres
By tilting the image intensifier at up to 60°, the SMX-160ET produces 3D images without inclining the sample.

Deformation of BGA solder spheres
Imaged while rotating the sample. Provides good confirmation of void positions and joint status.

BGA internal void
Reveals internal voids (air bubbles) in BGA solder spheres surface mounted to a board.

BGA joint status

Wire flow measurement
This is specialist software to calculate IC wire flow. It permits length measurement with range calibration.
Ultra-fast CT Processing System Provides the Optimum Solution

Microfocus X-ray CT System

CT-Solver

• Fast!
  Astounding, world-class CT processing speed

• Clear!
  Greatly enhanced processing power yields great image quality

• Simple!
  Crammed full of functions to make operation easy

Interior of the SMX-225CT

3D Image of CSP

3D Image of Solder Spheres

3D Image of Digital Camera

Wafer Inspection Instruments  CT System with Internal Robot

Automatic inspection instruments for 300 mm wafers.
Automatically loads wafers into the X-ray tester and inspects the wafer at programmed positions.

The internal multi-axis robot automatically loads samples.
Strength Evaluation for Electronic Components and Boards

Table-Top Material Tester

**EZTest**

- Easy strength testing of all components
- Compact unit fits anywhere

**Major Specifications**
- **Capacity**: 500 N, 100 N, 50 N, 20 N, 10 N, 5 N (six models)
- **Test force accuracy**: Set value ±1%
- **Test speed**: 0.5 to 500 mm/min.
- **Stroke**: 500 mm max.

**Resistor Tensile Test**

**PCB Bending Test**

**Potable Phone and Camera Switch Feel Test**

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**Peeling and Shear Testing of Electronic Components and other Small Specimens**

Universal Testing Machine

**AG/AGS Series**

- Solder strength evaluation for components soldered to PCBs
- Tensile strength of resist and insulating films on PCBs
- Connector pin insertion and withdrawal force evaluation
- Solder peeling tests

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**Endurance Test of Electronic Components**

**Electromagnetic Force**

**Micro Material Testing Machine**

**Microservo MMT Series**

- Electronic circuits in automobiles operate under severe conditions of vibration and temperature. The Microservo tester evaluates the reliability and endurance of the electronic components used in these circuits.
- Potable phones are subjected to repetitive forces due to body movements. The Microservo evaluates the endurance of potable phone cases and surface-mounted circuit boards.

**Bending Test of Surface-mounted PCB**

**Solder Peeling Test Instrument**

PCB mounted at 45°. The tension wire attached to a soldered IC lead wire, etc., is used to pull off the solder joint.
- **Max. load**: 200 N
- **Specimen size**: 40 x 40 to 100 x 100 mm

**Solder Shear Test Instrument**

PCB mounted vertically. Shear testing is conducted by applying a vertical shear force to a soldered IC, etc.
- **Max. load**: 200 N
- **Specimen size**: 40 x 40 to 100 x 100 mm

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**Tested Specimens**

- **Material**: ultrafine copper wire
- **Size**: 0.03 mm dia. (nominal)

**Test Conditions**

- **Load & stroke Control factor(s)**: load
- **Test waveform**: sine wave
- **Test rate**: 100 times/minute
- **Test load**: partially pulsating tension
- **Max. value**: 123 mN (12.5 gf)
- **Min. value**: 4.9 mN (0.5 gf)

**Fatigue Testing of Lead Wires (Ultrafine Copper Wires)**
Electronic Component Endurance Testing

Endurance Tester

**ENT-150**

- A single instrument evaluates insertion and withdrawal endurance and measures insertion and withdrawal forces.

**Major Specifications**
- Capacity: 500 N, 250 N, 100 N, 50 N, 20 N, 10 N, 5 N (seven models)
- Test rate: 0.1 to 50 mm/s
- Stroke: 150 mm max.
- Positional accuracy: ± 20 μm
- Repetitions: 200,000 cycles max.

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**Strength Evaluation of Liquid-crystal Spacers and Conducting Particles**

**Micro Compression Testing Machine (conforms to JIS Z8841)**

**MCT-W Series**

- Strength testing of individual particles and micro parts, including liquid-crystal spacers and plasma display ribs.

**Optional**

High-temperature system available

**Major Specifications (MCT-W500)**
- Test force: 98 to 4900 mN
- Compressive displacement measurements: 0 to 100 μm
- Compressive displacement min. measurement unit: 0.01 μm
- Options: High-temperature system (temp. range: 50 to 250°C)
Thin Film Adhesion Evaluation

Scanning Scratch Tester (conforms to JIS R3255)

SST-W101

- The unique moving-magnet detector evaluates the adhesion of sub-micron thin films, including ITO and DLC films.

**Major Specifications**

Test force: 0 to 980 mN
Vibration amplitude: 0 to 100 µm

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Evaluation of Thin Film Surface Hardness and Modulus of Elasticity

Dynamic Ultra Micro Hardness Tester

DUH-W201/W201S

- Evaluates the hardness related to dynamic strength and friction characteristics from the penetration depth of an indenter subjected to micro test forces.

**Major Specifications**

Test force: 0.1 to 1961 mN
Penetration depth measurement: 0 to 10 µm
Penetration depth min. measurement unit: 0.001 µm
Options: High-temperature system (temp. range: 50 to 250˚C)

<table>
<thead>
<tr>
<th>Test mode</th>
<th>Loading/Unloading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indenter</td>
<td>DH115</td>
</tr>
<tr>
<td>Test load</td>
<td>10mN</td>
</tr>
<tr>
<td>Hold time</td>
<td>5sec</td>
</tr>
<tr>
<td>Specimen name</td>
<td>Pt thin film</td>
</tr>
<tr>
<td>Load rate</td>
<td>1</td>
</tr>
<tr>
<td>Remarks</td>
<td>1 µm thick</td>
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</table>

<table>
<thead>
<tr>
<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
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<td>10.056</td>
<td>0.229</td>
<td>736.688</td>
<td>1.31E+11</td>
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<tr>
<td>2</td>
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<tr>
<td>**</td>
<td>9.997</td>
<td>0.23</td>
<td>731.112</td>
<td>1.33E+11</td>
</tr>
</tbody>
</table>

Expression to calculate dynamic hardness

\[ 115˚C \text{ triangular pyramid indenter} \]
\[ DHT_{115} = 3.858P/h^2 \]

- **P**: test force (mN)
- **h**: penetration depth (µm)
- **d1, d2**: diagonal length (µm)

(Using Vickers indenter)
Balance Measurements for Fast-rotating Bodies, such as Polygon Mirrors and Hard Disks

Dynamic Balancing Machine

DBM-G Series

- These instruments measure polygon mirror or hard disk balance when assembled with the motor, making them powerful tools for final-stage quality inspections.
- Ideal for balancing the high-speed precision motors that are indispensable information technology products.
- Compact, freestanding design permits versatile layout options.
- Highly efficient, requiring only 1/3 the time* of previous Shimadzu instruments for highly accurate measurements.
  * Excluding acceleration and deceleration times.

**Major Specifications**
- Measured plain(s) : 2
- Weight of measured body : 30 to 300g (550g including jig)
- Test speed : 5,000 to 30,000 min⁻¹
- Drive method : self-propelled
- Minimum detection limit : 0.01g.mm

**Comparison of Measurement Times**

<table>
<thead>
<tr>
<th>Size [div]</th>
<th>Speed (min⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 seconds (G Series)</td>
<td>8 seconds (D Series)</td>
</tr>
</tbody>
</table>

**Workplace acceleration**

The DBM-G Series includes dynamic balancer models to handle all balancing requirements.

**Precision Thin Rotor**

Dynamic Balancing Machine

SGB-03K

- HG Type Horizontal, 2-plains, hard
- SG Type Horizontal, 1-plain, soft
- VG Type Vertical, 1-plain/2-plains
Viscosity Measurements of Epoxy Resins for PCBs and Component Fixing
Flow Tester (Capillary Rheometer)
CFT-100D/500D

- The Flow Tester is a type of capillary rheometer that supplies the required molding condition data by measuring the resin melt viscosity and other parameters.
- It easily measures the melt viscosity and hardening time of heat-hardening resins, which are difficult to measure with a normal rheometer. It is extremely effective at determining the molding conditions for the epoxy resins often used with electronic devices.
- The diagram below shows the fluctuations of viscosity over time and indicates the differences in minimum viscosity due to differences in test temperature.

Extrusion method : Constant load
Test method : Constant temperature
Programmed temperature
Load range :   0.4903 to 49.03 MPa (CTF-500D)
0.098 to 9.807 MPa (CTF-100D)
Temperature : (Room temperature + 20˚C) to 400˚C

Fully Digital Control Achieves
Superior Stability and Response
Analytical Balance
AW/AX/AY Series

Internal Clock for Optimal Traceability
Electronic Balance
UW/UX Series

Incorporates Windows Direct Function. Only a single cable is required to transfer balance data to Windows. No interface or special software is necessary.

Features UniBlock – the next generation of mass sensor!
Shimadzu Overseas Customer Support

To support customers engaged in the product evaluation and quality control of electronic components, Shimadzu has established a global service network incorporating customer support, training and service centers in the USA, Germany, China and Singapore, as well as in Japan. Shimadzu provides comprehensive support services including instrument maintenance, training workshops and the provision of relevant information to meet customer needs regarding both software and hardware.