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A new dimension in image quality

The Hitachi TM Series: Pioneering the Future of Tabletop SEM
An instrument so compact that it fits on your desktop and as easy to operate as your digital camera. A scanning electron microscope designed for any level of expertise.

Gateway to Innovation

Tabletop Microscope

TM3030 Series

*Screen shows simulated image.

Simple and speedy
Start observing images in just 3 minutes
Obtain the data you need quickly

No sample preparation
Possible to observe even non-conductive samples without prior preparation

High-sensitivity backscattered electron detector
Determine the composition and three-dimensional structure of samples at high magnification up to 60,000×

First-in-class ability to observe secondary electron images (surface morphology) under low vacuum

Simultaneous acquisition of surface morphology and material compositional information

Variety of options from high-throughput EDX instruments to a choice of stages to meet your needs
Start observing images in just 3 minutes. Obtain the data you need quickly.

From morphology observations to elemental analysis, everybody in your laboratory can see research results easily and quickly.

Hitachi has created a solution to SEM users’ desire for obtaining data quickly and easily without the need for sample preprocessing.

TM3030 Series

1 Mount sample on sample stage
Sample: Printed circuit board

Proceed directly with no need for vapor deposition
In typical systems, vapor deposition would be required (non-conductive materials)

2 Mount sample stage in instrument

3 Initiate observation
Sample: Printed circuit board

Images observed in approximately 3 minutes

Tabletop installation
No cooling water is needed, so installation is quick and easy and requires only a standard 100-240 V AC power supply. Power supply unit is designed to fit into the main unit.

1 minute for specimen exchange
It takes 1 minute to vent the TM3030 specimen chamber. The high-performance vacuum system provides fast chamber venting.

Comparison of chamber venting time

TM3030 Series
About 1 min

TM-1000
About 2 min

Equipped with diaphragm pumps that need no oil
The vacuum-exhaust system uses diaphragm pumps that do not use oil. This eliminates the need to replace oil-mist traps or replenish the oil supply.

Automatically collect many types of data—then switch back and forth with a single click!
Backscattered electron image (Compositional information)
Secondary electron image (Surface morphology)
Mixed images (Backscattered electron images + secondary electron images)

Rapid acquisition of element maps

From observation to analysis in no time!
Observe non-conductive samples without sample preparation

Low-vacuum conditions make it easy to observe samples—including even samples that contain water or that readily acquire electric charge—with no preprocessing.

Conventional SEM* techniques cannot be used to observe non-conductive materials due to accumulation of electrons at the sample surface, causing the sample to acquire an electric charge. It is possible to observe such samples by—for example—applying a metallic coating; however, not only is this cumbersome and time-consuming, but it also leaves the sample surface covered in metal, which complicates subsequent characterization such as EDX analysis. The TM3030 series uses low-vacuum observation techniques which allow even non-conductive samples to be observed as is, with no need to apply metallic coatings.

**Charge-up reduction mode**

The TM3030 can operate either in “standard mode” or “charge-up reduction mode” depending on the extent of the specimen charging.

A wide variety of observations are possible under low vacuum.

Even samples that are easily charged—such as powders or fibers—may be observed as appropriate for the objective in question.

---

*Scanning Electron Microscope*
High-sensitivity backscattered electron detector

Observe the composition and three-dimensional structure of samples at high magnification up to 60,000x

High-sensitivity backscattered electron detector

All instruments in the TM3030 series are equipped with a high-sensitivity, 4-subdivision backscattered electron detector, offering a powerful tool for obtaining information on the distribution of regions of distinct composition, in addition to surface roughness and corrugations.

Surface mode (accelerating voltage 3 kV)

In typical instruments, low accelerating voltages yield reduced signal strength, resulting in dark images. The TM3030 series features a high-sensitivity detector that produces bright images—reflecting surface information—even at an accelerating voltage of 5 kV.

Comparison of backscattered electron images at high and low accelerating voltages

Examples of observations using the high-sensitivity backscattered electron detector

- Observation of electronic component (crystal particle morphology)
- Observation of foodstuffs (containing water)

Acquire compositional information for the sample surface

High-magnification observations with clear composition contrast

By adding or subtracting the signals from the segments in different combinations it is possible to emphasize compositional or topographic detail in the image, as well as produce "shadowed" images which highlight the sample from a particular direction.

Three-dimensional models allow height measurements

A 3-dimensional model can be generated without sample tilting and alignment, using 4 directional surface profiles from the signals acquired with each segment of the 4-segment backscattered electron detector. Surface roughness can be measured easily based on the height measurement between 2 points: the surface area and cross-section profile. The 3-dimensional model under observation can be manipulated (rotated and zoomed), while rotational manipulation of the model can be recorded in a dynamic image file.

3D-Image Viewer main screen 16-color contour lines Bird's-eye view

Key specifications of 3D-View

- Measurement functionality:
  - Automatic acquisition of 4-element image data from the backscattered electron detector
  - Display cross-sectional profile / Perform various types of calibration / Measure the horizontal (X-direction) separation, vertical (Y-direction) separation, length, and angle between any two points specified in the image / Measure the surface area / Measure the horizontal (X-direction) separation, vertical (Y-direction) separation, length, and angle between any two points specified in the cross-sectional profile / Measure the surface roughness on a cross-sectional profile / Zoom a cross-sectional profile display in the depth direction / Perform baseline calibrations (straight lines and curves) / Display bird's-eye view / Display color contour lines.

- Measurement performance:
  - Depth precision: ±20% (typical value). Depends on calibration accuracy, sample composition, observation mode, and observation conditions. Angles that may be detected: ±5° typical value. This is a typical value assuming the observation mode is set to Standard mode. The typical precision values listed here do not apply to cases in which the observation mode is set to Charge-up reduction mode and the observation conditions are set to Surface.
  - Charge-up reduction mode and the observation conditions are set to Surface.

- Measurement performance:
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First-in-class ability to observe secondary electron images (surface morphology) under low vacuum

High sensitivity low-vacuum secondary electron detector

Clear observations at high magnification

The TM3030Plus is equipped with a high-sensitivity low-vacuum secondary electron detector installed on higher-end instruments, making it a powerful tool for observing the morphology of the outermost surface of samples.

Examples of secondary electron images observed under low vacuum

- Observation of a pen tip with oil-containing components adsorbed
- Observation of foodstuffs (powder particles)
- Observation of a printed circuit board with poor electrical conductivity
- Observation of rubber (a non-conductive material)
- Observation of an emulsion (a water-containing substance)

- Observation of a printed characters on paper
- Observation of a wire bond

Illustrative observations

Allows surface observations of non-conductive samples and samples containing water or oil with no need for preprocessing

Observations are no longer restricted to conductive samples—now it is possible to observe non-conductive samples, and even samples containing water or oil, with no preprocessing required. You can also switch easily between secondary electron and backscattered electron images with the press of a single button.

- Sample: Cleaved metal surface Standard (15 kV) Magnification: 5,000×
- Sample: Metal interconnect in a solar cell Magnification: 100×
- Sample: Printed characters on paper Surface (5 kV) Magnification: 100×
- Sample: Wire bond Standard (15 kV) Magnification: 600×
- Sample: Sunscreen emulsion
- Sample: Raw rubber Surface (5 kV) Magnification: 2,500×
- Sample: Sunscreen emulsion

Samples containing water or oil with no need for preprocessing

Clear observations at high magnification

High sensitivity

Observe secondary electrons under low vacuum

Parameters: Standard (15 kV) Magnification: 30,000×

Secondary electron image (surface morphology)

Backscattered electron image (compositional information)
Simultaneous acquisition of surface morphology and material compositional information

**Mixed images**

Mixed images can be done with a single mouse click. The TM3030Plus performs not only separate acquisition of backscattered electron images and secondary electron images, but also mixed images combining both types of information. This allows detailed morphological and compositional information about your sample to be combined for simultaneous visualization, yielding observations that utilize the strengths of both probes. Switching between backscattered electron images, secondary electron images, and mixed images can be done with a single mouse click.

**Examples of mixed image observations**

- **Surface** (scanning electron microscope) information + surface morphology
- **Compositional information** in a single observation
- **Simultaneous acquisition of surface morphology and material compositional information**

**Overlay images**

- **Azblend**
  - Transmittance rate is changeable for comparative verification
  - Easy adjustment for differences in magnification or angle
  - Keystone functions for monochromatic, band-pass, and difference filtering

New information can be obtained from image overlay of TM3030 Series and other microscopes.

**Sample: Varistor**
- Manufacturer: ASTRON Inc.
- Sample courtesy of Dep. of Analytic Human Pathology, Nippon Medical School, Yukinari Masuda, Ph.D.

**Sample: Printed circuit board**
- Manufactuer: ASTRON Inc.

**Overlay image by Azblend**

**Sample: Renal biopsy**
- Sample courtesy of Dep. of Analytic Human Pathology, Nippon Medical School, Yukinari Masuda, Ph.D.

Manufacturer: ASTRON Inc.
Choose from 3 stages to meet the needs of your application

Motorized stage
Click an arrow at the edge of the screen, or double-click a desired location, to move smoothly to a new field of vision.

A handy optional feature for motorized-stage instruments: X-Y coordinate input function
Saving and recording the coordinates of stage positions. Simply type in numerical coordinates to move the field of view to the desired position.

* This feature is an optional extension for the TM3030Plus motorized-stage instruments.

Tilt Rotate Stage
Tilt Rotate Stage allows observation at -15° to 60° angles. It is possible to monitor the positioning in the sample chamber through a chamber scope.

TM3030Plus
Variable pressure range of the low vacuum SEM
A cooling stage
Condensation
A water (ice) vapor pressure curve

Cooling System
This cooling stage allows samples to be cooled to temperatures as low as -25°C and maintained there for times ranging from tens of minutes to a few hours. This reduces evaporation of water from moisture-containing samples, allowing observations and analysis to proceed without degradation of morphology. The cooling stage is particularly well-suited to observations of samples with high water content—such as foodstuffs and biological tissues—or samples susceptible to thermal damage.

At an ambient temperature
Sample shrinkage is seen after 5 minutes.

At -20°C (a cooling stage was used)
Sample shrinkage is not seen after 5 minutes.

Low-temperature observations of tissues—or samples susceptible to thermal damage. Particularly well-suited to observations of samples with high water content—such as foodstuffs and biological tissues—or samples susceptible to thermal damage.
**Quantax 70**

- High-speed color X-ray mapping with easy operation
- Move to specified locations to observe local spectra
- Hypermap allows spot analysis, line analysis, and mapping results with just a single measurement

**A choice of high-throughput EDX instruments**

- Simple, intuitive operation
- Full featured

**AZtecOne/AZtecOneGO**

- Icons arranged in order of procedural flow make operation easy
- Spectrum-fitting functionality allows easy observation of superposition of elements
- TruMap feature allows elements with overlapping peaks to be properly separated and displayed (AZtecOne)

**Sample measurements with the Quantax 70:**

- Analysis of a mineral sample (no vapor deposition)

**Sample measurements with the AZtecOne/AZtecOneGO:**

- Analysis of a mineral sample (no vapor deposition)

**Hypermapping enables many different types of analysis**

- Spot analysis
- Element mapping
- Line analysis

**Easy-to-understand visual operating environment**

- Simple operation menu
- Spectrum-fitting functionality

**Sample configuration in combination with a TM3030 series instrument**

*Screen shows simulated image.

**Sample: Mineral** (thin, polished rock fragment)

Sample courtesy of Designated Professor Mamoru Adachi, Nagoya University

Sample: Sulfide ore

Sample: Sulfide ore

**Sample: Sulfide ore**

* Screen shows simulated image.
AZtec One specification (Made by Bruker AXS, Karlsruhe, Germany)

Detector
- Energy dispersive X-ray detector
- Spectra measured in 160 s

Energy resolution
- 50 eV/100 kV: 154 eV (Cu-Kα)

Cooling (without fan and LN2 free)
- Rectangular, elliptical, or freehand-drawn regions
- Auto/manual
- KLM markers displayed

Energy resolution
- Selectable from 1,024 to 8,192 pixels

Resolution
- Selectable from 1,024 to 8,192 pixels

Sample size
- 290 (width) × 260 (depth) × 330 (height) mm, 10 kg

Installation conditions
- Single-phase AC, 100-240 V, 50/60 Hz, 1.5 kVA

Quantitative analysis
- Auto/manual
- Standardless quantitative analysis, normalized to 100%

Point & ID (Beam control)
- Detection element

MixMap
- 7 or more possible

Detectable elements
- Up to 80 elements

Element mapping
- Resolution: 512×384 pixels

Power supply (AZtecEnergy)
- Single-phase AC, 100-240 V, 50/60 Hz, 1.5 kVA

Power supply (AZtecOne)
- Single-phase AC, 100-240 V, 50/60 Hz, 100 VA

Multi-functional analysis instrument

The AZtec Energy offers advanced analysis functionality and flexible configurations of settings and conditions. Can be combined with a motorized stage to automate analysis.

Multi-featured segments

This analysis tool enables automated statistical processing, including classifying particles and determining particle size distributions from qualitative or quantitative analysis of particles detected in each view segment.

Wide-area mapping option: AZtec Large Area Mapping

The AZtec Large Area Mapping software automatically acquires data for multiple specified regions to produce a single combined set of mapping information.

Particle analysis option: AZtec Feature

This analysis tool enables automated statistical processing, including classifying particles and determining particle size distributions from qualitative or quantitative analysis of particles detected in each view segment.

AZtecOne specification (Made by Bruker AXS, Karlsruhe, Germany)

Detector
- Energy dispersive X-ray detector
- Spectra measured in 160 s

Energy resolution
- 50 eV/100 kV: 154 eV (Cu-Kα)

Cooling (without fan and LN2 free)
- Rectangular, elliptical, or freehand-drawn regions
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- KLM markers displayed

Energy resolution
- Selectable from 1,024 to 8,192 pixels

Resolution
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Sample size
- 290 (width) × 260 (depth) × 330 (height) mm, 10 kg

Installation conditions
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Quantitative analysis
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Application gallery

An extensive world of low-vacuum observations made possible by the TM3030 series

**Electronic materials**
- **Surface (5 kV)**
  - Image signal: Mix; magnification: 40×
  - Sample: Magnetic head
- **Standard (15 kV)**
  - Image signal: Backscattered electrons; magnification: 40×
  - Sample: Magnetic head
- **EDX (15 kV)**
  - Image signal: Secondary electrons; magnification: 1,000×
  - Sample: LSI interconnect

**Metallic materials**
- **Surface (5 kV)**
  - Image signal: Secondary electrons; magnification: 2,500×
  - Sample: Copper crystals
- **Standard (15 kV)**
  - Image signal: Backscattered electrons; magnification: 3,000×
  - Sample: Neodymium magnet
- **Surface (5 kV)**
  - Image signal: Mix; magnification: 100×
  - Sample: Non-woven fabric
- **Surface (5 kV)**
  - Image signal: Secondary electrons; magnification: 1,000×
  - Sample: Resin material

**Environmental and energy-related materials**
- **Standard (15 kV)**
  - Image signal: Backscattered electrons; magnification: 100×
  - Sample: Lithium-ion battery
- **Surface (5 kV)**
  - Image signal: Mix; magnification: 10,000×
  - Sample: Fluorescent material

**Processed product materials**
- **Surface (5 kV)**
  - Image signal: Mix; magnification: 40×
  - Sample: Magnetic head
- **Standard (15 kV)**
  - Image signal: Backscattered electrons; magnification: 40×
  - Sample: Magnetic head
- **EDX (15 kV)**
  - Image signal: Backscattered electrons; magnification: 800×
  - Sample: Lithium-ion battery
- **Surface (5 kV)**
  - Image signal: Mix; magnification: 10,000×
  - Sample: Fluorescent material
Application gallery

Biological samples, foodstuffs, pharmaceuticals

Surface (5 kV)
Image signal: Secondary electrons; magnification: 100x
Sample: Tick

Surface (5 kV)
Image signal: Mix; magnification: 1,000x
Sample: Stomach medication

Standard (15 kV)
Image signal: Backscattered electrons; magnification: 1,500x
Sample: Headache medication

Surface (5 kV)
Image signal: Secondary electrons; magnification: 300x
Sample: Japanese shiso lettuce leaf

Standard (15 kV)
Image signal: Backscattered electrons; magnification: 6,000x
Sample: Cross section of abalone shell

Surface (5 kV)
Image signal: Secondary electrons; magnification: 1,500x
Sample: Kidney glomerulus

Standard (15 kV)
Image signal: Secondary electrons; magnification: 20,000x
Sample: Bacillus Natto bacterium

Standard (15 kV)
Image signal: Backscattered electrons; magnification: 15,000x
Sample: Butterfly wing

---

### TM3030Plus / TM3030 specification

<table>
<thead>
<tr>
<th>Item</th>
<th>TM3030Plus</th>
<th>TM3030</th>
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</thead>
<tbody>
<tr>
<td>Magnification</td>
<td>x15 - x40,000 (with digital zoom, Up to x240,000)</td>
<td>x15 - x40,000 (with digital zoom, Up to x240,000)</td>
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<td>6 kV / 15 kV / EDX</td>
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<tr>
<td>Backscattered electrons</td>
<td>Backscattered electrons</td>
<td>Backscattered electrons</td>
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<tr>
<td>Secondary electrons Mix</td>
<td>Mix (backscattered electrons + secondary electrons)</td>
<td>Mix (backscattered electrons + secondary electrons)</td>
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<td>BSE: High-Sensitivity 4-segment BSE detector SE: High-sensitivity 4-segment BSE detector</td>
<td>BSE: High-Sensitivity 4-segment BSE detector</td>
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<td>Auto start, Auto focus, Auto brightness/contrast</td>
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<td>4-segment backscattered electron detector</td>
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