Unique Features of JED-2300

- Extremely simple: A click on an image completes analyses automatically from acquisition to archiving.
- Analyzed data are saved with an image, which shows analysis points. You never wonder where data were collected.

- Well-organized data files: Images of analyzed areas are displayed on the specimen holder graphic display.
- Analysis points marked on multiple areas can be analyzed automatically. Element maps as well as SEM images are stitched together to create montage images.

- Clear display of analysis points: Automatic qualitative and quantitative analyses, Probe tracking, Automatic probe current monitoring.

- Automatic analysis of large area: The patented MINI CUP detector keeps high sensitivity for light elements for a long period of time.
- The system is compatible with the multi-user function of Windows. An operation environment for each user can be saved.

- High precision with simple operation: Automatic analysis of foreign material is possible.
- Automatic particle analysis, Gun shot residue analysis, Phase analysis

- Long-lasting MINI CUP detector: A variety of analyses is available

- Multi-user environment compatible
- In-line analysis compatible

(1) SEM with motor controlled specimen stage
(2) Optional

Scanning Electron Microscope

Field Emission
JED-2300 is the EDS (Energy Dispersive X-ray Spectrometer) developed by JEOL, the top manufacturer of electron optics instruments. JED-2300 is optimized for use with JEOL SEM and TEM.
Quick Quant Mode

Simple and quick

A click on one icon finds elements

Start Analysis Program after finding an area of interest. A click on the “Start” icon starts acquisition of a spectrum. Labels of elements of interest are displayed if the elements have been selected on the periodic table. You can quickly check for your elements of interest. The Analysis Program is designed for acquisition and analysis of spectra.

Qualitative analysis

A click on the “Qual” icon determines elements for peaks on a spectrum and puts element labels on a spectrum. You can set the software to do qualitative and quantitative analyses automatically after acquisition of a spectrum. A click on a spectral peak lets you manually select the best-fit element for the peak. It is possible to perform qualitative or quantitative analysis during acquisition of a spectrum.

Real-time display of counting rate and dead time

The X-ray counting rate and the dead time can be displayed during acquisition of a spectrum. The optimum probe current setting can be found quickly. The probe current can be displayed on a system with the probe current monitor.
Quantitative analysis is quick

A quantitative analysis result is displayed instantly with a click on the “Quant” icon. ZAF and Phi-Rho-Z (option) quantitative software are available for an SEM. High precision quantitative analysis can be done using the standard data stored in the database. The software for quantitative analysis with user collected standard data is provided. The quantitative analysis software for a thin section specimen in TEM is provided.

One Click Report

A click on the “PView” button on the qualitative analysis window prints a report instantly.

Multi user compatibility

The system is compatible with the multi-user function of Windows. You can always run analysis in your own operation environment. General users cannot change fundamental operation parameters when they run the system as a limited user.
Single View Mode

Select areas, and analysis is done automatically

Analysis Station

The Analysis Station is the new analysis system developed on the concept of “seamless from observation to analysis”. The results of analyses are always saved with SEM images of analysis areas.

Start an analysis on the SEM monitor

You simply select a spot or an area of interest on the SEM monitor of JSM-6x80 or JSM-6x60 series. The EDS acquires an elemental spectrum followed by the acquisition of an SEM image showing the analysis area. You can set the sequence to do the qualitative and quantitative analyses automatically after the acquisition of a spectrum. The acquired data are automatically stored with the SEM image in a folder, which is created automatically for each analysis area.

The operation screen of JSM-6380LA (SEM)

Specimen: Face of a JEOL wrist watch
(The area in the red square was analyzed.)
Operating procedures at a glance

The function of icons on the SEM and the EDS operation screen is indicated with texts. The operation of the EDS is carried out by following the simple and easy to understand procedures. A click on the “Image” icon pastes an SEM image of the analysis area on the EDS monitor. A click on the “Spc” icon acquires an elemental spectrum. The acquired data are stored automatically with the SEM image.

Saving the acquired data

Pasting of an SEM image on the EDS monitor creates a data folder. The SEM image and elemental analysis data on this area are saved in this folder. A list of stored data collected on one area is shown when the SEM image of analyzed area is selected from the index images. You can select a data file and study the data. You can move the specimen stage back to the analysis area on an SEM with a motor-controlled specimen stage.

Detection of elements in a specimen

You can survey a specimen for your elements of interest quickly. A click on the “Spc” icon on the Analysis Station collects an elemental spectrum from the current area. The spectrum is automatically acquired without collecting an SEM image. The stage coordinates and the magnification of this area are automatically stored if the SEM is equipped with a motor controlled specimen stage. Later, if necessary, you can move to analyzed locations and display SEM images at the same magnifications used for analysis.
After finding an area of interest for EDS analysis on JSM-6X80LA or JSM-6X60LA, a click on “to EDS” icon on the SEM monitor pastes the SEM image on the EDS monitor of the Analysis Station. On the FE-SEM or TEM, the “Image” icon on the Analysis Station is used instead of “to EDS” icon.

**A complete analysis with just two clicks**

After displaying an image of analysis area on the EDS monitor, a click on the “Spc.” icon on the Analysis Station acquires an elemental spectrum. The acquired data are saved in the data folder, which is automatically created for the SEM image. You would not wonder later where this spectrum was collected.

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**Single View Mode**

**Only two icons complete analysis**

After finding an area of interest for EDS analysis on JSM-6X80LA or JSM-6X60LA, a click on “to EDS” icon on the SEM monitor pastes the SEM image on the EDS monitor of the Analysis Station. On the FE-SEM or TEM, the “Image” icon on the Analysis Station is used instead of “to EDS” icon.

**Image** Icon for acquiring SEM/STEM image

**Spc.** Icon for acquiring spectrum

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**Operation screen of Analysis Station JED-2300**

**Specimen:** Electronic device

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**Swing Mouse**

One mouse and one keyboard operate both the SEM and the EDS.

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**Defining points of interest on the SEM image**

You can define a point or an area on an acquired SEM image on the EDS monitor and quickly acquire an elemental spectrum.
In the Analysis Station, the Smile View, a report editing software, is included. The Smile View lets you freely edit microscope images, qualitative spectra, quantitative results, and elemental maps.

**One Click Report**

A click on the “PView” icon on the qualitative analysis window prints a report. On this report an SEM or STEM image and the analysis results on this area are automatically pasted.

**Smile View**

In the Analysis Station, the Smile View, a report editing software, is included. The Smile View lets you freely edit microscope images, qualitative spectra, quantitative results, and elemental maps.

**Quantitative line analysis**

The quantitative line analysis program performs quantitative analyses along a specified line on an SEM or STEM image and displays the quantitative analysis results in a graph. The conventional line analysis simply reflects X-ray counts, therefore, the line analysis does not necessarily show concentration of elements. The quantitative line analysis program performs quantitative analysis on each analysis point along a line so that a change of concentration along the line is displayed accurately.

Specimen: Electronic device prepared with the Cross Section Polisher (CP)
Elemental Mapping Mode

One icon completes elemental map

The elemental map is now widely used because it is easier to understand. A click on the “Map” icon completes acquisition of elemental maps automatically. The elemental maps are automatically saved in a folder, which is created for an image of analyzed area in the same way as for qualitative and quantitative analysis results.

Active Map

It is not necessary to know elements in a specimen prior to acquisition of elemental maps. A click on the “Map” icon starts acquisition of an SEM or STEM image and of a spectrum. Elements contained in a specimen are automatically detected from the spectrum and then elemental maps of detected elements are accumulated. It is possible to set elements manually during the acquisition.

Probe Tracking

The probe tracking compensates for drift of an analysis area during an analysis such as elemental mapping, which takes a long period of time. It acquires an image of analyzed area in the beginning. Then images are acquired during the acquisition at user-defined intervals and compared with the initial image. If drift is detected, the position of electron probe is corrected. This technique is applied to the automatic sequential analysis in order to position an electron probe precisely on predetermined locations. (Pin Point Navi)

High-definition elemental map

This program acquires an SEM or STEM image, and elemental maps up to 4096 x 3072 pixels. Up to four images can be acquired simultaneously.

Phase analysis (optional)

An EDS detects elements contained in a specimen. The phase analysis derives a distribution of materials in a specimen from the raw elemental maps. Materials distinguished by a statistical method can be determined by using the database in the Analysis Station.
Active Map
You can analyze stored data anytime

### Pop-up spectrum

The Active Map saves entire spectral information on each analysis pixel. It is not necessary to know elements in a specimen prior to analysis. Without analyzing the specimen again, you can analyze the acquired data later such as extracting an elemental spectrum by specifying any area on an Active Map or an SEM/STEM image and running a quantitative analysis on the extracted spectrum, or forming an elemental map in a few seconds by assigning any element of interest. You can study the acquired data on your PC with the optional Off-line Analysis Software.

### Chemical type

You can register chemical types with compositions you define. Then you can label on analysis points and areas with the chemical types. You can tell the chemical type of each analysis point easily. When the Chemical Type analysis is performed after qualitative and quantitative analyses on a Pop-up spectrum, a chemical type is labeled automatically on the area of the Pop-up spectrum.

### Active Map Line

The Active Map Line shows X-ray counts of elements along a line defined by a user on an Active Map. You can assign any elements for the Active Map Line.

### User palette of elemental map

**Edit, save, and read**

Four color palettes are provided for the elemental map. There are the single-color modes (automatic assignment of 5 colors, black and white, and fixed) and the multi-color mode (pseudo-color). In addition to these, you can assign, save, and reuse your own colors for elements. This let you assign colors for elements to meet requests from your clients.

### Quantitative Map

You can derive a quantitative map from an Active map. The quantitative map can separate overlapping peaks and suppress the effect of bremstrauckland from an elemental map.

<table>
<thead>
<tr>
<th>Original elemental map</th>
<th>Quantitative map</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

**Overlay display of three elements:** Green=Au, Red=P, Blue=W

**Specimen:** Electronic device
Multi View Mode

Analysis on multiple areas

Graphic display of analyzed areas

As you analyze multiple areas on a specimen, SEM images and analysis data are saved automatically. The analyzed areas are then displayed on the graphic display of a specimen holder. You can tell at a glance where you have been analyzing.

Analysis data on each analysis area are automatically saved in a folder, which is generated automatically for each analysis area as shown on the list view and the area view.

Analysis on multiple areas

Specimen: A face of wristwatch

Analyzed areas are displayed on the graphic display of a specimen holder on the left. The yellow area is magnified on the main display area. You can vary the size and location of the yellow area. The list view is displayed on the top left and the area view on the bottom.

Specimen: Face of a JEOL wristwatch.

Navigation

Did you want to go back to previous areas? The Analysis Station automatically saves coordinates and magnifications of analyzed areas so that you can go back to any previously analyzed area simply by selecting the image of an analyzed area.

Pin Point Navi

When analyses are done on multiple areas, the motor-controlled specimen stage moves a specimen to specified areas sequentially. There may be a slight shift between the originally assigned area and the area moved back to by the specimen stage for a sequential analysis. The Pin Point Navi compensates for this shift by comparing these two images and brings back the analysis points precisely.
Automatic sequential analysis

You can assign analysis points and areas on multiple SEM/STEM images and perform qualitative and quantitative analyses automatically. The analysis data are automatically saved in folders created for the SEM/STEM images. It is possible to set more than 10,000 analysis points and areas.

Index display

Analysis areas acquired at a variety of magnifications can be displayed at the same size regardless of the magnifications. You can set analysis points and areas on the index images. The index images can be used for navigation as well.

One Click Report

A report with an SEM or a STEM image and analysis data can be prepared automatically.
Smile Station 2

Multi area analysis expands application fields

Montage of SEM images and elemental maps
Smile Station 2 automatically acquires an SEM image and elemental maps on multiple areas and stitches them to form montage images covering a large area. You can analyze a large area in a short time (patent pending).

Elemental maps of selected areas
You can collect elemental maps of selected areas. In the example shown on the right, backscattered electron images were collected over the entire area. Then areas were selected for elemental maps. The automatic acquisition of elemental maps was performed only on the selected areas. The elemental maps can be overlaid on the backscattered electron images.

Elemental maps of arbitrarily selected areas
Analysis Station 2 can also collect elemental maps on arbitrary acquired SEM images. You can efficiently analyze an area in any shape (patent pending).
Particle Analysis

Particle Analysis Software 2

Particle analysis

This software automatically performs particle analysis including detection, measurement, and elemental analysis of particles. It is useful for characterization of fine particles, detection of certain elements, or analysis of foreign materials.

Particle Finder

The Particle Finder, which is a combination of the Particle Analysis Software 2 and the Smile Station 2, can perform particle analysis over an extremely large area. The Particle Finder is effective when more than a few thousands of fields on, for example, a filter with particles have to be analyzed. It can be used for automatic in-line analysis of foreign materials.

Automatic Gun Shot Residue analysis

The GSR unit combined with the Particle Finder can perform GSR analysis automatically. The GSR unit consists of standard specimens and a recipe for GSR analysis.
JED-2300T is the EDS analyzer for the JEOL transmission electron microscope (TEM). The system is capable of qualitative analysis, quantitative analysis, and elemental map on a thin-film specimen with high energy resolution and high sensitivity.

**High energy resolution**

The newly developed pulse processor and detector can collect a spectrum more efficiently with higher energy resolution, thus making it possible to analyze a specimen much faster.

**High sensitivity for light elements**

The ultra thin window developed by JEOL realizes high sensitivity for the light elements. The detector has high energy resolution even in the lower energy range so that the peaks of light elements including boron, carbon, nitrogen, and oxygen are separated clearly. A detector with a 50mm² active area is available for analyses requiring higher sensitivity. The solid angle of this detector is 0.28sr.

**Analysis Station**

The Analysis Station is combined with the JEOL TEM. It reads the TEM parameters such as magnification and accelerating voltage during analysis. Operating parameters for the elemental map or the multi point analysis can be preset on a STEM image. Data acquisition and archiving of collected data are automated. The probe tracking makes it possible to analyze for a long period of time for elemental maps or multi-points analyses with high spatial resolution, high sensitivity, and high precision.

Carbon nano-tube on boron nitride
Specimen courtesy of Dr. Yoshio Bando
Advanced Materials Laboratory, National Materials Science.
Comparing this to the analysis of a bulk specimen, a much smaller volume can be analyzed on a thin-film specimen with a TEM or with a STEM mounted on SEM, using higher accelerating voltages and minimizing the effect of the scattered electrons in a specimen.

**Specimen:**
Semiconductor device

**Specimen preparation:**
FIB

**Model:**
JEM-2100F/JED-2300T

**Electron probe diameter:**
1.5nm

**Effective area of detector:**
30mm²

**Acquisition time:**
5 minutes

**Number of pixels:**
128 x 128 pixels

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**Probes Tracking**

The probe tracking compensates for a slight drift of the analysis area, which sometimes occurs during an analysis at a high magnification when acquisition requires a long time.

Spectrum from the area shown at right.
MINI CUP Detector

The MINI CUP detector is a high-performance detector patented by JEOL. The Dewar of the detector is pumped by the vacuum system of an SEM prior to the filling of the detector with liquid nitrogen. An ice film on the detector element would absorb the low energy X-rays and lower the sensitivity for the light elements. The water vapor in the Dewar is also pumped out of the MINI CUP detector so that the condensation of ice on the detector is negligible. The MINI CUP detector keeps its original high sensitivity for many years. The detector requires liquid nitrogen only when the detector is in use. Therefore the maintenance of the detector is easier.

Light element analysis

The JEOL detectors have high sensitivity even for light elements. The extra and hyper detectors have better than 65eV energy resolution for carbon.

WD of SEM

Have you ever done EDS analysis at a wrong working distance (WD)? The Analysis Station watches the WD of an SEM. A warning message is displayed in the beginning of acquisition if a WD is not proper for EDS analysis. Even an inexperienced user can obtain reliable analysis data. (Note: This function is available on JSM-6380A/LA, JSM-6480A/LA, and JSM-6060A/LA.)

Spectrum by the Hyper MINI CUP detector
Specimen: Be and BN particles on carbon tape
# Specifications

## Principal specifications

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<td>Integration</td>
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<td><img src="image23.png" alt=" Swing mouse (SEM and EDS operated with one mouse and one keyboard) " /></td>
<td><img src="image24.png" alt=" Swing mouse (SEM and EDS operated with one mouse and one keyboard) " /></td>
<td><img src="image25.png" alt=" Swing mouse (SEM and EDS operated with one mouse and one keyboard) " /></td>
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<tr>
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<td><img src="image43.png" alt="Simple montage, large area elemental map" /></td>
<td><img src="image44.png" alt="Simple montage, large area elemental map" /></td>
<td><img src="image45.png" alt="Simple montage, large area elemental map" /></td>
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<tr>
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<td><img src="image53.png" alt="Specimens and recipe for GSR" /></td>
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<td>Phase analysis software</td>
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<td><img src="image64.png" alt="Automatic multi phase analysis" /></td>
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<td>Probe current compensation unit</td>
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<td>JED-Z300 license</td>
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<td><img src="image80.png" alt="Optional" /></td>
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### Detectors

A variety of detectors is available.

#### Detectors for SEM

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<td>Manual</td>
</tr>
<tr>
<td>Ultra MINI CUP</td>
<td>138eV</td>
<td>10,000/1</td>
<td>B to U</td>
<td>1.0 liter&lt;sup&gt;(4)&lt;/sup&gt;</td>
<td>Manual</td>
</tr>
<tr>
<td>Hiper MINI CUP</td>
<td>133eV</td>
<td>10,000/1</td>
<td>Be to U</td>
<td>1.0 liter&lt;sup&gt;(4)&lt;/sup&gt;</td>
<td>Manual</td>
</tr>
<tr>
<td>Extra MINI CUP</td>
<td>129eV</td>
<td>10,000/1</td>
<td>Be to U</td>
<td>1.0 liter&lt;sup&gt;(4)&lt;/sup&gt;</td>
<td>Manual</td>
</tr>
<tr>
<td>Nine</td>
<td>144eV</td>
<td>10,000/1</td>
<td>Na to U</td>
<td>9.5 liter</td>
<td>Manual</td>
</tr>
<tr>
<td>Ultra Nine</td>
<td>138eV</td>
<td>10,000/1</td>
<td>B to U</td>
<td>9.5 liter</td>
<td>Manual</td>
</tr>
<tr>
<td>Hiper Nine</td>
<td>133eV</td>
<td>10,000/1</td>
<td>Be to U</td>
<td>9.5 liter</td>
<td>Manual</td>
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<tr>
<td>Extra Nine</td>
<td>129eV</td>
<td>10,000/1</td>
<td>Be to U</td>
<td>9.5 liter</td>
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</table>

#### Detectors for TEM

<table>
<thead>
<tr>
<th>Detectors for TEM</th>
<th>Energy resolution</th>
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<td>Detector30 with a gate valve</td>
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<td>Detector30 with a gate valve (premium)</td>
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<td>10,000/1</td>
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<td>Automatic</td>
</tr>
<tr>
<td>Detector50 with a gate valve</td>
<td>143eV</td>
<td>10,000/1</td>
<td>B to U</td>
<td>9.5 liter</td>
<td>Automatic</td>
</tr>
<tr>
<td>Detector50 with a gate valve (premium)</td>
<td>138eV</td>
<td>10,000/1</td>
<td>B to U</td>
<td>9.5 liter</td>
<td>Automatic</td>
</tr>
</tbody>
</table>

<sup>(1)</sup> The optional probe current compensation unit is required.

<sup>(2)</sup> Applicable to JSM-6X60A/LA series and JSM-6X80A/LA series SEM

<sup>(3)</sup> Applicable to an SEM with a motor controlled specimen stage

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### Off line analysis software (optional)

The off line analysis software, JED-Z300 license, lets you analyze acquired analysis data and prepare reports on your PC. The JEOL original SMile View report editing software is included. You can generate elemental maps with any elements, form spectra from any areas on an elemental map and run qualitative and quantitative analyses.

<sup>(4)</sup> Liquid nitrogen is required only when the detector is in use.