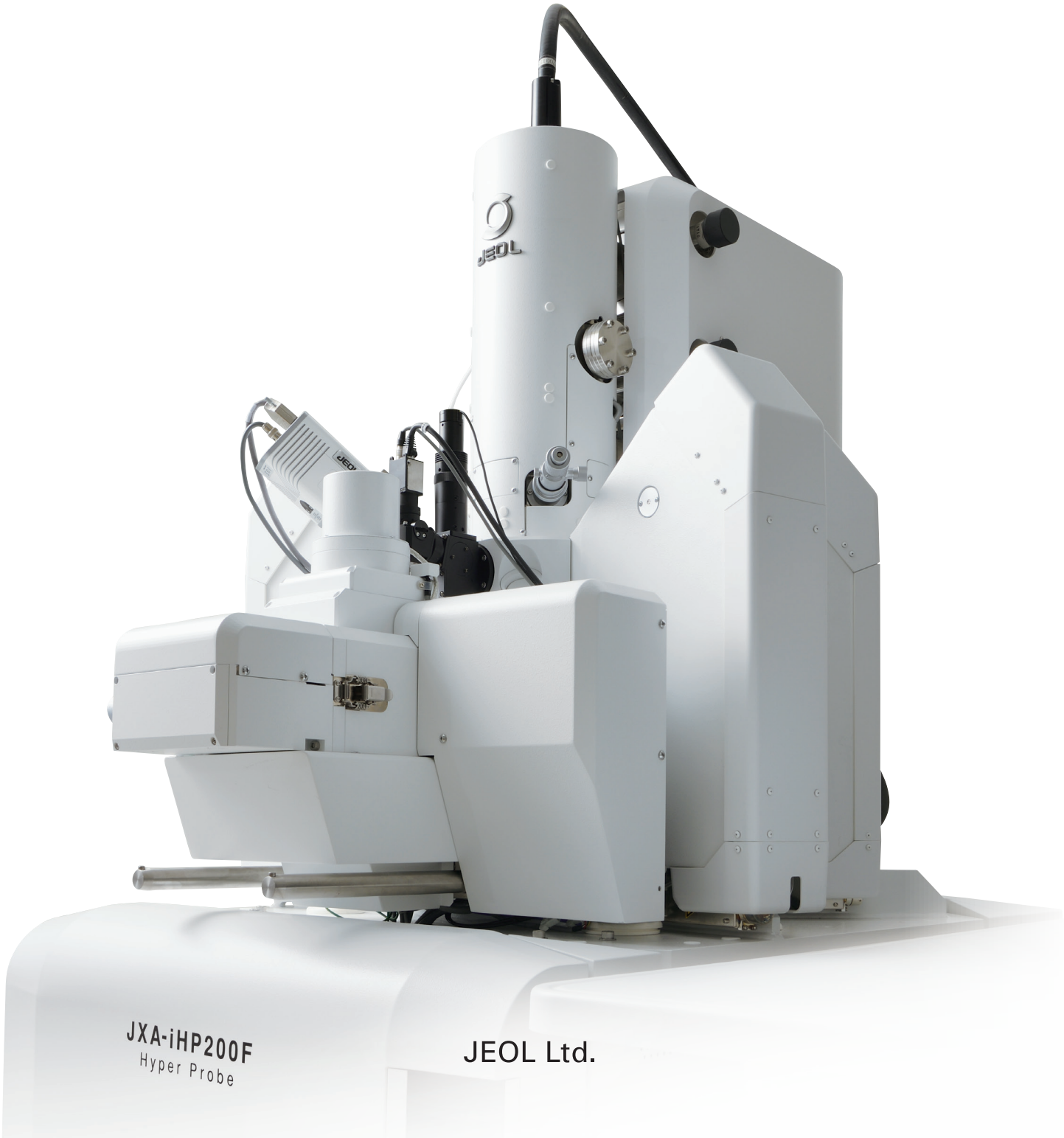
Scientific / Metrology Instruments

Electron Probe Microanalyzer

Solutions for Innovation

JXA-iHP200F
JXA-iSP100



JEOL Ltd.

Novice and Expert Collection and

New EPMA
Ultimate Performance with

Processing of Microanalysis Data

Technology Usability & Expandability

Evolution of Integrated EPMA

JXA-*i*HP200F・JXA-*i*SP100

integrated Hyper Probe　　integrated Super Probe

Easy Maintenance

Efficient Calibration with 18 built-in standard specimens

- The new spectrometer calibration function reduces the steps of periodic calibration and eliminates misoperations by using in-built standard specimens.
- Greater efficiency by running automated instrument calibration in the nighttime.
- The maintenance notification function ensures proper maintenance at the required timing.

Analysis

Auto functions Easy EPMA for

Setting

Holder insertion with Auto Loading!
Quickly find the target observation point!

- Specimen insertion and acquisition of an optical image of the specimen holder (Stage Navigation image) is executed with a single click.
- The field for analysis can be selected from the Stage Navigation image.

enabling anyone to obtain high-grade SEM images
fast elemental analysis with simplified instrument setting

- In combination of the Auto Focus function of an optical microscope and Auto functions of SEM incorporating a new system with higher accuracy and faster degree of capabilities, any user can acquire high grade SEM images.
- Live Analysis enables elemental screening during observation.
- "Easy EPMA" is available, so novice users can smoothly operate the EPMA.
- Operability is further enhanced with the integration of SEM, EDS, WDS and optical images.

Auto Functions

Simpler operation, from specimen loading to SEM observation

The "IN" button for Auto Loading, an Auto Focus button for the optical microscope, and Auto function buttons for SEM observation. With 3 Auto buttons, the instrument can easily be operated from specimen exchange to SEM observation.

Specimen loading

Place a specimen holder in the Auto Loader.

Auto1

IN button **IN**

With a single click, the specimen chamber is evacuated, a Stage Navigation image is acquired and the sample is introduced. All 3 steps are performed automatically.

Specimen chamber evacuation starts.

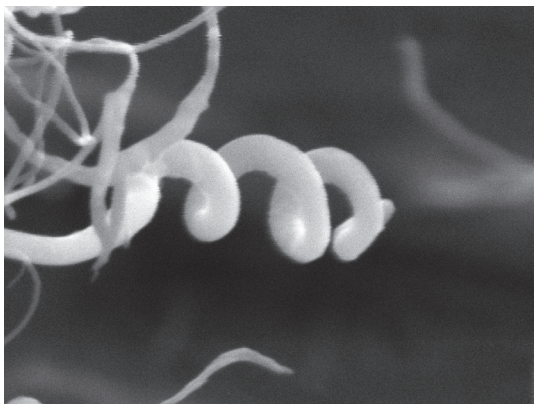
Stage Navigation image is acquired during specimen chamber evacuation.

Image range: 10×10 cm

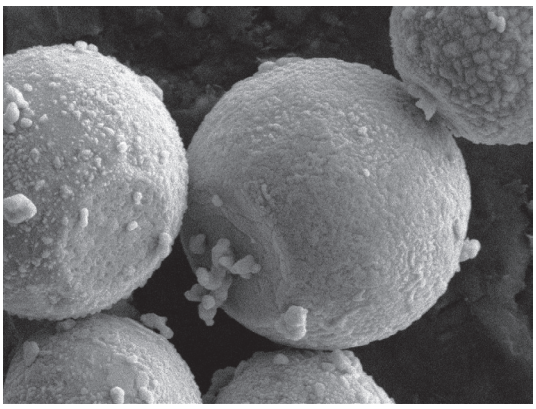
After evacuation is completed, the sample is automatically introduced.

High-grade SEM images in just a few steps

By combining the use of the Auto buttons of the optical microscope and SEM, high-grade SEM images can be obtained easily. The JXA-iHP200F equipped with the in-lens Schottky Plus electron gun delivers high-definition images at high magnification.

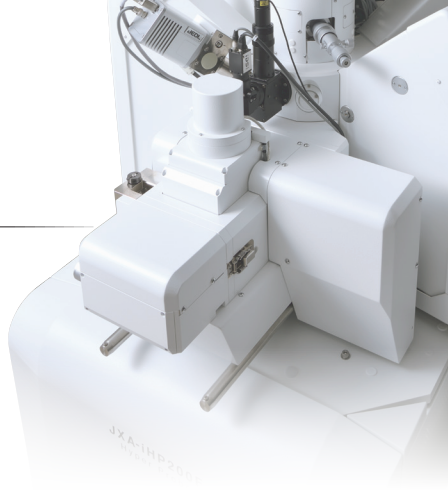


Specimen: Multiwall CNT
Acc. Vol: 5 kV
Mag.: ×50,000



Specimen: ZnO particles
Acc. Vol: 5 kV
Mag.: ×20,000

nce.



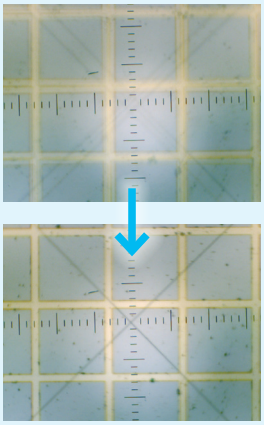
Shift the field of view

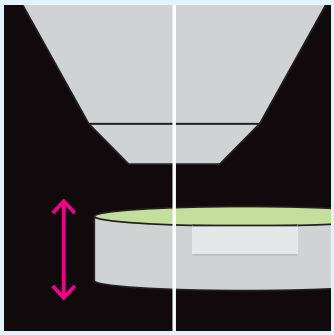
Click the Stage Navigation image to move to the area for analysis.

Auto2

Optical microscope Auto Focus button 

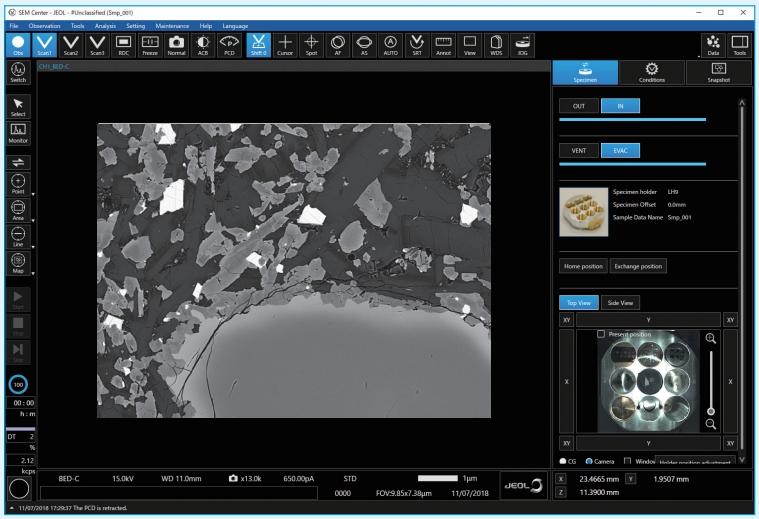
The height of the specimen stage is adjusted and the optical microscope is focused automatically. The stage height is adjusted to the EPMA analysis position.





Auto3

SEM observation Auto buttons 



Start SEM observation

The Auto functions for SEM observation, provided by a new and improved system with higher accuracy and faster degree of capabilities, enable clear images to be quickly acquired.
The location you want to be focused can be set using the mouse cursor.

Faster. More Efficient.

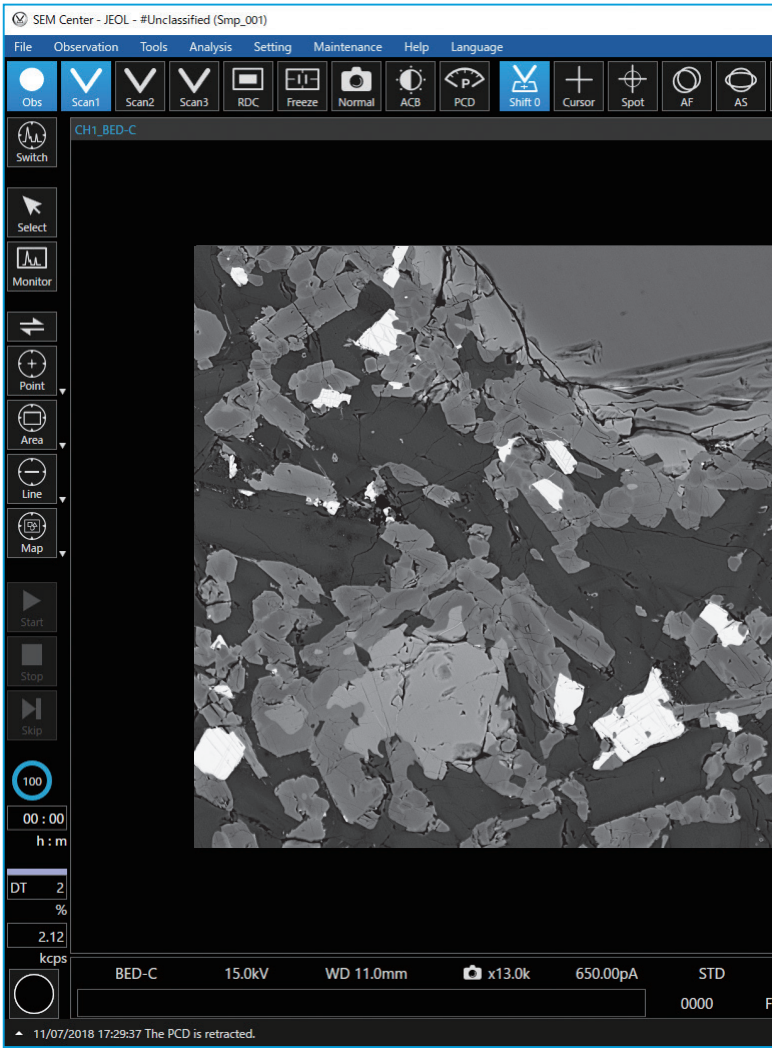
Screening during SEM Observation

Live Analysis

With Live Analysis, the main element analysis results are displayed in real-time with simultaneous display of a live SEM image. You can determine whether elements of interest are present in the observation area.

Features of Live Analysis

- X-ray spectrum is always displayed.
- Display of the main constituent elements for finding unexpected elements.
- Alert display of elements of interest.
- Element registration of detected elements with Easy EPMA.



WDS/EDS Integration System

Highly efficient and accurate elemental analysis with simple operation

● Combined WDS/EDS advantages for accurate analysis

The WDS/EDS integration system enables efficient, accurate elemental analysis.
Analyses with EDS for main constituent elements and with WDS for trace elements takes advantage of the strengths of both systems for large-area stage mapping and efficient data acquisition in quantitative analysis.
With WDS and EDS both manufactured by JEOL, it offers seamless integration with exceptional operability.

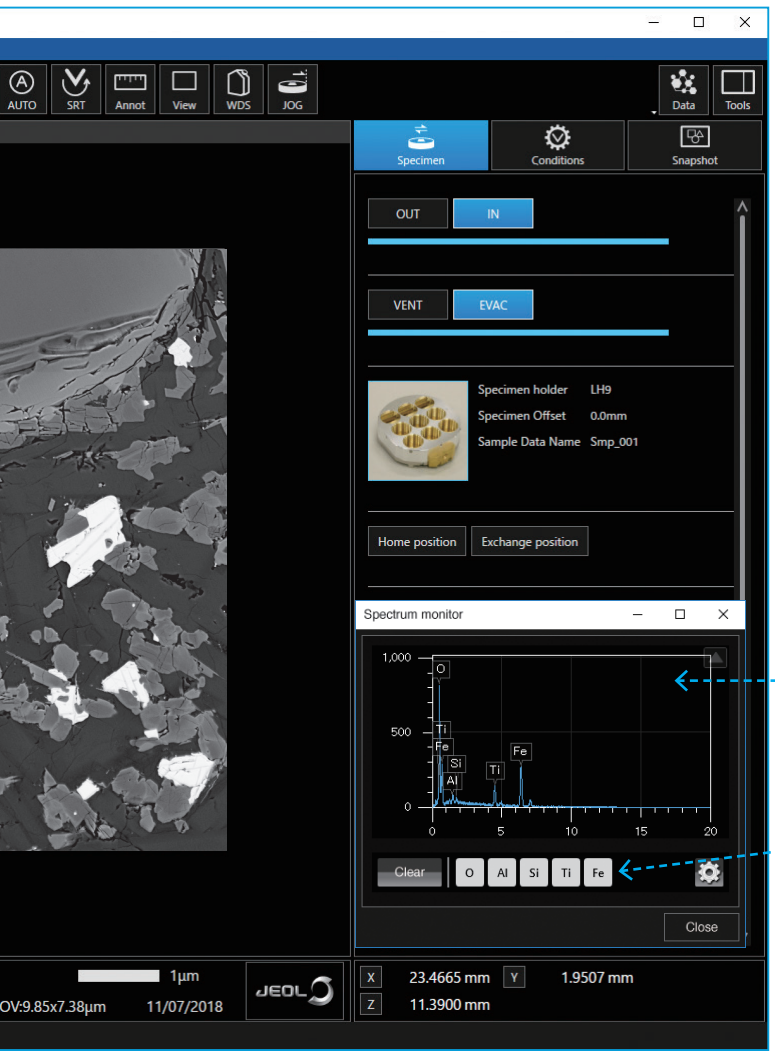
WDS advantages

- ✓ Analysis with up to 5 channels
- ✓ Trace element analysis with large probe currents (1 nA to10 μA)
- ✓ Highly accurate qualitative/quantitative analysis
- ✓ Chemical state analysis with superior wavelength resolution
- ✓ High sensitivity detection for light elements

EDS advantages

- ✓ Simultaneous analysis of multiple elements
- ✓ Probe condition for X-ray analysis same as for SEM image observation
- ✓ Fast analysis
- ✓ Analysis with minimum specimen damage

Combined advantages of WDS + EDS



Spectrum display

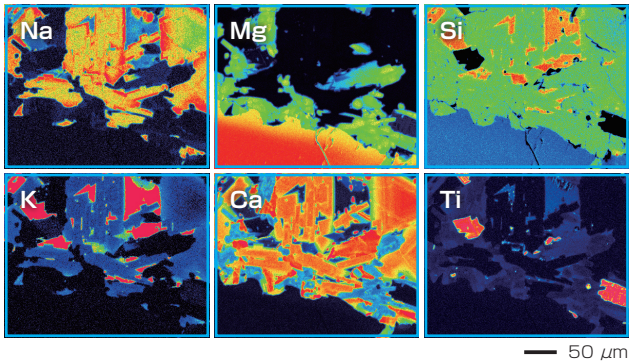
The X-ray spectrum from the measurement area and automatic qualitative analysis results are always displayed.

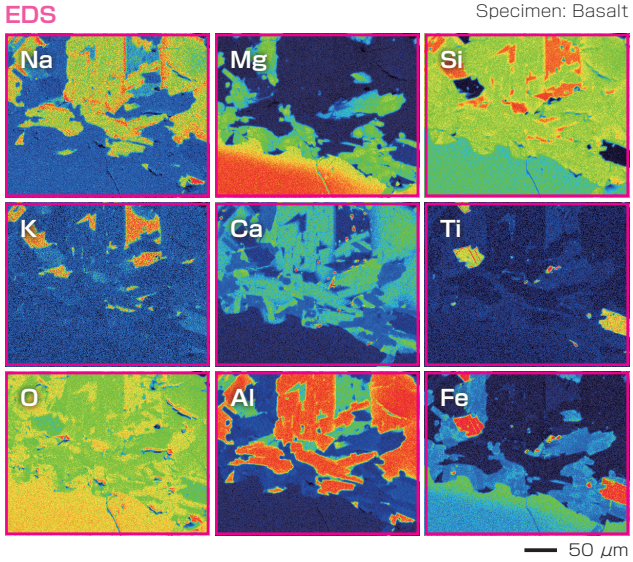
Element display

The main constituent elements detected in the measurement area are displayed.

WDS/EDS combined map

WDS/EDS color maps of basalt. (left: WDS, right: EDS)



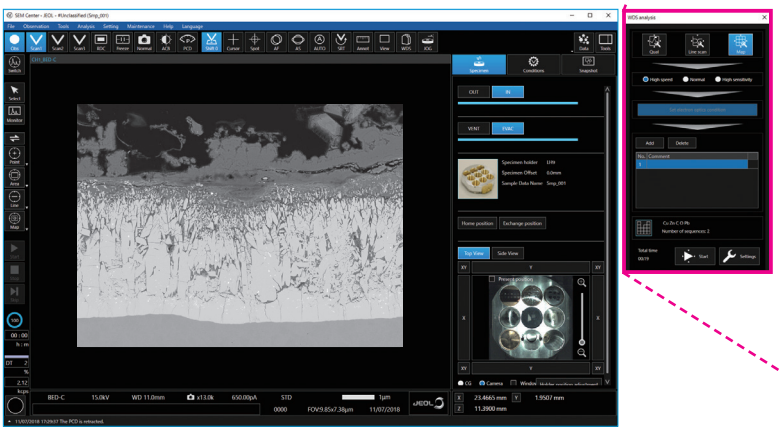


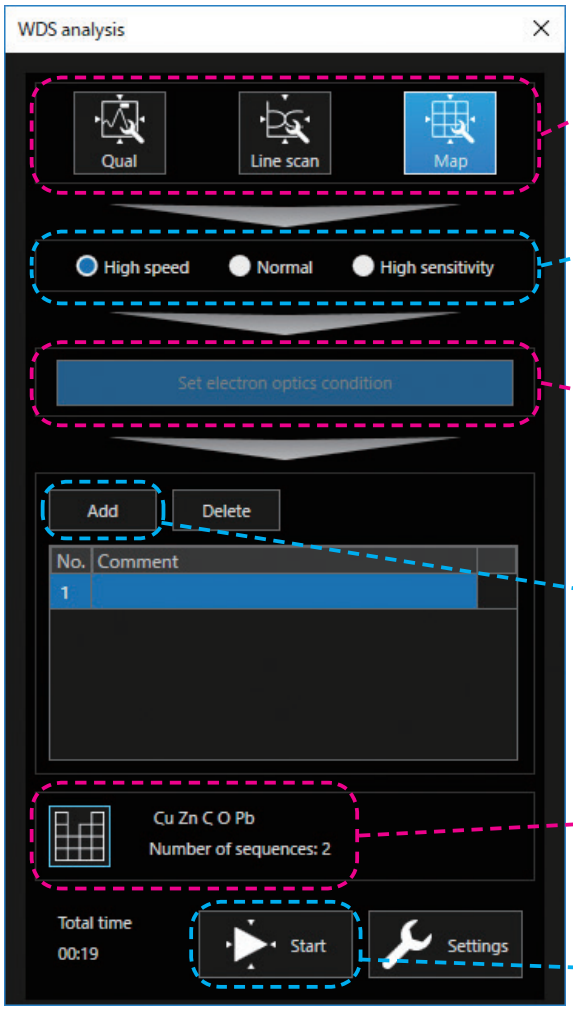
Simpler. More Accurate.

Easy EPMA

What is the best way to operate the EPMA? The answer is Easy EPMA.

For simple elemental analysis, you can control SEM, EPMA, and EDS from one screen.





Specimen: Corrosion-tested zinc plating

Easy Maintenance

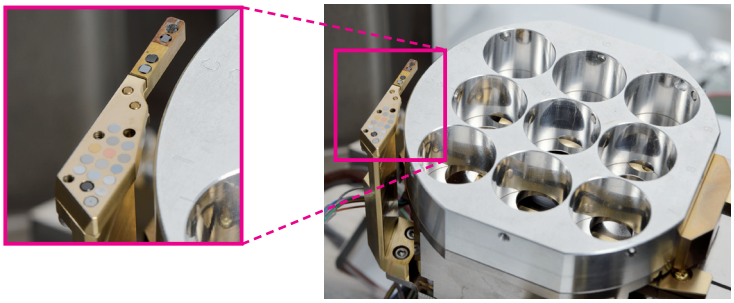
Easy and Reliable Maintenance! Spectrometer calibration & Maintenance notification

Since the maintenance is carried out only when necessary, such as filament replacement and spectrometer calibration, the instrument is maintained in its optimal condition.

● Simplified calibration

The coordinates of the standard specimens incorporated in the specimen stage are pre-registered in the calibration programs for the spectrometers. This eliminates the specimen exchange procedure and the coordinate registration errors. Monthly maintenance is more efficient by performing standard tasks automatically in the nighttime.

Note: Calibrations of Be and N are excluded.



In addition to Easy EPMA, advanced analysis functions are available. There is a Recipe function for repeating analyses under the same conditions, as well as PC-EPMA, allowing all parameters to be set by the user.

Select the desired analysis mode from "Qual", "Line", and "Map".

Select the measurement sensitivity, from "High-speed", "Normal", and "High sensitivity".

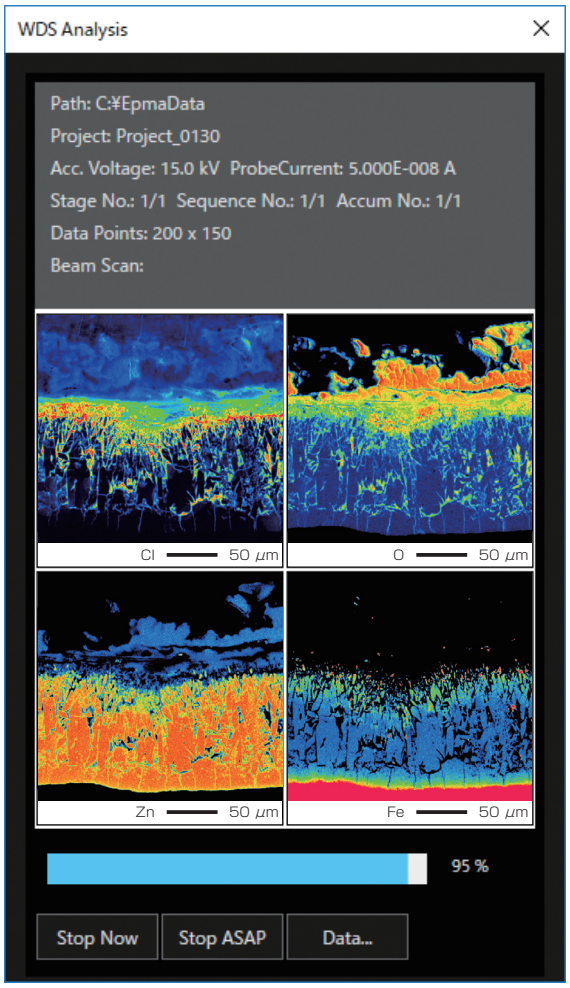
*Using the settings for [Normal] as 1,
for [High-speed] the time is 1/2 and the current is 1,
for [High-accuracy] the time is 2 and the current is 2

Clicking "Set Electron Optics Condition" automatically sets the measurement conditions.

Click "Add" to register the parameters, such as analysis position.

When you click the Periodic table button, you can display the elements detected with Live Analysis and add measurement elements.

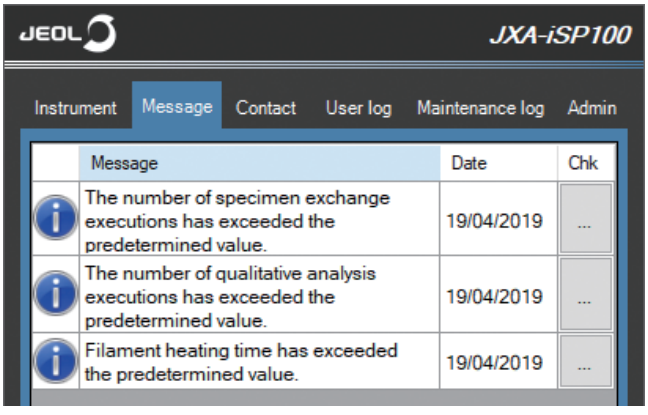
Click "Start" for analysis start.



During data acquisition, you can confirm the status in the Easy EPMA window.

Maintenance notification function in the Customer Support Tool

Maintenance notifications are delivered based on instrument operation logs. In addition to the electron gun, notifications are issued according to the usage status of each system, including the spectrometer, stage, Auto Loader.
Notices are issued to recommend regular maintenance before any malfunction or degradation in performance arises. This support tool reduces instrument down-time.



Actual image may differ from the above picture.

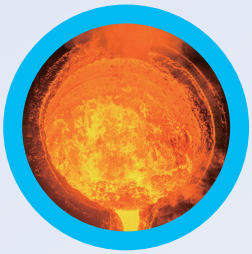
Application Fields of EPMA

EPMA applications

Key Words: Small area, Trace elements, and Large area

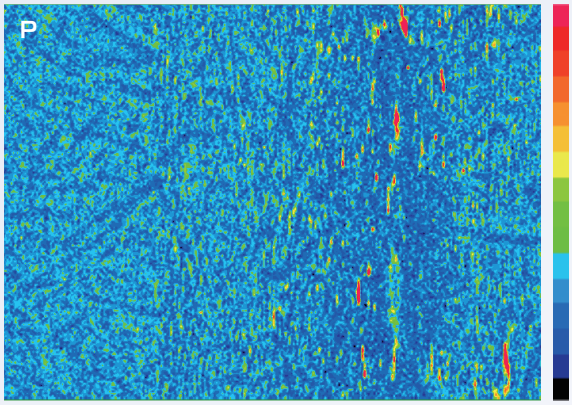
With a high-precision stage for large areas, a high-sensitivity WDS for detecting trace elements, a high-stability electron gun for overnight operation, this innovative EPMA allows for flexible and highly accurate analysis in 24-hour routine work.

Distribution of trace elements in large areas



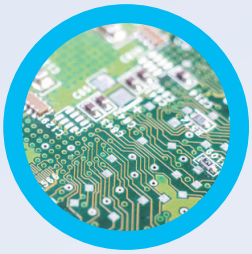
Steel
center segregation

Center segregation arises for some steel materials at the cooling status. Evaluation of the segregation allows for quality and cost control of steels. The figure on the right shows EPMA data of the center segregation in P (phosphorous) in the order of 100 ppm. In order to perform long analysis of the trace elements over a large area in the order of cm, with the ppm order, it is needed for an EPMA equipped with a high-sensitivity WDS, a high-precision stage and a high-stability electron gun.



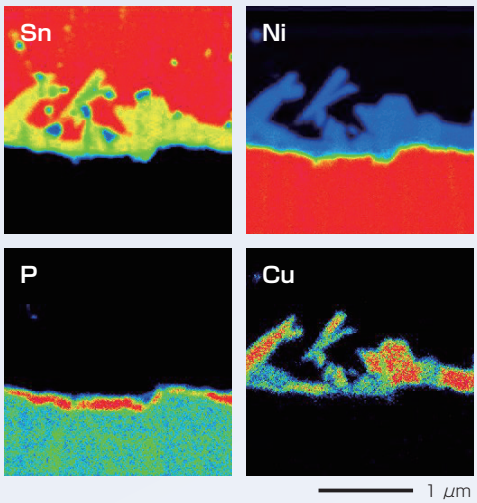
Specimen: Steel
Acc. Vol.: 15 kV
Probe current: 1 μA
Multi crystal addition (three crystals)

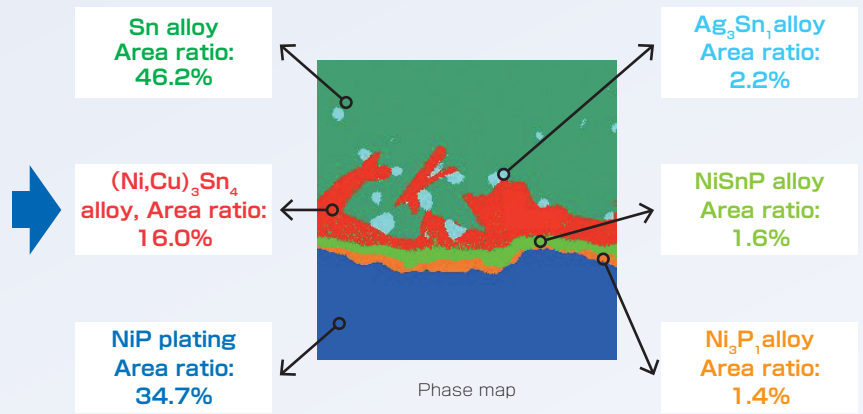
Phase analysis



Phase separation of intermetallic compound in plating

Especially for novice users, examination of the distribution of phases is difficult simply by confirming normal mapping data when the specimen of intermetallic compound in plating has the same elements present but different composition ratio. Since EPMA provides high-accuracy analysis results, its phase analysis function clearly displays each phase.



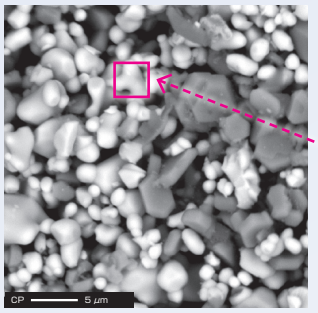


Specimen: Solder plating

Area analysis of multiple elements with a difficulty in separating each peak

Quantitative and area analyses of **Powders** containing **Rare earth elements**

Elements in rare earths are difficult to analyze using EDS due to overlap of each spectral peak. In addition, multiple rare earths are contained in a raw material, necessitating simultaneous analysis of those rare earths in one specimen. An EPMA that comes with multiple WDS with high wavelength-resolution is very effective for analysis of rare earths used for luminescent materials, catalysts and magnets. The rare earths elements are important for age dating by monazite.



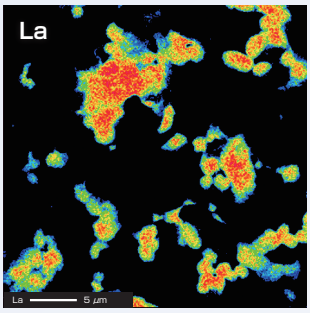
BSE compositional image

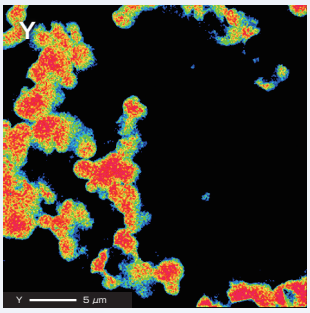
ZAF Metal

Element	Mass(%)	Atom(%)	K(%)
O	26.038	67.7650	13.139
Mg	0.601	1.0295	0.163
Al	3.253	5.0211	1.139
P	5.055	6.7976	2.678
Ca	0.237	0.2463	0.217
Y	0.607	0.2840	0.333
Ba	1.951	0.5914	1.607
La	34.554	10.3583	28.624
Ce	18.414	5.4724	15.436
Tb	9.290	2.4343	6.804
Total	100.000	100.0000	70.142

Norm.F = 1.068

Semi Quantitative analysis

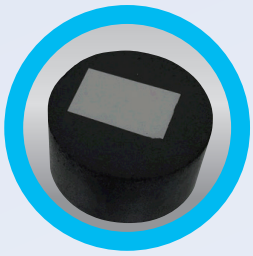




Area analysis

Specimen: Phosphor particles

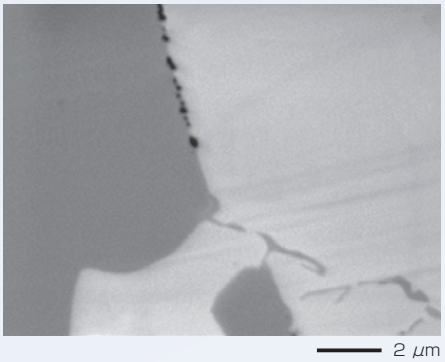
Element concentration variation in small areas



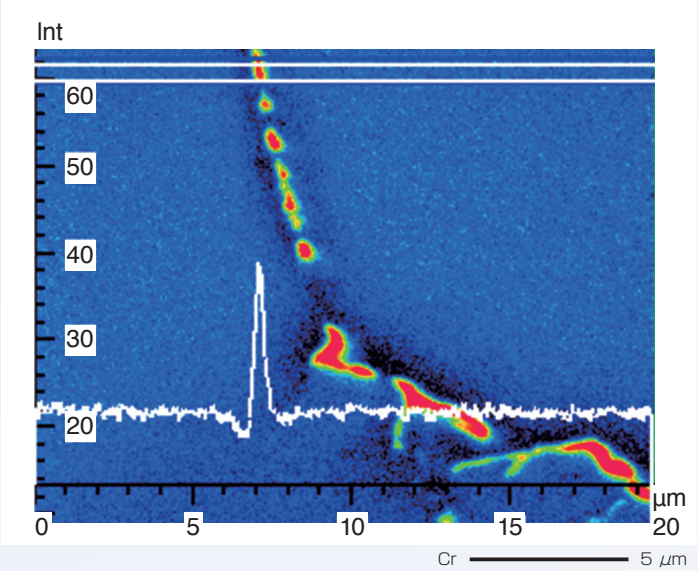
Stainless Steel sensitization analysis

Sensitization is a phenomenon in which Cr carbides precipitate at the grain boundaries in stainless steel, as the Cr in the surrounding areas is depleted. This results in a reduction in the resistance to corrosion at the grain boundaries. Grain boundary segregation, due to sensitization, starts from the areas next to the carbide precipitation, and can differ according to the location, so simultaneous EPMA area analysis of multiple grain boundaries is useful. The image below is a backscattered electron composition image of sensitized stainless steel, with Cr carbides and Cr depletion layers formed at these grain boundaries. The figure below shows a line profile obtained from the area analysis results for Cr. It was possible to confirm the presence of Cr carbide and the surrounding Cr depletion layers.

Specimen : Sensitized stainless steel



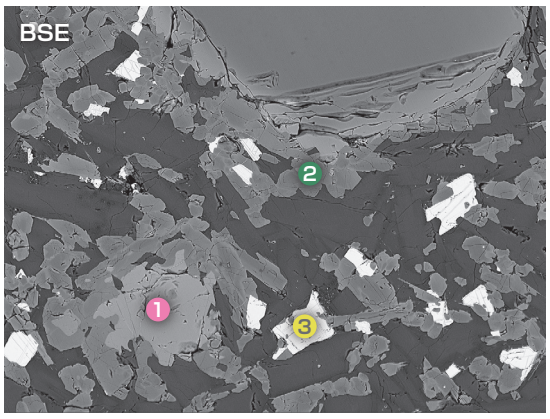
Backscattered electron composition image



Area analysis results

Basalt of Mt.Fuji

Mt. Fuji is the largest volcanic mountain in the Japanese islands located on the Pacific plate subduction zone. For a long time, Japanese cultures and arts have focused on the beautiful sight of Mt. Fuji. Magma released from Mt. Fuji is a basaltic composition and low viscosity from a change through the subduction zone volcanoes. This magma typically forms a cone-shaped mountain. We can obtain the important volcanic information under the surface by careful interpretations of evidences in basalt rocks that appear on the surface.



Specimen Basalt of Mt.Fuji
Accelerating voltage:15 kV　Mag: ×300
Backscattered electron (BSE) image

Estimation of minerals

Results of quantitative analysis of areas indicated in the BSE image on the right. Estimation of mineral species is possible by quantitative analysis.

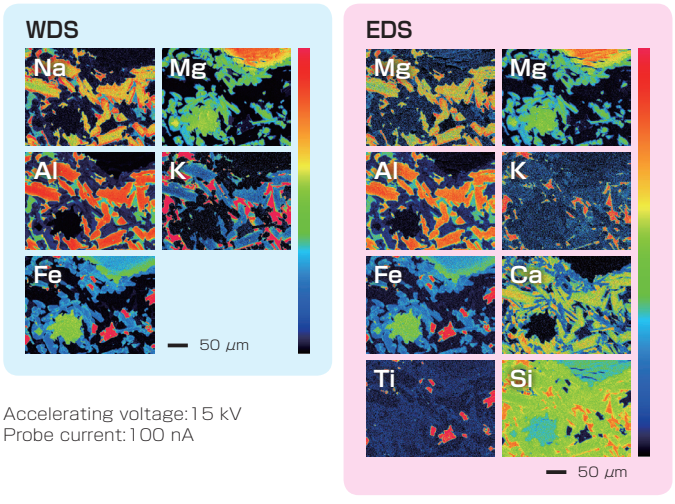
Mass%

	①Olivine	②Pyroxene	③$FeTiO_3$- Fe_2O_3
MgO	32.436	20.101	1.156
Na_2O	-	0.064	-
Al_2O_3	0.049	1.282	2.214
MnO	0.442	0.532	0.444
FeO	30.429	19.698	71.983
CaO	0.199	5.804	0.028
SiO_2	36.625	52.410	0.126
Cr_2O_3	-	0.022	0.110
TiO_2	0.034	0.612	20.990
Total	100.214	100.525	97.051

Accelerating voltage:15 kV
Probe current: 20 nA
Calculated as FeO

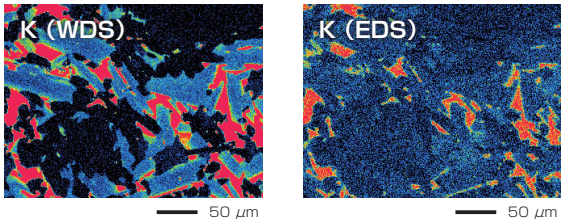
Element map WDS/EDS integration system

WDS and EDS analysis can simultaneously work on the JXA-iHP200F and JXA-iSP100. It can reduce analysis acquisition time of WDS for the trace elements, and EDS' s simultaneous multi element analysis for major elements.



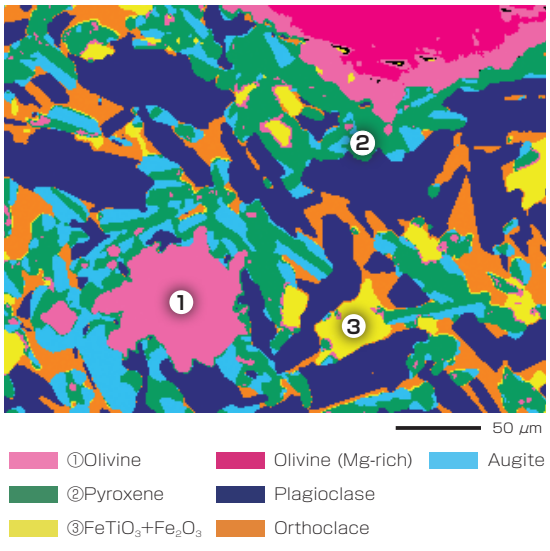
Accelerating voltage:15 kV
Probe current:100 nA

Comparison results of area analysis of potassium between WDS and EDS. WDS (high P/B) can give a clearer indication of concentration difference of small areas compared to EDS.



Distribution of minerals (chemical compound)

"Phase Map Maker" provides us phase images as below figure with a single mouse-click. This function is very useful to evaluate the spatial distribution of minerals (chemical compounds).

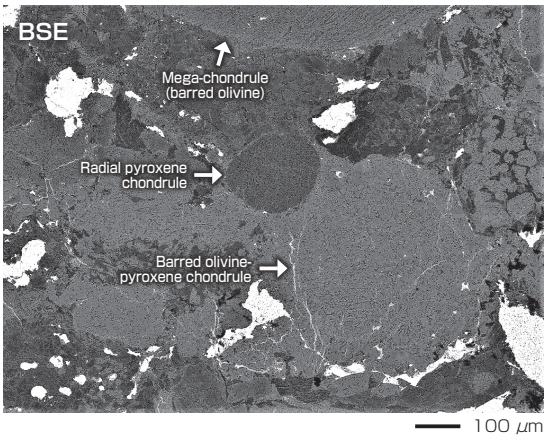


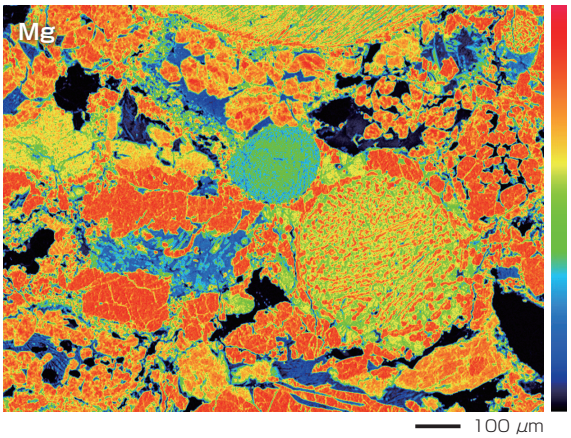
Accelerating voltage:15 kV
Probe current:100 nA

＊Phase map maker is optional.

Area analysis of chondrules of ordinary chondrite: Julesberg (L3.6)

Chondrites are meteorites that provide important clues to understanding the origin of the solar system. They are known as the oldest rocks –their components formed during the early solar system, about 4.6 Ba (billion years ago)- and their abundances of non-volatile elements are close to those in the solar system photosphere.

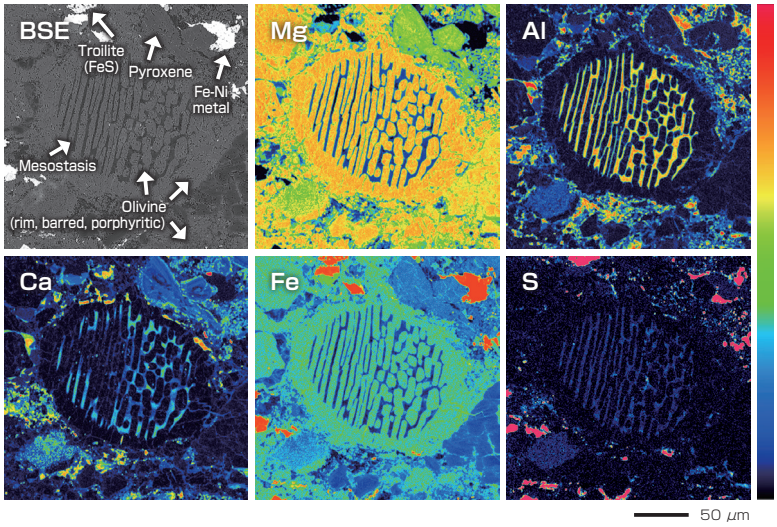


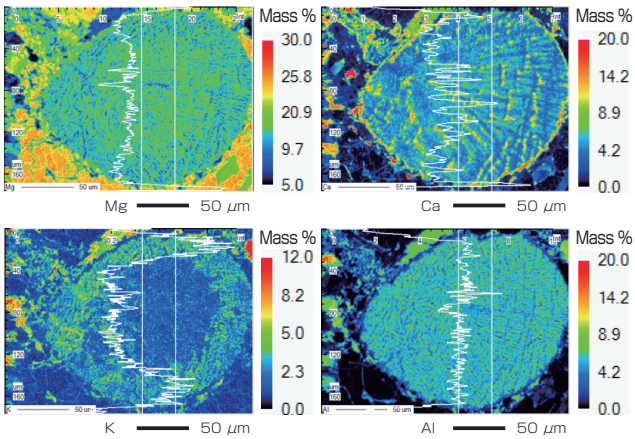


The two images above are backscattered electron (BSE) image and magnesium mapping. Spherical (rounded) components are chondrules. These igneous particles can observe only in the chondrites, they are not present in the earth and moon rocks. Chondrules were melted by flash heating, which subsequently rapidly cooled in the solar nebula. However, the mechanisms of the heating and cooling of chondrule formation have not been completely resolved, which is important for a fuller understanding of the formation of the solar system.

Barred Olivine Chondrule

Well defined barred grain growth of olivine crystals are formed by the rapid cooling process. These textures are typical for barred olivine chondrule and surrounding minerals. Aluminum and calcium are distributed in the mesostasis of the chondrule.





Line profile of radial pyroxene chondrule

The offline "Analysis" tool of the "EPMA Data Processor"* software can easily provide the averaged line profiles for any selected area on the results of a map analysis. This line profile tool is idea for pyroxene chondrule. Line profile analysis is suitable for quantitative comparison of heterogeneous distributions of elements. Being able to analyze offline allows for the EPMA to be used for analyzing other samples, as the user investigates the results.

*EPMA Data Processor

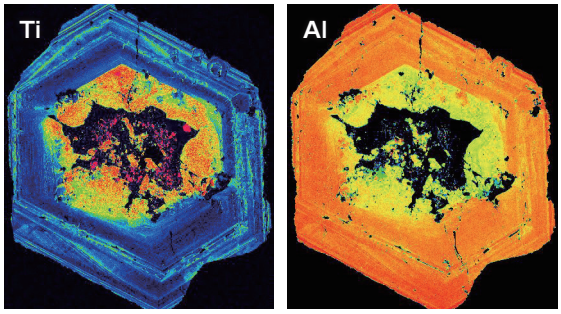
Area Analysis

Powerful area analysis functions

- Allows for analysis of specimen of up to 90 mm square.
- Loadable specimen size of up to 100 mm square.
- The micro-step stage drive enables very small steps (minimum step: 0.04 μm/step, intervals: 0.02 μm/step), allowing for superbly variable stage scan.
- Simultaneous acquisition of multiple data sets, up to 5 elements analyzed by WDS, all EDS spectra (all analyzed elements), compositional image and CL image (option).
- Arbitrary shape map, Random surface map and P-B mode are standard.
- A wealth of analytical functions, including the quantitative map program, the thin-film analysis program and the non-flat surface analysis program.
- Automatic selection of the optimal analysis crystal for composition information, WDS, EDS, and XRF analysis results.
- New quick map function for simple area analysis, which enables you to automatically select proper analyzing crystals by specifying elements.
- Dedicated image processing filter for characteristic X-ray analysis: Auto Color Map (ACM) is a standard function.
- The report function and a variety of export functions enables the data format to be converted depending on various user needs.

Large area analysis

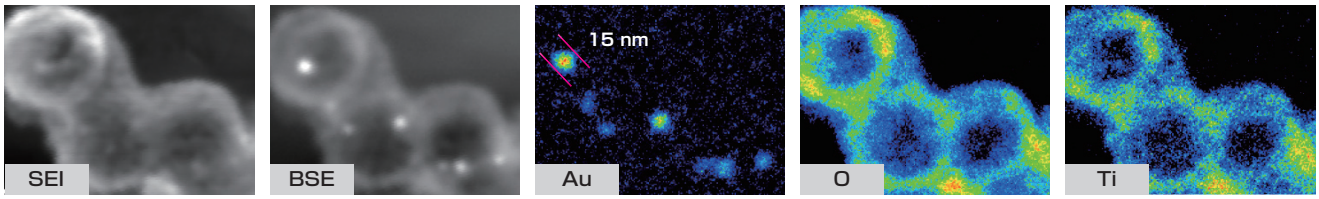
Large area analysis can be performed on areas up to 90 mm square. The use of stage scan enables acquisition of area analysis results with no distortion.



Specimen: Mantle mineral
Specimen courtesy: Dr. Yoshiyuki Iizuka
Academia Sinica

High-magnification, small area analysis

With the JXA-iHP200F equipped with the In-lens Shottky Plus electron gun, a gold particle with a size of 15 nm was confirmed.

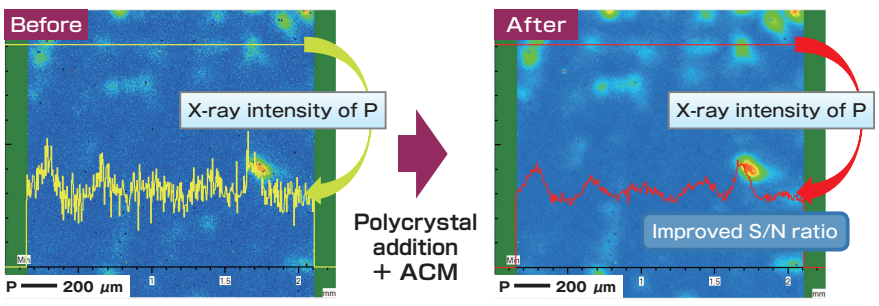


Specimen: Catalyst Mag.: ×300,000 Acc. VOL.: 30 kV Probe current: 7 nA Specimen courtesy: Prof. Dr. Ferdi Schüth, Max-Plank-institute Mülheim

Abundant data processing functions

Multi crystal addition and Auto color map filter (ACM) enabling fast generation of easy-to-understand presentation data!

Figures to right are analysis results for P (phosphorous) of about 100 ppm in steel. The use of multi crystal addition function to sum analysis results using multiple analyzing crystals and ACM allows for acquisition of an elemental map with high signal-to-noise ratio (S/N).



Specimen: Iron steel

A combined use of Polycrystal addition and ACM in this example reduced the measurement time to about 1/10.

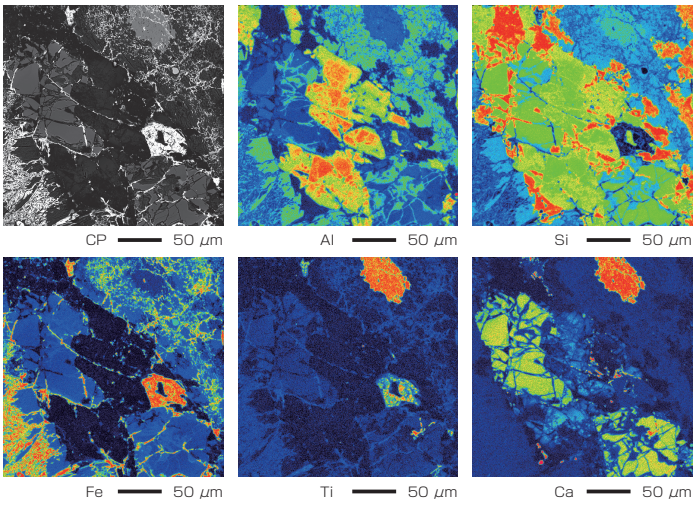
the data you need. A wealth of functions and data processing

Phase analysis～Phase Map Maker*～

Specimen: Basalt

Even with the same elemental components, "phases" with different composition ratio are displayed with a single click

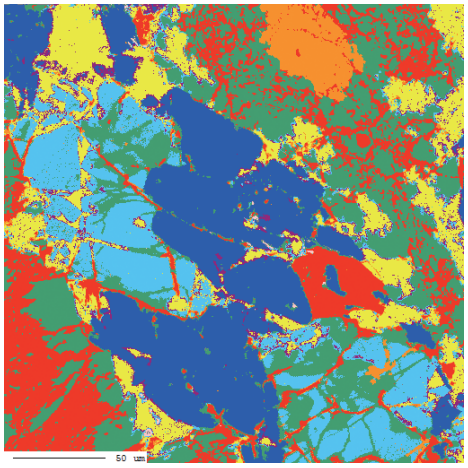
Analyses of multiple elemental maps are difficult to understand. In such cases, using the Phase Map Maker clearly reveals fine structures in elemental distribution maps by displaying "phases".



Normal elemental maps

Detailed analysis with even faster hierarchical cluster analysis

- High-speed cluster analysis (HSCA): Multivariable analysis enabling analysis of trace components.
- Each phase is displayed in pie graph with numerical values.
- For each phase or each sub-cluster, the X-ray intensity, composition, area, and C/V value acquired by the calibration curve method are numerically output.
- Since processing only takes about 10 seconds, there is no difficulty in analyzing data.

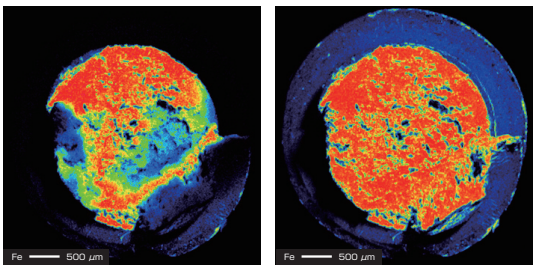


High-speed cluster analysis (HSCA) results

Curved specimen is easy to analyze! Multi-height map providing easy area analysis results with no height effects

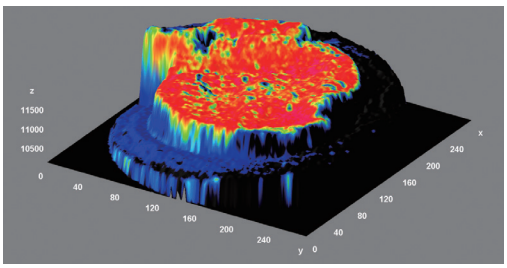
Area analysis results of curved specimens are affected by the variation in the sample height. Analysis with less error is possible by using the multi-height map and specifying the analysis region (Z-axis). This is especially effective for analysis of a large area of several nm square when the coordinate registration is complicated.

Specimen: Cross section of screw fracture



Ordinary map (Fe) Multi-height map

3D display



3D display of an X-ray intensity map using image processing software

*option

More Advanced, Faster, More Accurate Analysis

Qualitative & Quantitative Analyses

Automatic qualitative analysis, Standard-less quantitative analysis

More faster, more accurate analysis

- A newly-developed element detection algorithm and spectral intensity calculation function, for detection of components less than 0.1% and for improved standard-less quantification.
- The spectrum analysis function distinguishes very small differences in the chemical state.
- With analyzing crystals that flip at any position, and independently-driven spectrometers, fast analysis is achieved in a few spectrometers configuration.
- Simplified periodic calibration makes it possible to maintain the optimal condition of the instrument.

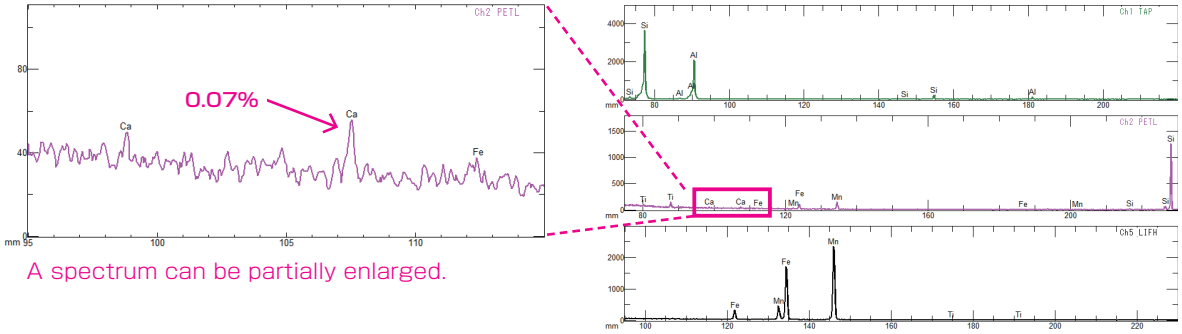
Garnet qualitative analysis results

ZAF Metal

Element	Mass(%)	Atom(%)	K(%)
C	4.191	8.2630	0.985
O	36.916	54.6400	21.131
Al	10.290	9.0315	6.960
Si	17.421	14.6869	12.615
Ca	0.072	0.0425	0.067
Ti	0.209	0.1032	0.186
Mn	18.608	8.0205	15.749
Fe	12.293	5.2123	10.605
Total	100.000	100.0000	68.298

Norm.F = 1.029

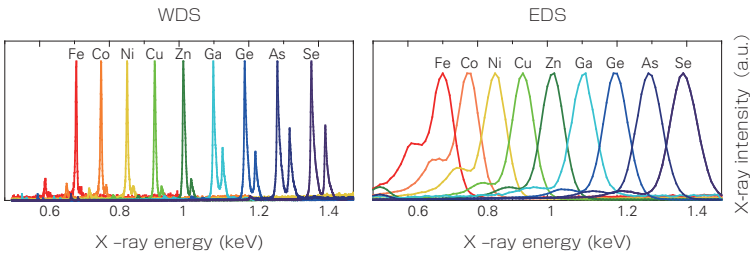
Standardless quantitative analysis.



A spectrum can be partially enlarged.

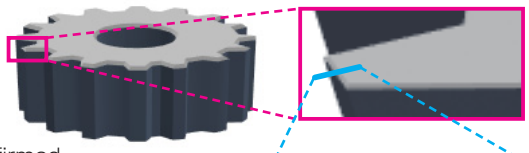
High wavelength resolution WDS

The figures to the right show X-ray spectra of L line for elements near the transition metals. In the EDS spectra, the spectral peaks of neighboring elements overlap. If the K, L and M lines are very close, the problem of overlapping lines becomes more extensive. To the contrary in the WDS spectra, the individual peaks do not overlap, demonstrating high wavelength resolution delivered by WDS.

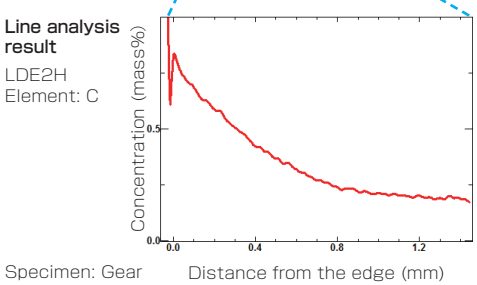


Line Analysis

Line analysis reveals the distribution of elements on a specified line. Very small changes in the element concentrations can easily be confirmed.



- A line analysis method is selected from a stage scan and a beam scan.
- The lines can run in an arbitrary direction on the motor-driven stage.
- The lines can run in an arbitrary direction on the stage in minimum steps of 0.04 μm.
- Line analysis on a random surface* enables acquisition of line analysis results from irregular-shaped specimens with a reduced effect of surface unevenness.
- Allows for a flip horizontal display of the X-axis.



Specimen: Gear

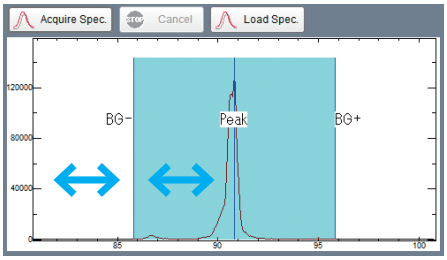
Various Quantitative Analysis Programs

4 types of quantitative-analysis matrix correction methods are available to meet the diverse needs of users

- ZAF correction method (metals/oxides)
- Phi-Rho-Z method*
- Calibration curve method
- Thin-film quantification method *

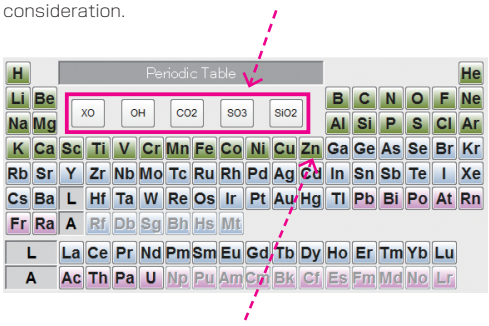
Functions that provide highly accurate and fast qualitative analysis

- Newly-developed Peak Doctor to extract large peak overlaps.
- Since each spectrometer uses an independent drive function and analyzing crystals flip at any position, quantitative analysis is executed at high speed.
- Multiple-point quantitative analysis can be easily performed either along a line or in a grid.
- Enables direct output of quantitative analysis results to Excel® for simplified creation of graphs for multiple-point analysis results.
- Using the composition information and WDS, EDS, XRF analysis results, the optimal analyzing crystal is automatically selected.
- When Probe tracking is used, the reproducibility of the beam irradiation position is 0.08 μm.
- Dating program* (CHIME method) are available.
- Mass absorption coefficients compatible with FFAST (NIST2005).



The background position can be entered from the spectrum display

With the ZAF correction method, the atomic group of CO_2, H_2O and OH, halogen elements, or elements containing negative ions, can be taken into consideration.



Elements can be simply be entered from the Periodic table with a single click.

ZAF Oxide

Element	Mass(%)	Cation	K(%)	ZAF
MgO	43.7222	9.8567	37.2111	1.1750
Na_2O	0.0027	0.0008	0.0024	1.1471
Al_2O_3	0.0094	0.0017	0.0077	1.2309
CaO	0.1415	0.0229	0.1399	1.0117
SiO_2	39.7404	6.0100	33.5683	1.1839
K_2O	0.0004	0.0001	0.0008	0.4746
FeO	16.0627	2.0316	15.9096	1.0096
MnO	0.2546	0.0326	0.2156	1.1813
Cr_2O_3	0.0048	0.0006	0.0139	0.3425
NiO	0.2626	0.0319	0.2376	1.1051
TiO_2	0.0020	0.0002	0.0050	0.0640
Total	100.2033	17.9891	87.3119	Total 0 =24

Mineral (Olivine) quantitative analysis results

Trace Element Analysis Program*

A high-grade analysis program is available to obtain accurate trace-element analysis results

- Automatic qualitative-analysis condition creation function:
  Qualitative analysis conditions are created from compositional information on the object to be analyzed. Settable conditions: X-ray type, analyzing crystal, spectroscopy range, acquisition time and probe current.
- Automatic quantitative-analysis condition creation function:
  Quantitative analysis conditions are created from compositional information on the object to be analyzed. Settable conditions: X-ray type, analyzing crystal, background position, acquisition time and probe current.
- Detection-limit estimation function:
  The detection limit is estimated in advance of the analysis using the standard specimen data.
- Polycrystal addition function:
  The detection sensitivity is improved by adding the measurement results using multiple analyzing crystals.

Enter compo information ➡

Auto setting of optimal conditions ➡ Results

Element	Authentication value (input value)	Peak analysis time (s)	Background position (mm)	Quantitative analysis results(%)
Si	0.66	10	2	0.583
P	0.028	200	1	0.021
Cr	12.12	10	5	11.685
Mn	0.67	10	2	0.683
Fe	85.385	10	5	84.823
Ni	0.91	10	2	0.876
Mo	0.06	200	1	0.027
Total	99.833			98.698

*option

Choose the Electron Gun to Suit Your Application

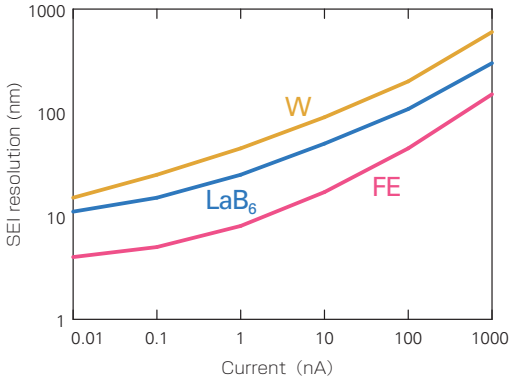
Features of various electron guns

In-lens Schottky Plus FEG on JXA-iHP200F

Thermionic emission guns on JXA-iSP100

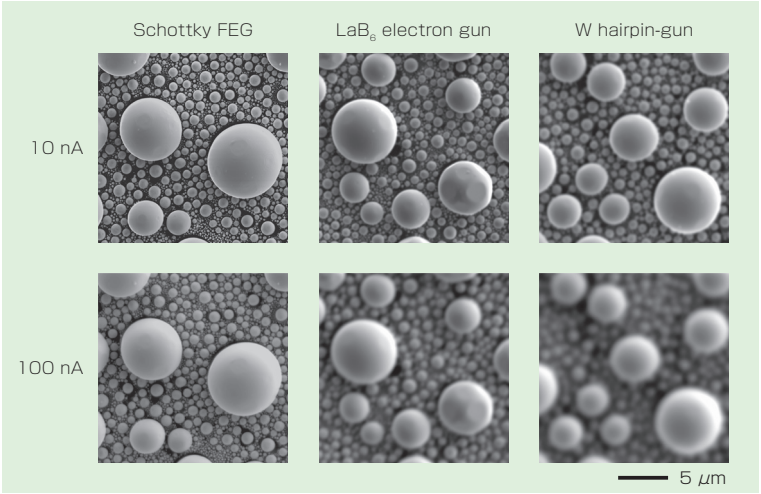
The in-lens Schottky Plus FEG provides high resolution at low accelerating voltages, enabling high spatial-resolution SEM imaging and analysis at high magnifications. Thermionic emission guns, which achieves large probe currents with high stability over long periods of time, are suitable for fast trace-element analysis and for overnight analysis of multiple specimens.

● Secondary electron image resolution provided by various electron guns



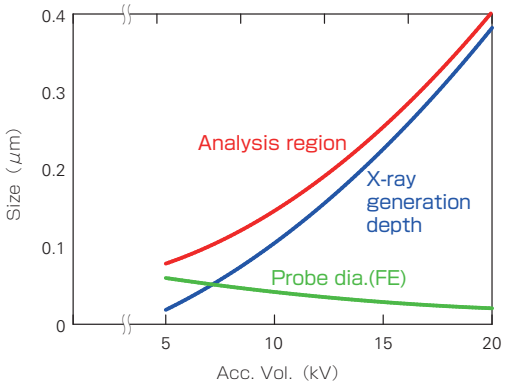
Relationship between the secondary electron image resolution and probe current of various electron guns at 10 kV accelerating voltage.

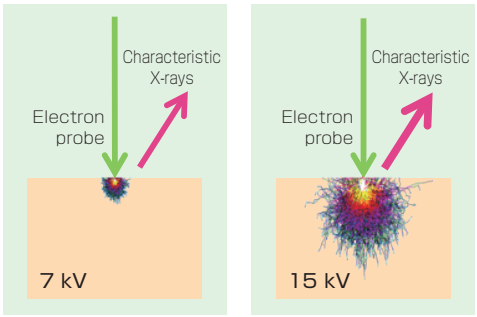
Specimen: Au particles



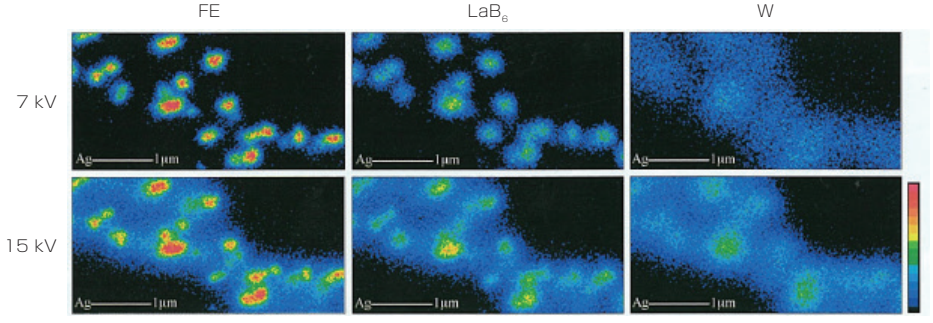
Comparison of X-ray spatial resolution between in-lens Schottky Plus FEG and Thermionic emission guns

In order to analyze sub-micrometer-sized features, improvements in the X-ray spatial resolution are necessary. The analysis region is controlled by the depth of the X-ray generation within the specimen and/or the electron probe diameter. To make the analysis region smaller, the use of both a smaller probe and a low accelerating voltage is necessary.





Relationship between the X-ray generation region, probe diameter of Schottky FEG and analysis region



Specimen: SnAgCu solder

Large current analysis provided by the features of thermionic emission gun

- Detection of trace elements in a short time with high current analysis. (Max. probe current: 10 μA)
- Easy maintenance, for simple replacement of a gun filament.
- No baking required after filament replacement.
- The beam stabilizer provided in the standard configuration maintains current stability over long periods.

± 0.05% / h (W)
± 0.3% /12 h (W)

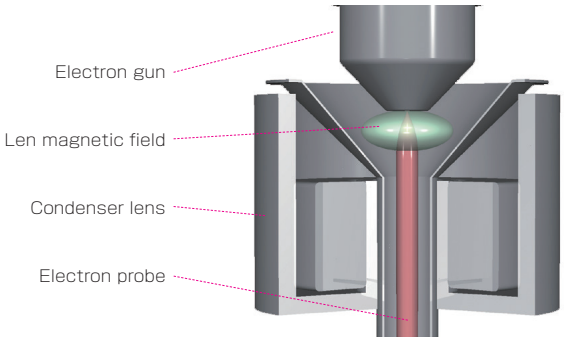
Long-life LaB_6 gun

- Unavoidable filament replacement during long acquisition of elemental maps is reduced.
- Single crystal, long-life LaB_6 tip.
- Unlike the W hairpin-gun, large probe currents and high spatial resolution are achieved at low accelerating voltages.
- The LaB_6 filament can easily be interchanged with a W filament.

New In-lens Schottky Plus FEG

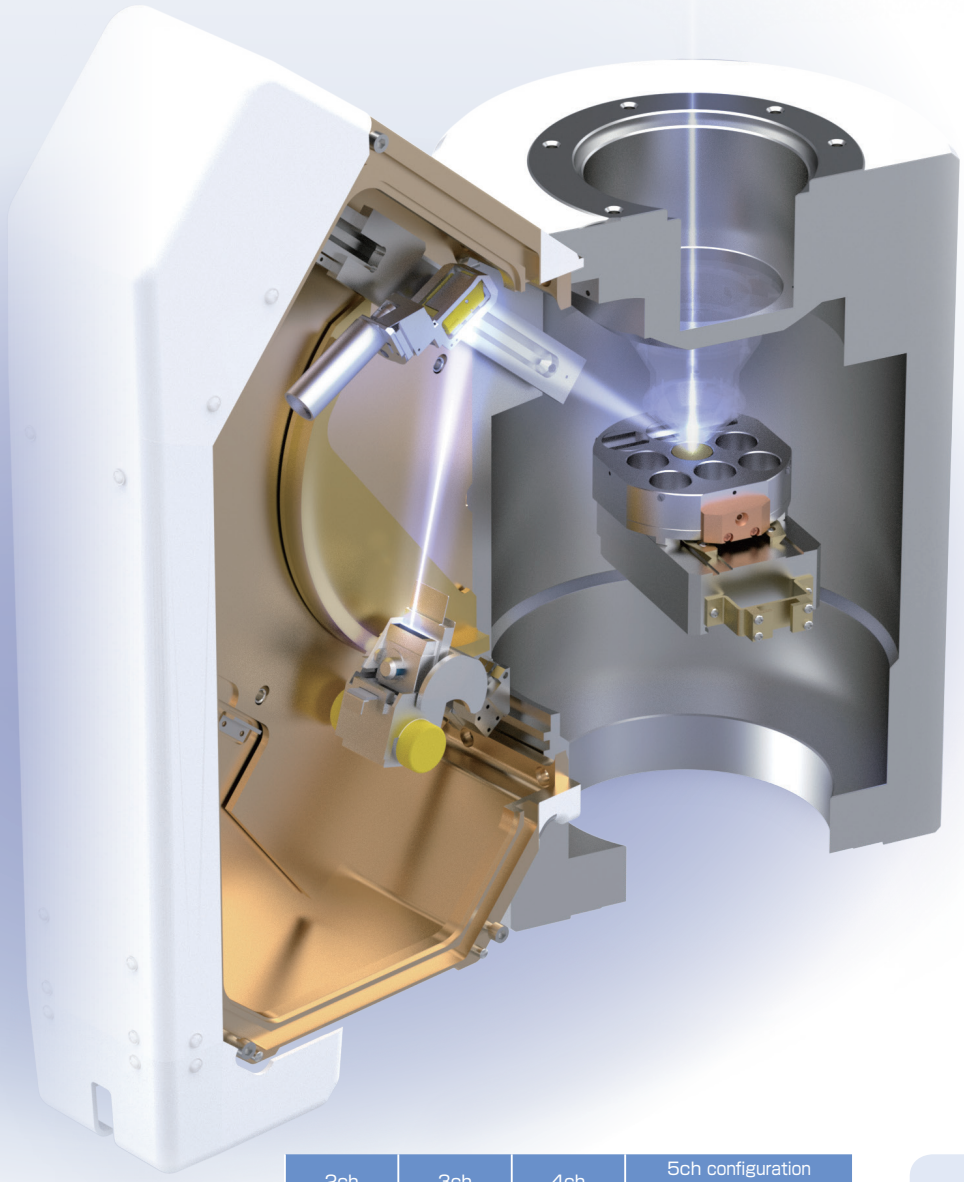
The In-lens Schottky Plus FEG. which combines the electron gun and condenser lens, delivers a stable, small probe with large probe currents. Furthermore, the optimization for EPMA enables large current analysis on the order of μA.

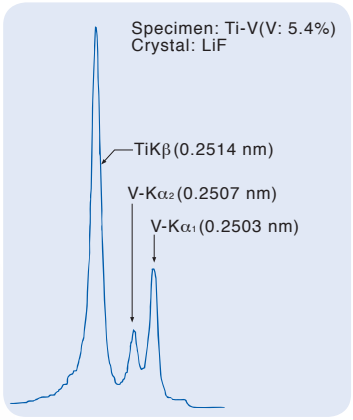
± 0.3% / h
± 1.0% /12 h



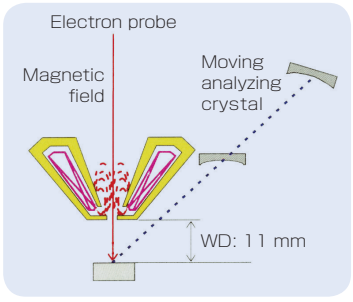
High Sensitivity, High Wavelength Resolution! A

JEOL's X-ray spectrometers, the core of the EPMA, solve many analytical needs. A wide range of spectrometers, including a high-resolution type, a high X-ray intensity type, and a four-crystal type, can meet a variety of research requirements. Also, a range of analyzing crystals are available, which cover the Periodic Table from Be to U. To analyze very light elements, sophisticated synthetic superlattice analyzing crystals, with higher intensities than conventional ones, are available. The analyzing crystals can flip at any position.





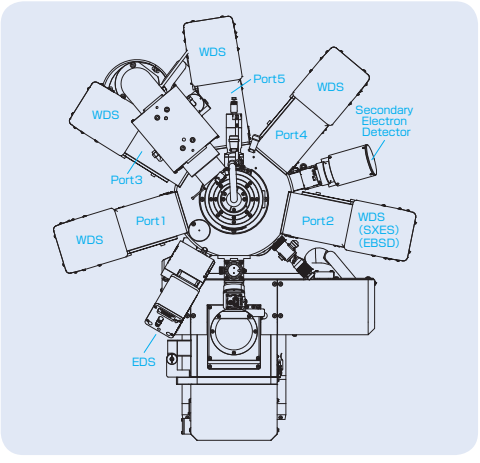
High wavelength resolution data, a feature of the XCE type WDS (Rowland circle radius: 140 mm)



Motor drive for crystal

	2ch configuration	3ch configuration	4ch configuration	5ch configuration	
				Light element field	Heavy element field
1ch	PET	PET	TAPH	LDE1H	TAPH
	LIF	LIF	LDE2H	LDE2H	LDE2H
2ch	TAP	TAP	TAP	TAP	TAP
	LDE2	LDE2	LDE1	LDE1	LDE1
3ch		PETH	PET	TAPH	PET
		LIFH	LIF	LDE6H	LIF
4ch			PETH	PETH	PETH
			LIFH	LIFH	LIFH
5ch				PETH	PETH
				LIFH	LIFH

Configuration of analyzing crystals



WDS/EDS Installation position

Wealth of Analyzing Crystals

Spectrometer types and features

Name	Model	Abbreviation	Number of crystals	Crystal exchange	Features
XCE-type X-ray spectrometer	XM-36010XCE	XCE	2	Any position	High wavelength resolution
L type X-ray spectrometer	XM-36030L	L	2	Any position	Improved count rate while maintaining the high wavelength resolution
H-type X-ray spectrometer	XM-36020H	H	2	90% of full range	High count rate
XCE-type 4-crystal X-ray spectrometer	XM-36040FCS	FCS	4	90% of full range	Up to 4 crystals can be mounted B to U can be analyzed

Analytical ranges of crystals

K-line (Kα or Kβ) L-line (Lα or Lβ) M-line (Mα, Mβ or Mγ)

Name	Crystal	2d (nm)	Analysis elemen 10Ne 20Ca 30Zn 40Zr 50Sn 60Nd 70Yb 80Hg 90Yh	Applicable spectro-meter	Rowland circle
LIF	LiF	0.4027	19K – 37Rb, 48Cd – 92U	XCE	140R
LIFL			19K – 35Br, 48Cd – 87Fr	L	
LIFH			20Ca – 31Ga, 50Sn – 79Au	H	100R
PET	PET	0.8742	13Al – 25Mn, 36Kr – 65Tb, 70Yb – 92U	XCE	140R
PETL			13Al – 24Cr, 36Kr – 62Sm, 70Yb – 92U	L	
PETH			14Si – 22Ti, 37Rb – 56Ba, 72Hf – 92U	H	100R
TAP	TAP	2.5757	8O – 15P, 24Cr – 41Nb, 57La – 79Au	XCE	140R
TAPL			8O – 14Si, 24Cr – 38Sr, 57La – 75Re	L	
TAPH			9F – 13Al, 24Cr – 35Br, 57La – 70Yb	H	100R

LIF: Lithium fluoride (200), PET: Pentaerythritol (200), TAP: Phthalic acid thallium (100), XCE: (XM-36010XCE), L: (XM-36030L), H: (XM-36020H)

List of crystals for the detection of very light elements

In 1986, JEOL developed the first practical artificial superlattice analyzing crystals for EPMA in the world. Since then, continual improvements have been made to these crystals, leading to high-sensitivity synthetic multi-layered analyzing crystals. In addition, a high-reliability pulse height analyzing system and high-reproducibility spectrometers have made JEOL WDSs the leading tools for light-element analyses. The LDE1 and LDE2 analyzing crystals have wide analytical ranges and versatility. The LDE5H achieves very high X-ray intensities for N, 30 times higher than the STE crystal. The LDE6H is very effective for analyzing trace concentrations of C and B.

Name	Lattice spacing: 2d (nm)	Analyzable element						Applicable spectro-meter
		Be	B	C	N	O	F	
LDE1	Approx.6			△	◎	◎	◎	XCE FCS
LDE2	Approx.10		◎	◎	◎	○		
LDEB	Approx.14.5	◎	○					
LDE1L	Approx.6			△	★	★	★	L
LDE6L	Approx.12		★	★				
LDE1H	Approx.6			△	★	★		H
LDE2H	Approx.10		★	★				
LDE3H	Approx.20	★	○					
LDE5H	Approx.8			◎	★			
LDE6H	Approx.12		★	★				

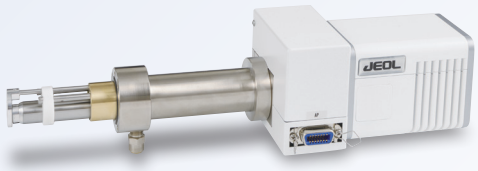
★best ◎better ○good △possible

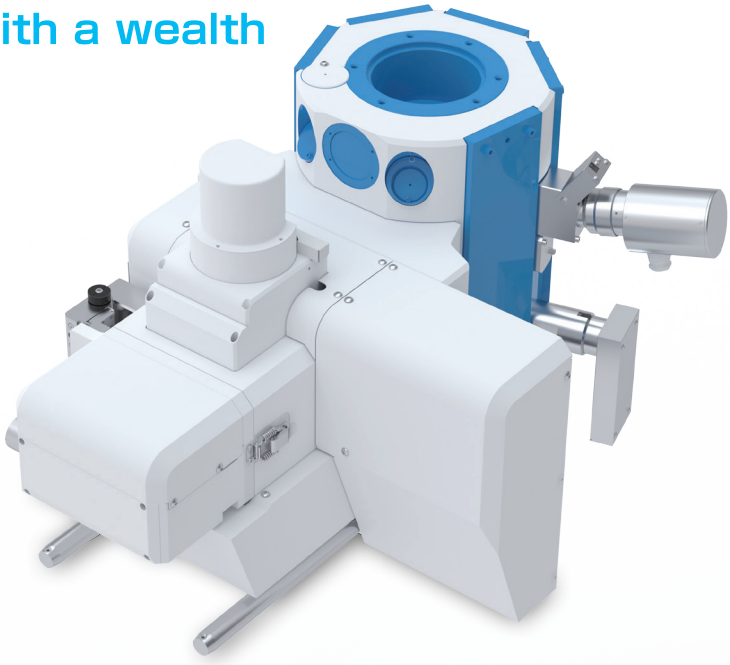
High Extensibility

Support for various analyses with a wealth of attachments

EDS

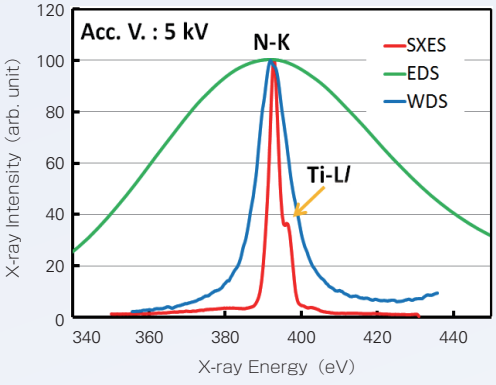
JEOL energy dispersive X-ray spectrometer.
With our Live Analysis function, screening analysis can be performed during search of the analysis area, and also combined EDS/WDS analysis is achieved, thus making analyses more efficient.



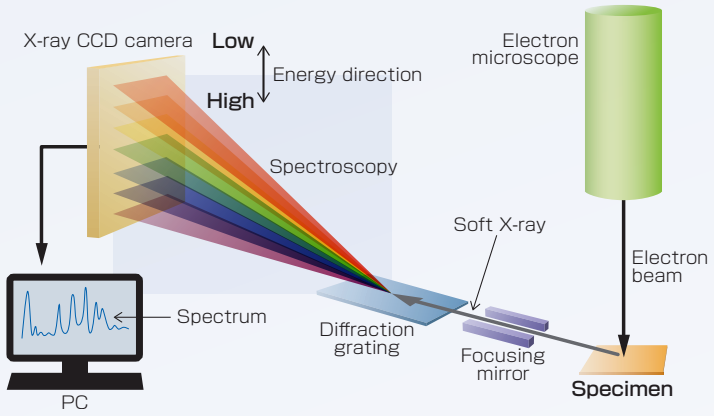


SXES/ SXES-ER for high energy-resolution analysis of soft X-rays

An SXES/SXES-ER spectrometer achieves ultra-high energy resolution, by making use of an aberration-corrected, varied-line spacing diffraction grating and a high-sensitivity, parallel-detection CCD camera. This spectrometer provides superior detection of trace light elements with chemical state analysis.



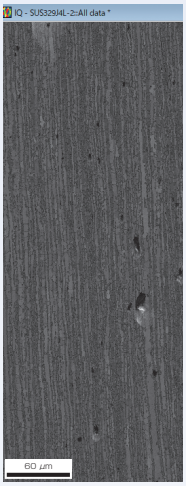
Specimen:
Titanium nitride
Measurement:
EDS, WDS, SXES



Crystal orientation analysis: EBSD

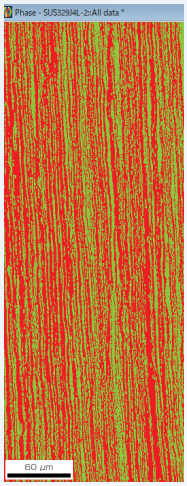
An EBSD (electron backscatter diffraction) system is used to analyze the crystal orientation. A dedicated tilt holder is also available for EBSD. EBSD is effective for analysis of rolled steel materials and characterization of grain boundaries.

Detector



ImageQuality map

Inverse Pole Figure map



Phase map
Red: Ferrite
Green: Austenite

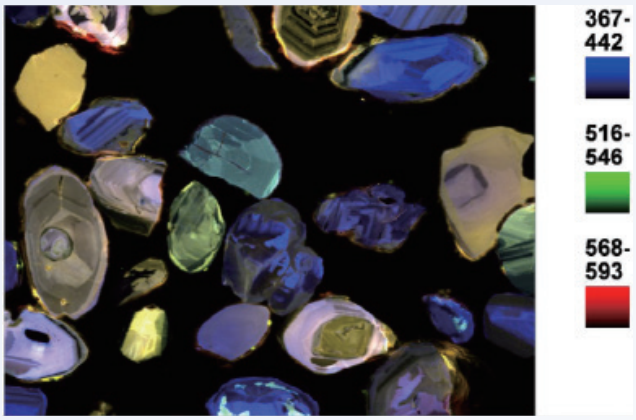
Specimen: Two-phase stainless steel
When the phases cannot be seperated by EDS/WDS, analysis is possible with EBSD.

miXcroscopy™

The same field observed with an optical microscope can be recalled on a SEM image at a micrometer order. Analysis points specified with the optical microscope can be converted into a coordinate table for EPMA point analysis. This is useful for analysis of materials that include color information that can only be observed with an optical microscope, or glass materials that are difficult to observe with secondary electron images. It is also possible to perform coordinate registration for EPMA analysis points more efficiently by transferring the sample to the EPMA after observation with the optical microscope.

Hyper Spectrum Map CL System xCLent

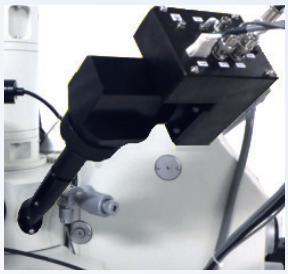
The xCLent is a hyper spectral CL (cathodoluminescence) spectrometer effective for CL mapping and spectroscopy of materials, by the use of an optical microscope built into the EPMA.



Specimen: Zircon

Panchromatic CL

CL detector of panchromatic type. Used for geological high-speed mineral screening.

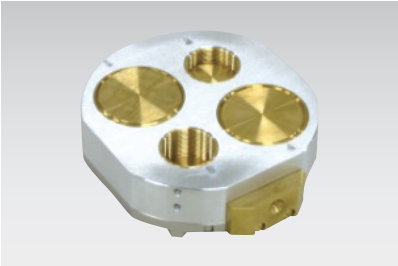


Applicable to all sample types

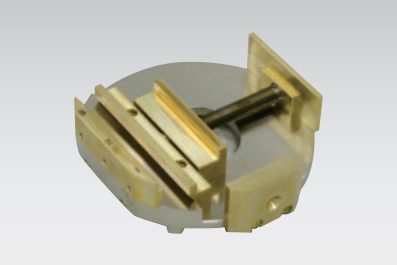
Specimen holders

Large Specimen Holder [LH9]
XM-86LH9
Maximum specimen size:
25.5 mm dia. × 20 mmH × 9

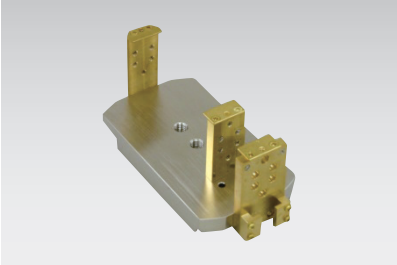
Large Specimen Holder [LH4]
XM-86LH4
Maximum specimen size:
36 mm dia. × 20 mmH × 4



Large Specimen Holder [LH44]
XM-86LH44
Maximum specimen size:
40 mm dia. × 20 mmH × 2,
25.5 mm dia. × 20 mmH × 2

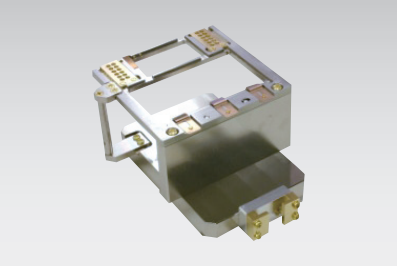


Large Specimen Holder [LH70]
XM-86LH70
Maximum specimen size:
70 mm × 100 mm × 10 mmH
Vise type specimen fixation

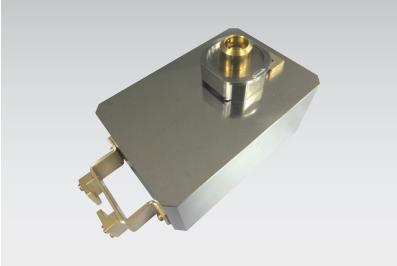


Large Specimen Holder [LH100]
XM-81320 (LH100)
Maximum specimen size:
100 mm × 100 mm × 50 mmH

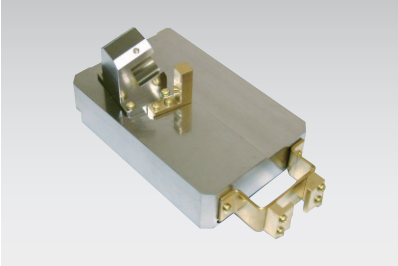
Specimen Rotation Holder
XM-81450 (TRH)
Maximum specimen size:
25.5 mm dia. × 15 mmH
0 to 20° tilt and endless rotation.
Cable kit XM-11420 (CKMH) is required.



OMT holder
28 mm × 50 mm × 1.5 mmH × 3



SEM Compatible Holder Adapter
XM-21410SHA
This holder adapter is used to attach the SEM specimen holder for JEOL SEM* to the EPMA specimen stage.
*Applicable JEOL SEMs includes
JSM-7xxx series, JSM-F100, JSM-IT300 series, and JSM-IT500 series.



EBSD Specimen Tilt Holder
XM-21330STEB
This special-purpose holder is used with the EBSD analysis system. With this holder, the specimen can be mounted at the tilt angle of 70°.

Specifications

JXA-iHP200F Principal Specifications

Detectable element range	WDS: Be*1 / B to U, EDS: Be to U
Detectable X-ray range	Detectable wavelength range with WDS: 0.087 to 9.3 nm Detectable energy range with EDS: 20 keV
Number of spectrometers	WDS: Up to 5 selectable, EDS: 1
Maximum specimen size	100 mm × 100 mm × 50 mm (H)
Accelerating voltage	1 to 30 kV (0.1 kV steps)
Probe current range	1 pA to 3 μA
Probe current stability	± 0.3% / h, ± 1.0% / 12 h*2
Secondary electron image	2.5 nm
Analytical conditions Secondary electron image resolution	20 nm (10 kV, 10 nA) 50 nm (10 kV, 100 nA)
Scanning magnification	×40 to 300,000 (W.D. 11 mm)
Scanning image resolution	Maxium 5,120 × 3,840

JXA-iSP100 Principal Specifications

Detectable element range	WDS: Be*1 / B to U, EDS: Be to U
Detectable X-ray range	Detectable wavelength range with WDS: 0.087 to 9.3 nm Detectable energy range with EDS: 20 keV
Number of spectrometers	WDS: Up to 5 selectable, EDS: 1
Maximum specimen size	100 mm × 100 mm × 50 mm(H)
Accelerating voltage	0.2 to 30 kV (0.1 kV steps)
Probe current range	1 pA to 10 μA
Probe current stability	± 0.05% / h, ± 0.3% / 12 h(W)
Secondary electron image	6 nm(W), 5 nm(LaB_6)*3
Scanning magnification	×40 to 300,000 (W.D. 11 mm)
Scanning image resolution	Maxium 5,120 × 3,840

*1 With analyzing crystal for Be analysis.
*2 Room temperature variation: less than ± 0.5 ℃
*3 LaB_6 is an option.

Installation Requirements

Power supply

Main unit	Single phase 200 V, 50/60 Hz, 4 kVA, Allowable input-voltage fluctuation: Within ± 10% Grounding terminal: 1,100 Ω or less
Computer	Single phase100 V, 50/60 Hz, 1.5 kVA or more

Cooling water

*Cooling water circulator with the temperature control ± 0.1 ℃ accuracy (option) is recommended.

Faucet	1, JIS B 0203 Rc3/8 (R3/8 at hose side)
Flow rate	3 to 3.5 L/min
Pressure	0.1 to 0.25 MPa(Gauge)
Temperature	20 ± 3 ℃
Drain	1 or more (Accommodates O.D. 10 mm hose ×2)

Dry N_2 Gas

Prepared by the customer.

Pressure	0.5 to 0.7 MPa (Gauge)
Gas outlet	ISO7/1 Rc1/4 (internal thread)

PR Gas

Prepared by the customer.

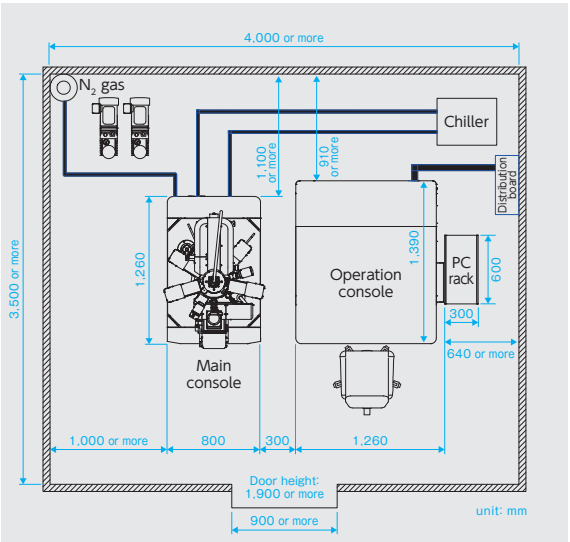
Component	Ar 90%, CH_4 10%
Gas outlet	ISO7/1 Rc1/4 (internal thread)

Installation room

Room temperature	20 ± 5 ℃ (Air conditioner with ± 0.5 ℃ or less variation is reccomended)
Humidity	30 to 60% (No condensation)

*For other conditions, we will conduct a room survey prior to installation and the highest magnification attainable.

Installation Layout (JXA-iHP200F)



Ceiling height:(JXA-iSP100) 1,900 mm or more, (JXA-iHP200F) 2,700 mm or more

*RP: 1 unit for JXA-iSP100
*Specifications and appearance are subject to change without notice.
*EPMA is an abbreviation of Electron Probe Micro Analyzer.

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