



# ZSX Primus II



## X-ray Fluorescence Spectroscopy

**Advanced XRF**  
**Proceed to the next level with tube-above optics**



## Introduction

At last, a WDXRF system designed to reduce both maintenance and downtime; thereby improving your productivity.

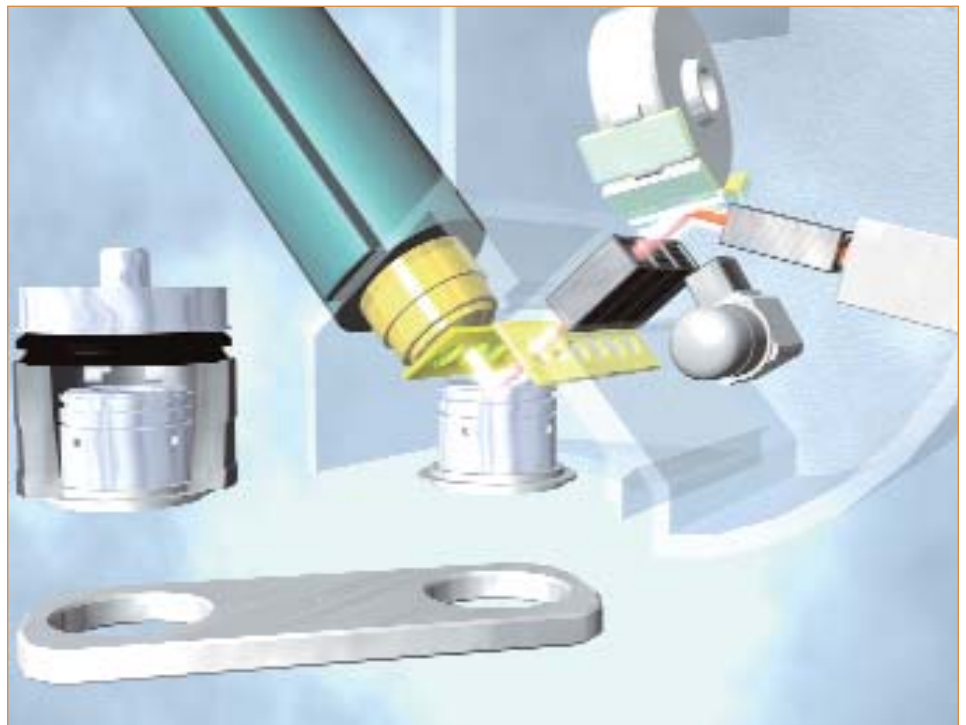
In addition to all the superior features of the **ZSX Primus**, the **ZSX Primus II** offers tube-above optics. With this unique configuration, problems with sample contamination of the optical path are eliminated. Material dropping from the sample surface or residue from sample breakage within the instrument obstructing the X-ray path or interfering with mechanical components within the sample and analysis chambers can now be completely avoided.

The **ZSX Primus II** is capable of analyzing solids, powders, and most liquids with the speed, accuracy, and efficiency that has been proven with the **ZSX Primus**.

With its tube-above design, the **ZSX Primus II** is the most versatile and advanced WDXRF unit available, offering lower cost of ownership and greater return in production.

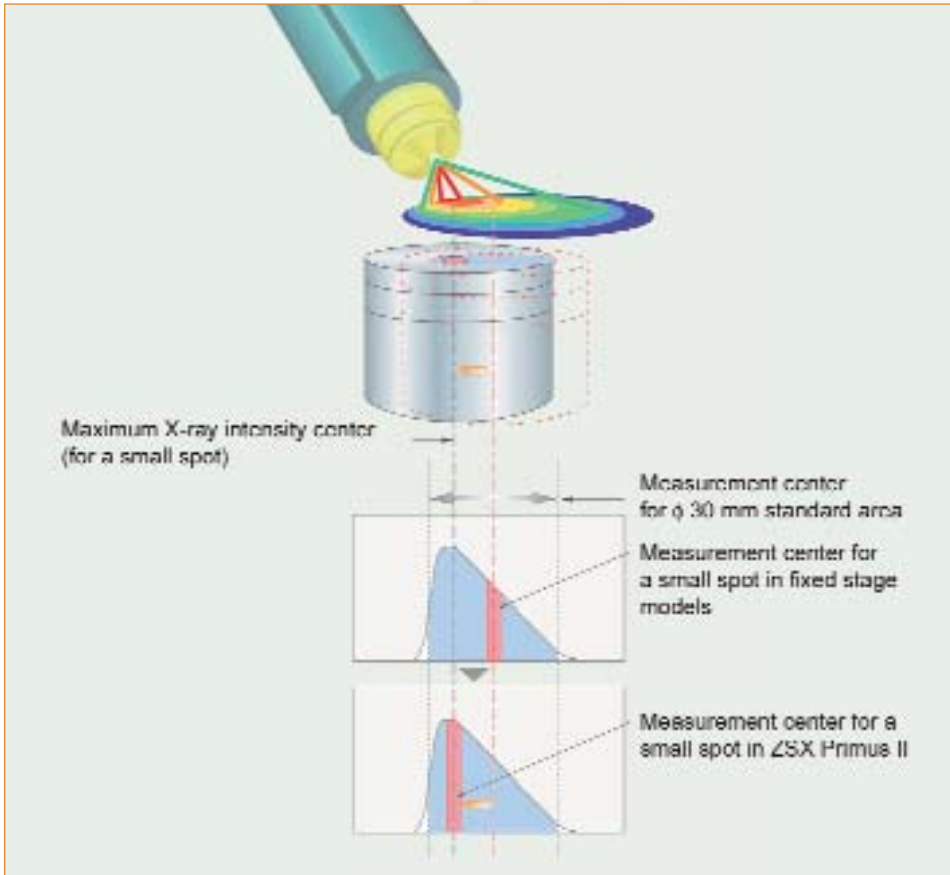
- Tube-above configuration
- Greater sensitivity for ultra light elements
- High intensity response on small spot analysis (500  $\mu\text{m}$ )
- New modular, advanced software
- Mapping/micro analysis
- 30  $\mu\text{m}$  tube window
- Lower operational cost
- Dual pump vacuum system

The Rigaku ZSX Primus II WDXRF Spectrometer is a completely contained X-ray generating system. Interlocks and safety "X-RAY ON" indicators are present to protect operators from exposure to X-rays being produced. The spectrometer meets all North American safety codes and is CE marked. State regulations governing radiation safety and registration of X-ray emitting equipment can be obtained by contacting individual state government agencies.



**Tube-above optics system**

Hardware

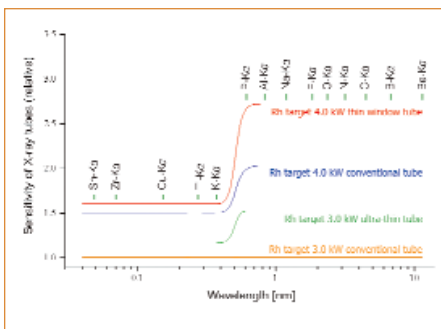


**Point analysis**

Using the CCD image, an analysis with a positioning resolution of 100  $\mu\text{m}$  can be directed to a single point, line, or area with a spot diameter down to 500  $\mu\text{m}$  anywhere on the sample surface.

Material	Remarks
Al	CdL $\alpha$ ; eliminating RhL $\alpha$
Ti	Cr, Fe, Co, Zn
Cu	PbL $\beta_1$ , AsK $\alpha$
Zr	CdK $\alpha$ ; eliminating RhK lines

The r-theta sample stage eliminates the effects of spatial distribution of the primary X-rays, and ensures the highest sensitivity analysis for small spot sizes.



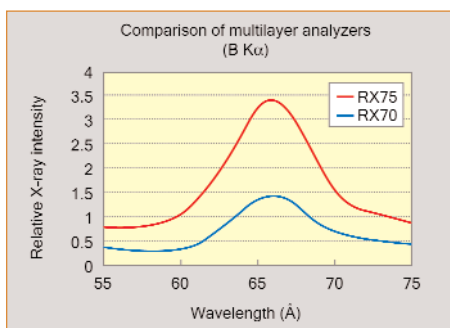
**X-ray tube suitable for light elements**

The 4 kW 30  $\mu\text{m}$  thin-window X-ray tube produces the highest sensitivity for light element analysis of any instrument.

**Primary X-ray beam filter**

Multi-position filter bar efficiently eliminates characteristic tube lines or enhances the signal-to-noise (S/N) ratio.

## Hardware



### New multilayer analyzer

New multilayer analyzers such as the RX75 provide improved sensitivities.

### PAS: Automatic pulse-height adjustment<sup>†</sup>

Pulse-height adjustment automatically carried out.

### ACC system: Automatic F-PC center wire cleaning<sup>†</sup>

Automated F-PC center wire cleaning eliminates downtime for replacement and degrading intensity response.

### Energy and space saving

#### Energy features

- Energy-saving function (automatically turns down tube power)
- Reduction of flow rate for external cooling water {5 L/min (temperature: lower than 30°C)}
- Reduction of P10 gas flow rate (5 mL/min)

#### Space

- Space saving all-in-one design produces a footprint 70% smaller than previous models.

<sup>†</sup>Patent pending

## Powder analysis

### Rapid vacuum system

The dual vacuum system (main chamber and sample loading port), one of the key features of the ZSX Primus series, prevents disruption of the vacuum level in the main chamber during sample loading/unloading. This is essential for light (Cl - Na) and ultralight (Be - F) analysis stability.

### Powder trap

This prevents fine sample particles from entering the vacuum pump system.



### Rapid automatic sample changer

Upgradeable sample changers support 12, 24, 36 or 48 positions. (Also with special option for 96 positions)

## Software

NEW

**Scattering X-ray FP method**

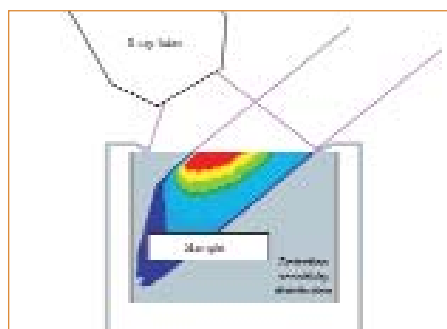
You can now perform an accurate analysis without analyzing major ultra-light element components. Previously, it was difficult to accurately analyze samples such as fly ash, soil, tissue or polymers unless all components were defined properly. With the newly-developed Scatter FP method, scatter lines are used to estimate the effect of these non-analyzed components. Since the geometry effect is considered in the calculation of scatter lines in this method, the amount of sample does not affect analysis accuracy. This method enables you to perform SQX easier and more accurately for oil-type samples and difficult-to-press powder samples.

Analysis example of city waste fly ash

Element	Standard value	Scatter FP	FP (O balance)
Ti	0.851	0.883	0.807
Cr	0.086	0.089	0.082
Mn	0.14	0.13	0.12
Fe	2.13	1.96	1.79
Ni	0.012	0.013	0.012
Cu	0.13	0.13	0.12
Zn	2.6	2.5	2.3
Se	0.0041	0.0041	0.0038
Cd	0.047	0.044	0.042
Sb	0.04	0.05	0.05
Pb	1.09	1.02	0.94

(Loose powder method)

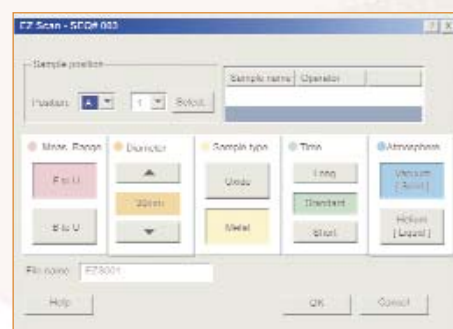
unit: mass%

**Geometry effect**

Short-wavelength X-rays have high penetration depth. The accumulated X-ray intensities vary greatly depending on sample thickness. This uncertainty is known as the geometry effect.

**Software format**

Improved functionality is achieved in the software by combining the new modular format with developed analytical programs.

**Quick and easy set-up: EZ scan**

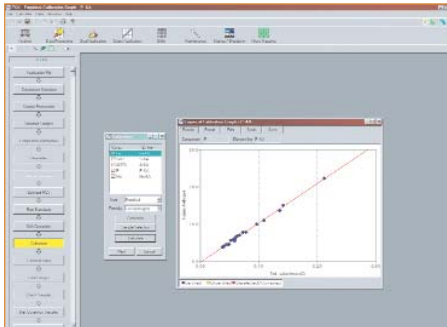
(semi-quantitative analysis)

Rapid, pre-programmed SQX can be performed with minimal effort.

**Fixed angle measurement mode**

A quantitative approach to a qualitative analysis: count peak and background intensities for specified times, thus reducing statistical errors. Background position is automatically determined and collected.

## Software



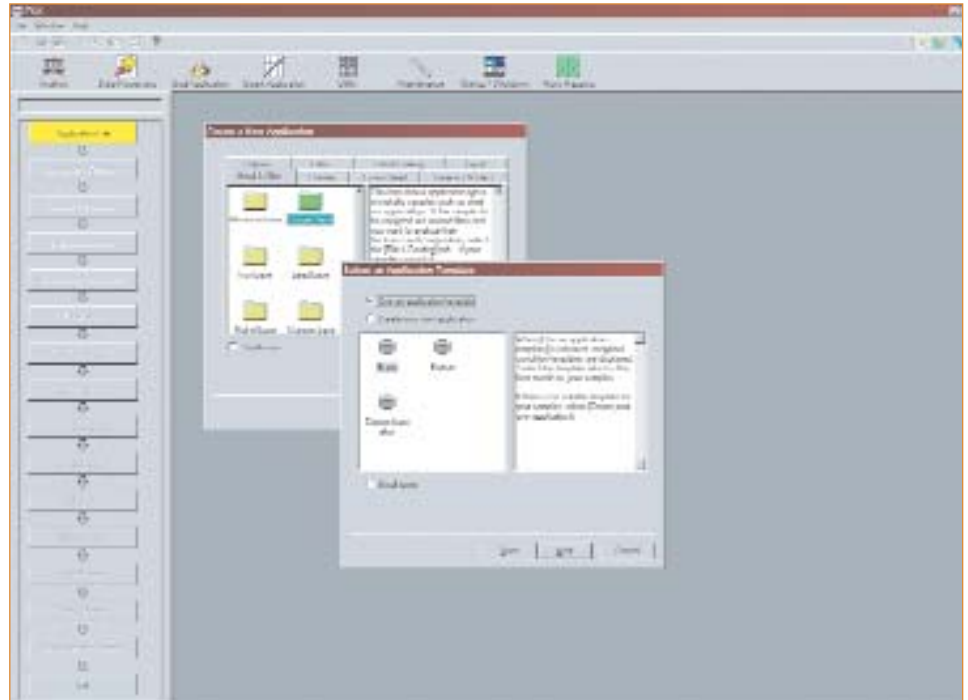
### Flow bar

Using the flow bar, you can proceed through any application in a logical, organized, and easy-to-understand sequence.

### Other featured programs

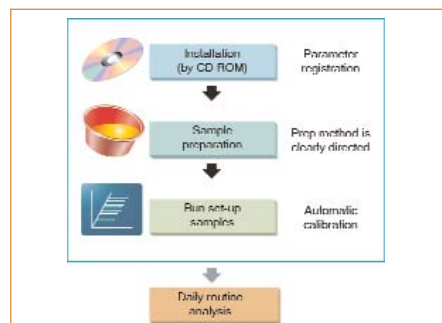
- SQX analysis
- Matching library
- Material judgment
- Theoretical overlap correction
- Fusion disk correction
- Program operation
- Charge correction

**NEW**



### Application template

Analysis made simple: templates containing not only practical measuring conditions but also sample preparation or alternative analytical set-up suggestions.



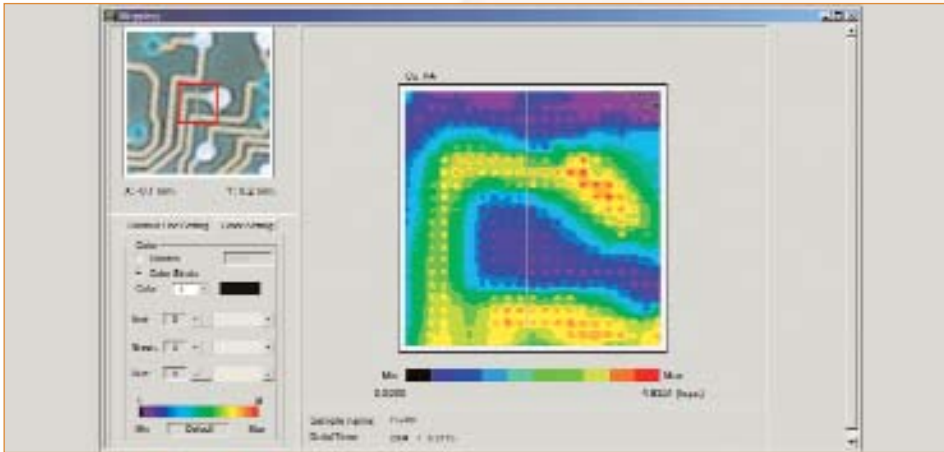
### Application packages

- Low alloy steel
- Special steel, nickel alloy
- Brass, lead brass
- Refractory
  - clay
  - silica
  - high-alumina
  - magnesia
  - chrome-zirconia
  - zircon-zirconia

### Application package

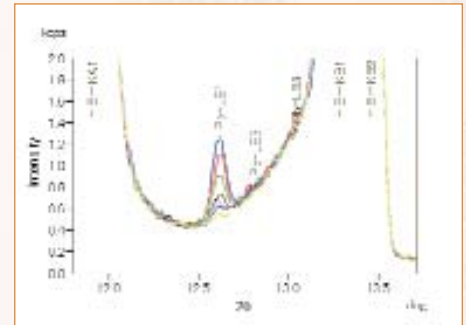
These packages are composed of set-up samples (reference standard samples and drift correction samples), CD-ROM (measurement condition, correction coefficients, etc.) and an instruction manual.

Example applications



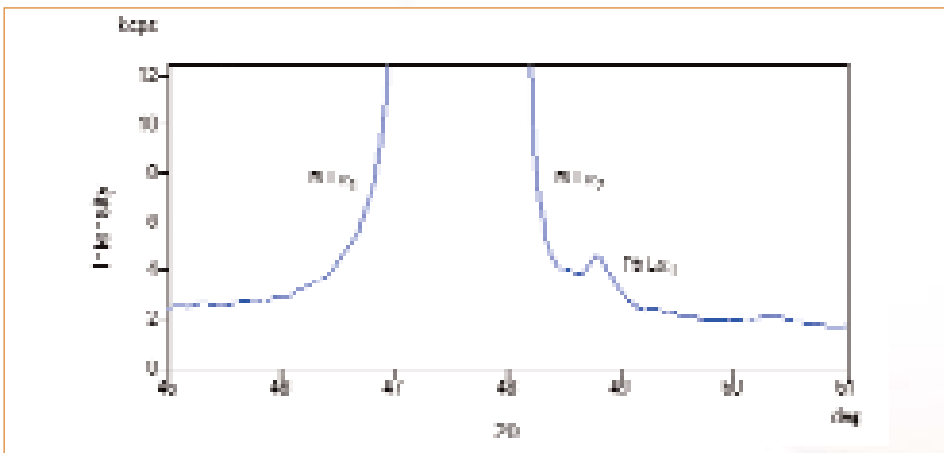
**Mapping analysis for a printed circuit board**

It is possible to perform mapping analysis using a 500 μm diameter spot analysis. The figure above is the result of mapping analysis for Cu traces on a printed circuit board.



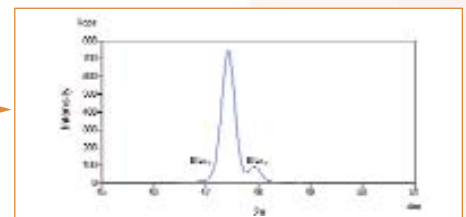
**Pb analysis for Br-rich polymer**

For trace Pb analysis in polymer containing a high Br flame retardant, it is important to separate Pb-Lβ₁ from Br-Kα and Br-Kβ₁. Since wavelength-dispersive XRF (WDXRF) has superior spectrum resolution, it is possible to separate such spectra and analyze trace Pb.



**Pb analysis for Bi-contained Pb-free solder**

The above scan shows evidence of trace Pb in a solder. Resolution and sensitivity are important in this type of analysis. As can be seen from the scan, both are achieved.



Ele.	SQX	Std.
Cu	0.14	0.11
Ag	0.026	0.035
Sn	45	43
Pb	0.12	0.08
Bi	54	56

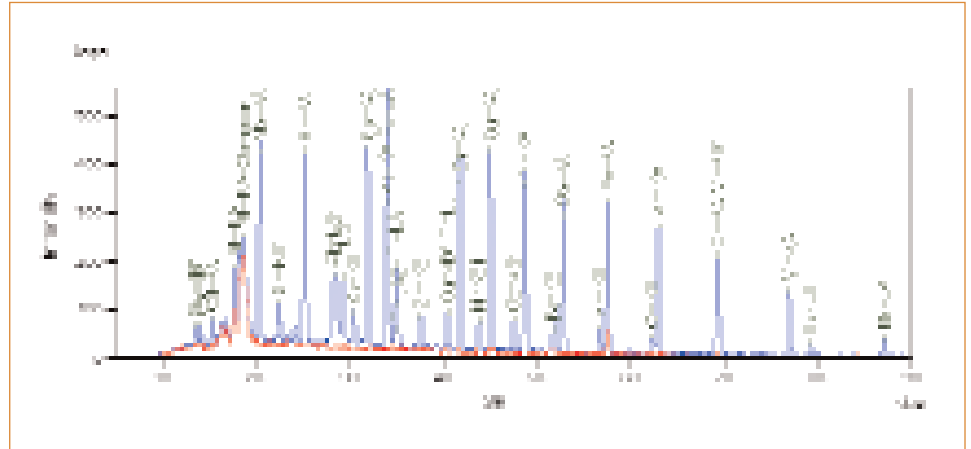
Unit: mass%

## Ultra Carry



### Trace element analysis with Ultra Carry

With the capacity for absorbing a greater aliquot of liquid, the Ultra Carry support can create highly concentrated specimens. In addition, background intensities with Ultra Carry are much lower than those with filter paper. With Ultra Carry you can now analyze ppb-level elements.



This chart is a comparison of a specimen with 500  $\mu$ L SPEX LPC Standard 1 (20 ppm of Pb, As, Cr, Se, Cd, etc) and a blank. The elements are clearly detected due to the very low background intensities.

Ele.	LLD	Ele.	LLD	Ele.	SQX	Std.	Ele.	SQX	Std.
B	30 ppm	Zn	18 ppb	Na	18	20	As	21	20
F	1 ppm	As	16 ppb	P	72	100	Se	19	20
Na	76 ppb	Se	24 ppb	K	92	100	Sr	20	20
P	56 ppb	Sr	25 ppb	V	18	20	Mo	19	20
K	12 ppb	Mo	27 ppb	Cr	20	20	Ag	3	5
V	34 ppb	Ag	152 ppb	Mn	21	20	Cd	20	20
Cr	26 ppb	Cd	182 ppb	Fe	20	20	Sn	18	20
Mn	16 ppb	Sn	40 ppb	Co	20	20	Sb	22	20
Fe	18 ppb	Sb	43 ppb	Ni	21	20	Ba	18	20
Co	17 ppb	Ba	105 ppb	Cu	19	20	Ti	20	20
Ni	20 ppb	Ti	81 ppb	Zn	19	20	Pb	18	20
Cu	19 ppb	Pb	76 ppb						

LLD (Lower limit of detection)

SQX analysis results

Unit: ppm 500  $\mu$ L

Sample was dried

LLD was calculated for 100 s counting time

The above tables demonstrate the LLDs and SQX results (standardless analysis) using Ultra Carry. Close correlation between the resulting values and the standard values is apparent. Using SQX, it is possible to perform screening analysis for liquid samples without standard samples.



Periodic table of elements / Sample preparation accessories

Ia																		IIb																		IIIb																		IVb																		Vb																		VIb																		VIIb																																																																																																																																																																																																					
1	H																2	He																																																																																																																																																																																																																																																																																															
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3	Li																4	Be																5	B																6	C																7	N																8	O																9	F																10	Ne																																																																																																																																																																																									
11	Na																12	Mg																13	Al																14	Si																15	P																16	S																17	Cl																18	Ar																																																																																																																																																																																									
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19	K																20	Ca																21	Sc																22	Ti																23	V																24	Cr																25	Mn																26	Fe																27	Co																28	Ni																29	Cu																30	Zn																31	Ga																32	Ge																33	As																34	Se																35	Br																36	Kr															
37	Rb																38	Sr																39	Y																40	Zr																41	Nb																42	Mo																43	Tc																44	Ru																45	Rh																46	Pd																47	Ag																48	Cd																49	In																50	Sn																51	Sb																52	Te																53	I																54	Xe															
55	Cs																56	Ba																57-71	LA																72	Hf																73	Ta																74	W																75	Re																76	Os																77	Ir																78	Pt																79	Au																80	Hg																81	Tl																82	Pb																83	Bi																84	Po																85	At																86	Rn															
87	Fr																88	Ra																89-103	AC																																																																																																																																																																																																																																																																														
57~71																		57	La																58	Ce																59	Pr																60	Nd																61	Pm																62	Sm																63	Eu																64	Gd																65	Tb																66	Dy																67	Ho																68	Er																69	Tm																70	Yb																71	Lu																																																
89~103																		89	Ac																90	Th																91	Pa																92	U																93	Np																94	Pu																95	Am																96	Cm																97	Bk																98	Cf																99	Es																100	Fm																101	Md																102	No																103	Lr																																																

	LIF-SC		LIF(220)		RX45
	PET		RX4		RX61
	Ge		RX9		RX61F
	RX25		RX35		RX75
	LIF-PC		RX40		RX80



Micro-droplet method (Ultra Carry)



Micro-droplet method (Micro Carry)



Small-sample cell



Small-amount cell



Y-shape sample mask



Scatter-elimination cup (Al and Ti)

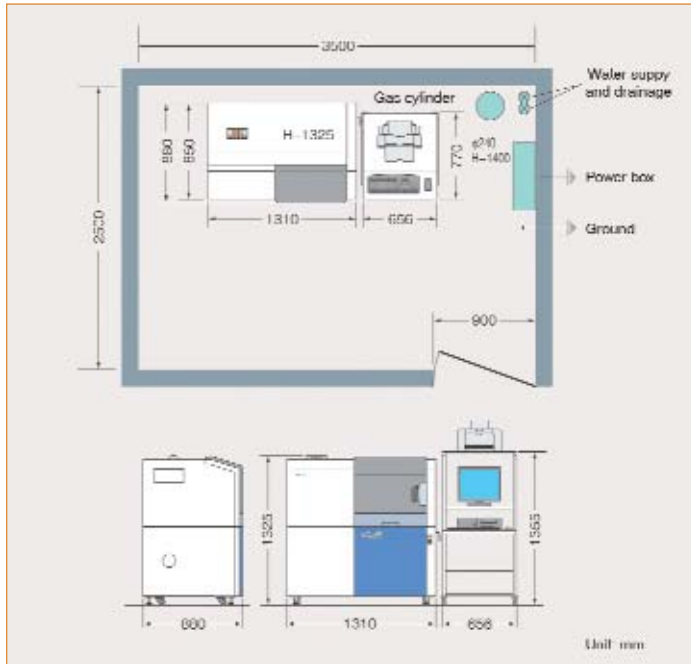


Loose-powder cell



Oil-solidification method

## Installation requirements



**Cement**



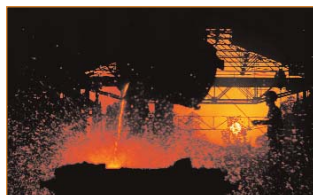
**Geology**



**Recycle**



**Ceramics**



**Steel, alloy**



**Mining**



**Precious metals**



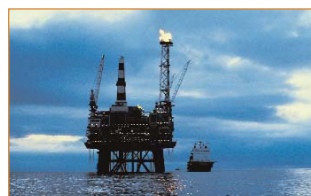
**Glass**



**Electronics**



**Polymers**



**Oil**



**Environmental analysis**

## Specifications

General		Data processor	
Element application	$^4\text{Be}$ - $^{92}\text{U}$	Hardware	Computer: Windows® PC 17" TFT display Color inkjet printer <small>Windows is a registered trademark of Microsoft Corporation in the United States and/or other countries.</small>
Optics	Wavelength dispersive		
<b>X-ray generator</b>		Software	Qualitative analysis: Automatic peak identification Smoothing, background subtraction Quantitative analysis: Matrix correction: Lachance-Traill, DeJongh, JIS, etc. Linear, quadratic and cubic regression, multiple line Fundamental parameter method EZ scan (qualitative) Application template† Analysis area automatic selection† (mask size detection) Peak deconvolution (function and standard profile)† Background fitting (multi-point function fitting, area designation) Fixed precision analysis† Help function E-mail forwarding function Universal standard sample Analysis simulation program (analysis depth evaluation, etc.)
X-ray tube	End window type, Rh target 4 kW or 3 kW		
High voltage generator	High frequency inverter system Maximum rating: 4 kW, 60 kV - 150 mA Stability: $\pm 0.005\%$ (against $\pm 10\%$ input variability) Various safety circuits Energy saving operation (optional)		
Cooling device	Water-to-water heat exchanger (built-in)		
<b>Spectrometer</b>		Optional program	SQX program EZ scan (SQX) Fixed angle measurement† Thin-film analysis Theoretical overlap correction‡ Drift correction library Photoelectron FP method† He atmosphere correction† Sample film correction† Impurity correction† Matching library‡* SQX scatter FP method‡ Material judgment‡ Quantitative scatter FP method Quantitative FP theoretical overlap correction Fusion disk correction (flux evaporation) Charge correction Program operation Time preset analysis Energy saving Auto power off Sample observation mechanism Point/mapping function† Remote control function (VCP)‡
Sample changer	Expandable sample changer (standard 48 samples, 96 optional)		
Sample inlet	Air lock system		
Maximum sample size	$\phi$ 51 mm x 30 mm (H)		
Analysis sample area	Maximum $\phi$ 35 mm		
Sample rotation	30 rpm		
Primary X-ray filter	Al, Ti, Cu and Zr		
Analysis area diaphragm	6 sizes automatic exchange mechanism ( $\phi$ 35, 30, 20, 10, 1 and 0.5 mm)		
Divergence slit	3 positions automatic exchange mechanism Standard resolution, high resolution and ultra coarse (optional)		
Receiving slit	For SC and for F-PC		
Goniometer	$\theta$ - $2\theta$ independent driving mechanism		
Angular range	SC: $5^\circ$ - $118^\circ$ , F-PC: $13^\circ$ - $148^\circ$		
Maximum scan speed	1400°/min ( $2\theta$ )		
Angular reproducibility	$\pm 0.0005^\circ$		
Continuous scan	0.1 - 240°/min		
Crystal exchanger	10 crystals automatic exchange mechanism		
Analyzing crystal	(Standard) LiF200, Ge, PET, RX25 (Optional) LiF220, RX-4, RX-9, RX35, RX40, RX45, RX61, RX61F, RX75, RX80, TAP		
Vacuum system	High speed vacuum system (2 pumps) Powder trap attachment (optional)		
He flushing system (optional)	With partition		
Temperature stabilizer	36.5°C $\pm$ 0.1°C		
<b>Counting/Control system</b>		Maintenance	Automatic pulse height adjustment (PAS)‡ Automatic center wire cleaning (ACC)‡ Automatic tube aging Self diagnosis function Remote diagnosis (optional)
Detector	For heavy elements: SC Counting linearity: 1000 kcps For light elements: F-PC Counting linearity: 2000 kcps Heating-type center-wire automatic cleaning system		
Attenuator	In-out automatic exchanger (attenuation 1/10)		

†Patented

‡Patent pending

\*Options available when SQX is ordered



**Introduction**

**Hardware**

**Software**

**Example applications**

**Ultra Carry**

**Periodic table of elements / Accessories**

**Installation requirements**

**Specifications**



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