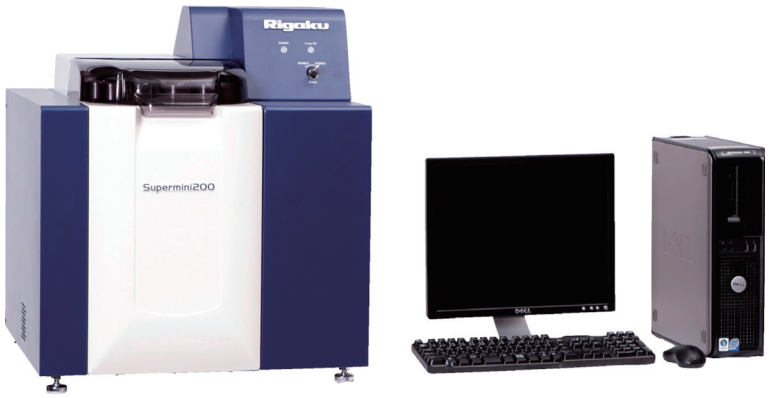
Sequential benchtop WDXRF spectrometer

Supermini200



1. Introduction

A new sequential benchtop wavelength-dispersive X-ray fluorescence spectrometer, the Supermini200, has been released.

The Supermini200 successfully inherits all of the superior characteristics of the Supermini, such as an energy and space-saving design, good sensitivity due to a high powered 200W tube, high spectral resolution utilizing WDX optics and highly flexible and feature-rich operation software.

Improvements to the spectrometer include:

- Easier operation using an "EZ Analysis" window
- SQX Scatter FP method for powder samples (optional)
- Oxygen analysis supported by SQX analysis
- Universal Power Supply for worldwide wall outlets

This article introduces the latest WDX spectrometer from Rigaku.

2. Features of Hardware and Software

The Supermini200 is a benchtop system designed to minimize installation utilities, such as cooling water, power supply and installation space, etc. Built-in Universal Power Supply enables the spectrometer to utilize worldwide wall outlets without any external electric transformer. The spectrometer is also equipped with an air-cooled 200W X-ray tube and up to three analyzing crystals, with which elements from oxygen to uranium can be analyzed. The helium gas is optionally available for chamber atmosphere, so that liquid sample analysis can be performed. The hardware specifications of the Supermini200 are summarized in Table 1.

The software provides users with easy-to-use operation, the same as used the full-sized ZSX Primus series. As a new function, EZ Analysis window is added to the main menu, the intuitive user interface contains all operations used in a routine daily analysis (Fig. 1).

Table 1. Specifications of the Supermini200.

X-ray source	X-ray tube	End-window Pd target 200 W
	Generator	High frequency generator 200 W, 50 kV-4 mA
Spectrometer	Measurement area	30 mm (diameter)
	Maximum sample size	44 mm (diameter), 33 mm (height)
	Primary beam filter	In/Out system
	Crystal	3 crystal changer Standard crystals: LiF(200), PET Optional crystals: RX25, Ge
Counting	Detector	Heavy elements: SC (scintillation counter)
		Light elements: F-PC (gas-flow proportional counter)

The Supermini200 is the first benchtop spectrometer covering oxygen in semi-quantitative analysis, performed by SQX (Scan Quant X). By integrating the analysis results of oxygen, the results of unknown polymer sample screening can be improved.

3. Newly Integrated SQX Scatter FP method

SQX Scatter FP method is a newly available function on the Supermini200. This function is optimized for powder sample analysis.

Semi-quantitative analysis by the Fundamental Parameter (FP) method is a useful method for elemental screening of materials. However, the FP calculation requires principally the information of all elements in a sample. This requirement is inconvenient on

Table 2. SQX results of dehydrated cake (sludge residue).

unit: mass%

	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	Cr
Chemical value	0.90	1.22	7.26	16.7	0.12	—	—	1.14	3.90	0.40	—
SQX	**0.69**	**1.28**	**8.20**	**15.9**	**0.12**	**0.19**	**0.06**	**1.12**	**3.69**	**0.38**	**0.02**

(Continued)

	Mn	Fe	Cu	Zn	Br	Rb	Sr	Y	Zr	Pb	Balance
Chemical value	0.10	4.87	0.012	0.086	0.003	0.006	0.024	0.002	0.008	0.013	—
SQX	**0.09**	**4.90**	**0.01**	**0.08**	**0.003**	**0.004**	**0.026**	**0.003**	**0.008**	**0.015**	**63.1**

Table 3. SQX results of deep sea sediment (JMS-2).

unit: mass%

	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr
Certified value	4.30	1.95	7.50	19.5	0.55	0.29	4.05	2.24	3.34	0.84	0.018	0.008
SQX	**4.29**	**1.87**	**7.34**	**17.3**	**0.48**	**0.30**	**4.32**	**2.16**	**3.15**	**0.78**	**0.018**	**0.015**

(Continued)

	Mn	Fe	Co	Ni	Cu	Zn	As	Rb	Sr	Y	Zr	Balance
Certified value	1.75	7.67	0.023	0.031	0.045	0.017	0.004	0.007	0.045	0.025	0.022	—
SQX	**1.87**	**7.45**	**0.021**	**0.031**	**0.046**	**0.020**	**0.005**	**0.007**	**0.050**	**0.026**	**0.023**	**48.0**

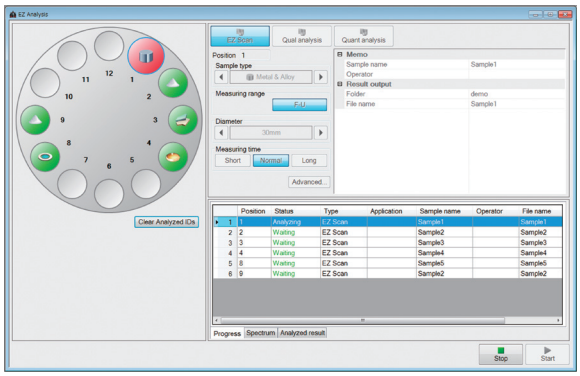


Fig. 1. EZ Analysis window of the Supermini200.
The window is composed of 3 panes, sample position (left), sample ID (upper right) and measurement information (lower right).

fully unknown sample analysis since the elements from hydrogen to oxygen are usually unmeasurable or difficult to determine accurately by the XRF.

To solve this problem, RIGAKU has developed a new method to estimate an average atomic number for non-measured light elements in a sample using the intensities of scattered X-rays and applies this to the estimation of a balance component on the SQX analysis [(1)].

This new function, SQX Scatter FP method, has been available for only the ZSX Primus series but now we can use this advanced method on the benchtop XRF spectrometer.

To illustrate the power of the SQX Scatter FP method, two powder samples, which are difficult to analyze accurately by conventional SQX method owing to large amount of unmeasurable elements contained in the samples, are provide.

One sample is dehydrated cake (sludge residue), which is a residue remaining after dehydration of sludge. Another is sediment obtained from a deep sea floor. The deep sea sediment, JMS-2, is a certified reference material supplied by the Geological Survey of Japan (GSJ). Both types of samples generally have complex matrices and contain moisture and some organic matters with very wide variation.

The well-dried samples were pressed into PVC rings and then analysis was performed on the Supermini200.

The results of the SQX Scatter FP method are in good agreement with the chemical and certified values (Tables 2 and 3). The successful results show availability of this advanced method on the Supermini200 as well as on ZSX Primus series.

This new function powered by RIGAKU's advanced FP technology expands the capabilities of the Supermini200 significantly.

Reference

(1) Y. Kataoka, N. Kawahara, S. Hara, Y. Yamada, T. Matsuo, Michael Mantler: *Advances in X-ray Analysis*, **49** (2006), 255–260.