DRAWELL
Artist of Science

Wavelength Dispersive X-ray Fluorescence Spectrometer (For Cement testing instrument)

DW-WDX200

DW-WDX200 Compact Multi-channel X-ray Fluorescence Spectrometer, with configuration of 10 fixed channels and capability to analyze 10 elements simultaneously, is able to conduct elemental analysis of arbitrary ten elements from Na to U based on the users' requirements.

This instrument is widely used in cement, steel, powder metallurgy, coal, petroleum, kaolin, glass, refractory materials, environment protection and accordingly an ideal choice for quality control in large and middle-scaled enterprises.

Application Fields

- Application Fields
- Building materials (cement, glass, ceramics)
- Metallurgy (steel, non-ferrous metals)
- Petroleum (trace elements S, Pb and so on)
- Chemical engineering
- Geography and Mining
- Commodity Inspection

Parameters

Temperature control accuracy	Setting value ±0.1 °C
Measurable elements	10 arbitrary elements from Na to U
X-ray tube	400W thin Be end window X-ray tube made by Varian company, Rh anode (Pd anode optional)
Analysis algorithms	empirical coefficient algorithm and theoretical a-coefficient algorithm
Power Supply	AC220V, 1 KVA AC purified stabilized voltage power supply
High voltage supply	200W (50KV4mA)
12-hour stability of tube voltage & tube current	less than 0.05 %
Vacuum pump	biphase~220V, 2 liters
Industrial computer	industrial 104 computer
Analysis accuracy	°n-1(24 hours, percent content) W0.05 %
Measurement time of single sample	W3-5 minutes (including time for changing samples and vacuum pumping)
Detector	gas proportional detector + sealed proportional detector; 10 path 1024 channel independent pulse height analyzer
Vacuum system	independent vacuum pump station, easy maintenance
The highest vacuum degree	lower than 5 Pa
Gas flow system	High Sophisticated Gas Density Stabilizer with pressure stability up to ±0.003 KPa
Analysis software	equipped with software for two quantitative analysis algorithms: empirical coefficient algorithm and theoretical a-coefficient algorithm. With innovative technology of full spectrum analysis, every spectrum line can be timely traced and corrected, which greatly improves the repeatability and stability of quantitative analysis and also serves as intuitive evidence of instrument status diagnosis. Complete measures for self-diagnosis are supplied. In-built RS-232 serial communication protocol, TCP / IP protocol (S/ C based on Socket) and OPC protocol (OPC server) all offer ways to share data with DCS or QCS system.

Features

- **Excellent qualities**

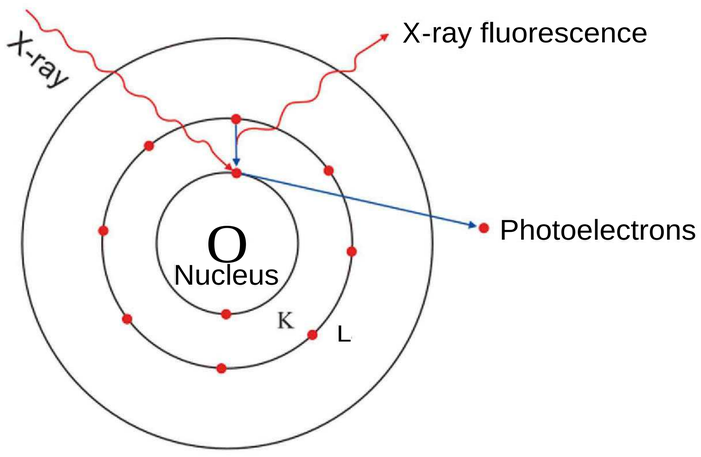
Rapid and non-destructive analysis of powder and bulk samples

Multi-channel high speed MCA offers timely measurement of every element peak, benefiting not only instrument debugging and failure diagnosis but also the enhancement of stability.

Compared with sequential scan large power spectrometers, DW-WDX200 gains adequate analysis precision even when lower power and equal measurement time are adopted, which not only endows the instrument with high cost performance, but also prevents wearing of the goniometer, prolongs the service life of X-ray tube, minimize failures of the high voltage power supply and reduce the maintenance cost of the whole instrument.

- **Element characteristic X~ray radiation**

Different elements have extra-nuclear electronic orbitals of different binding energies, as a result, they give off X-ray photons carrying energies different from each other when excited, that is, each element emits X-ray at its own special energy, representing the characteristic of this element and accordingly called characteristic X-ray.



Characteristic X- ray of each element has its specific wavelength;

so when we detect X-ray of specific wavelength, we can identify the presence of the interested element in a sample.

- **Principle of Wavelength Dispersive Spectroscopy**

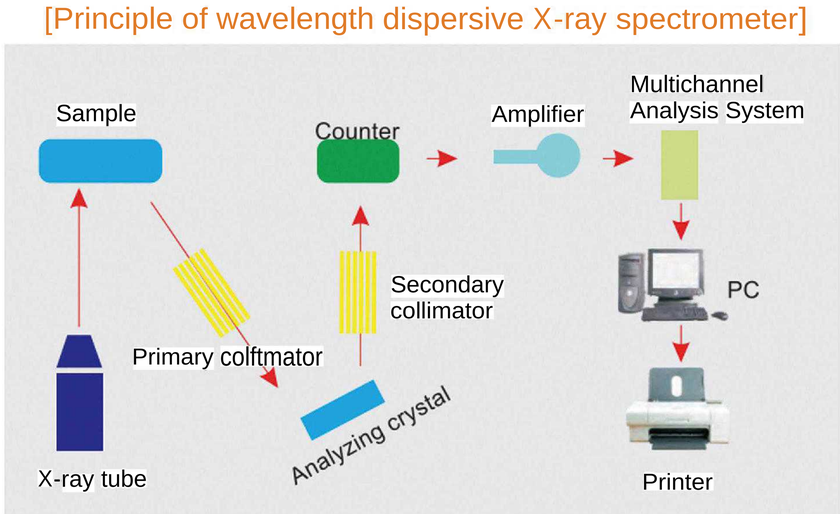
When many elements coexist in a sample and get irradiated by primary X-ray emitted from the X-ray tube, they will emit their corresponding characteristic X-rays, which in general are termed as X-RAY FLUORESCENCE. To separate and measure characteristic X-ray of these elements is called X-ray Fluorescence Spectroscopy.

As characteristic X-rays of different elements have specific wavelengths, they can be separated by using Crystal Diffraction based on Bragg Equation. This kind of spectroscopy is called Wavelength Dispersive Spectroscopy.

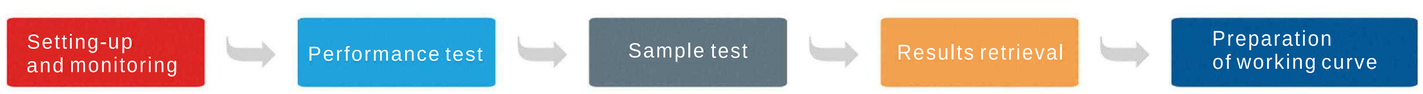
Bragg Equation:$2d\sin\theta = n\lambda$.

Where d is the interplanar spacing of the lattice planes of the crystals, θ is the angle of incidence and diffraction,λ is the wavelength of the incident radiation,N is the order of diffraction and is integer.

[Principle of wavelength dispersive X-ray spectrometer]

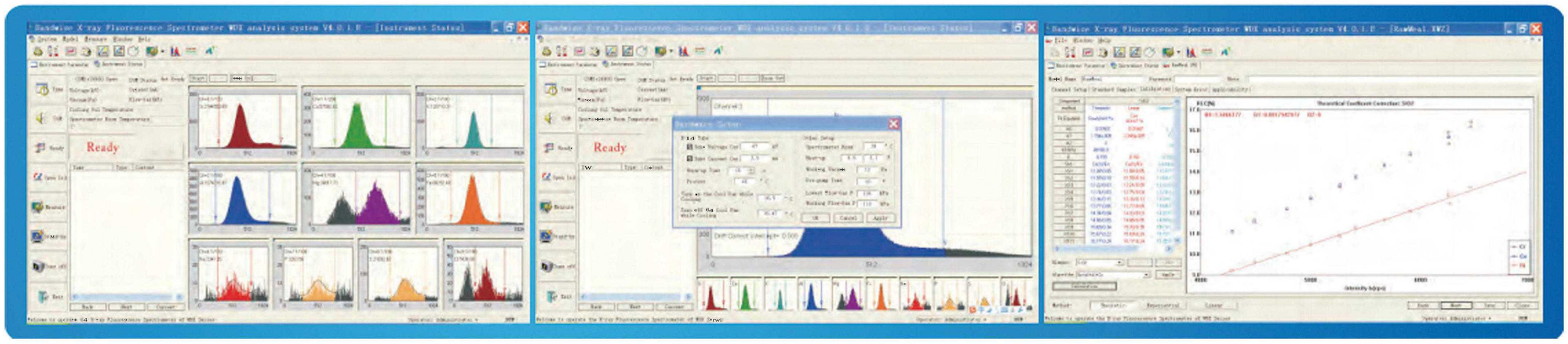


- **Software Overview**



1. Self-developed software system for X-ray Fluorescence Analyzers, applicable to windows operating system
2. Easy manipulation realized by operating interface in all Chinese language
3. With innovative technology of full spectrum analysis, every spectrum line can be timely traced and corrected, which greatly improves the repeatability and stability of quantitative analysis and also serves as intuitive evidence of instrument status diagnosis.
4. Equipped with software for two quantitative analysis algorithms: empirical coefficient algorithm and theoretical a-coefficient algorithm, among which the latter algorithm reduces the number of standard samples and retains adequate accuracy at the same time
5. Analysis data treatment including linear fitting and all kinds of matrices correction
6. Calculation of characteristic value based on analysis value
7. Man-machine interaction, allowing you to set and modify parameters
8. Timely output of analysis data and report
9. Complete self-diagnosis measures

Spectrum of Wavelength Dispersive Spctrometer



Results of Cement Measurement

Cement Standard XS04-2

XS04-2	Si	Al	Fe	Ca	Mg
Standard value	12.71	2.86	3.09	43.29	1.6
Average value	12.724	2.862	3.074	43.318	1.584
Max value	12.79	2.98	3.11	43.35	1.69
Min value	12.66	2.83	3.06	43.3	1.62
Range	0.03	0.15	0.05	0.05	0.09
SD	0.015391	0.01091	0.004891	0.017776	0.014327
RSD(%)	0.120967	0.36987	0.160313	0.041037	0.875739

Results of Agglomerate Measurement

Below are the Results of Repeated Tests of the unknown sample:

No.	Sample No	Measurement Time	Fe(%)	CaO(%)	MgO(%)	Si02(%)	So3(%)
1	17#	2007-11-09 13:35	53.85	12.13	3.44	5.76	0.041
2	17#	2007-11-09 13:39	53.87	12.09	3.44	5.75	0.041
3	17#	2007-11-09 13:42	53.90	12.07	3.43	5.73	0.039
4	17#	2007-11-09 13:46	53.91	12.10	3.43	5.75	0.040
5	17#	2007-11-09 13:50	53.92	12.08	3.45	5.73	0.039
6	17#	2007-11-09 13:53	53.87	12.08	3.44	5.74	0.043
7	17#	2007-11-09 13:57	53.91	12.06	3.43	5.76	0.041
8	17#	2007-11-09 14:01	53.86	12.07	3.43	5.79	0.040
9	17#	2007-11-09 14:05	53.88	12.08	3.44	5.78	0.039
10	17#	2007-11-09 14:08	53.89	12.09	3.46	5.74	0.041

Test of 18-hour stability taken by unknown sample 17#; the results after total 306 times are:

Constituent	Average	Min	Max	SD
Fe(%)	53.890	53.851	53.920	0.013
CaO(%)	12.082	12.06	12.130	0.015
MgO(%)	3.443	3.430	3.470	0.011
Si02(%)	5.750	5.730	5.790	0.011
So3(%)	0.0401	0.038	0.043	0.001

Test of 15-hour stability taken by unknown sample D1-2702A#; the results after total 253 times are:

Constituent	Average	Min	Max	SD
Fe(%)	12.773	12.710	12.750	0.019
Si02(%)	7.836	7.710	7.850	0.018
CaO(%)	50.227	50.420	50.250	0.027
MgO(%)	9.231	9.120	9.200	0.038

Results of Converter Slag Measurement

Below are the results of repeated tests of the unknown sample:

No.	Sample No	Measurement Time	Fe(%)	Si02(%)	CaO(%)	MgO(%)
1	D1-2702A	2007-11-12 16:52	12.74	7.73	50.42	9.17
2	DI-2702A	2007-11-12 16:56	12.74	7.73	50.38	9.17
3	DI-2702A	2007-11-12 17:00	12.72	7.72	50.33	9.16
4	DI-2702A	2007-11-12 17:04	12.71	7.71	50.32	9.15
5	DI-2702A	2007-11-12 17:08	12.75	7.76	50.37	9.17
6	DI-2702A	2007-11-12 17:11	12.73	7.85	50.29	9.12
7	DI-2702A	2007-11-12 17:15	12.71	7.83	50.26	9.16
8	DI-2702A	2007-11-12 17:19	12.73	7.81	50.27	9.12
9	DI-2702A	2007-11-12 17:22	12.74	7.87	50.26	9.17
10	DI-2702A	2007-11-12 17:26	12.75	7.86	50.25	9.20