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WAVELENGTH DISPERSIVE X-RAY FLUORESCENCE SPECTROMETER QUALIX™ W2

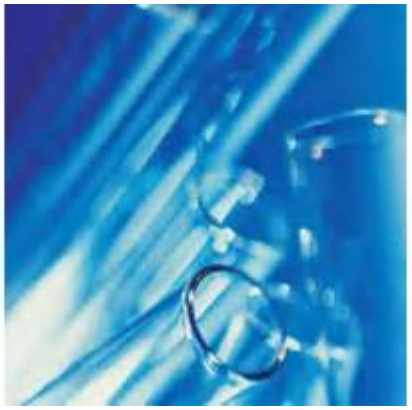
APPLICATIONS

Wavelength Dispersive X-Ray Fluorescence Spectrometer QualiX™ W2

QualiX™ W2 Compact Multi-Channel X-Ray Fluorescence Spectrometer is designed with 10 fixed light diffraction channels. It allows for the simultaneous analysis of 10 user-defined elements ranging from Sodium (Na) to Uranium (U). The standard configuration includes elements such as sodium (Na), magnesium (Mg), aluminum (Al), silicon (Si), sulfur (S), chlorine (Cl), potassium (K), calcium (Ca), iron (Fe), and phosphorus (P) or titanium (Ti) as an option. This instrument is an excellent quality control solution for both large and medium-sized businesses.

Application Fields

- Steel
- Cement
- Glass


FEATURES

Wavelength Dispersive X-Ray Fluorescence Spectrometer QualiX™ W2 Features

Performance and Characteristics:

- Rapid and Non-Destructive Analysis: Efficiently analyzes both powder and lump samples without causing any damage.
- Versatile Analyzer: Quickly processes compact powder, fused beads, and lump materials.
- Enhanced Efficiency: The multi-channel digital MCA significantly improves measurement efficiency, aiding in instrument debugging and failure diagnosis, and enhancing measurement accuracy and stability.

Key Advantages:

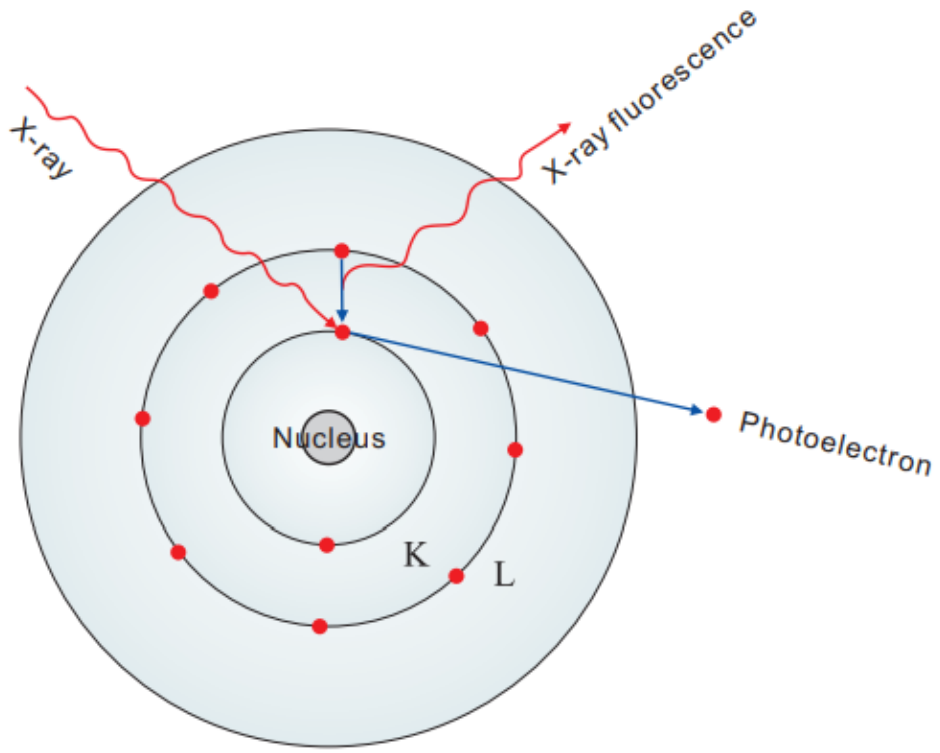
- Higher X-Ray Power
- Increased Measurement Precision
- More Stable Measurement Data
- Higher Excitation Efficiency
- Lower Detection Limit

THEORY & METHOD

Principle of X-ray Fluorescence Analysis

Characteristic X-Rays of Elements

Different elements have extra-nuclear electronic orbitals with varying binding energies. As a result, when excited, they emit X-ray photons with distinct energies. Each element emits X-rays at its unique energy, representing its characteristic signature, thus termed as characteristic X-rays. The characteristic X-ray of each element has a specific wavelength. By detecting X-rays of these specific wavelengths, we can identify the presence of the target element in a sample.



Principle of Wavelength Dispersive Spectroscopy

When many elements coexist in a sample and are irradiated by primary X-rays from the X-ray tube, they emit their corresponding characteristic X-rays, generally known as X-ray fluorescence. The process of separating and measuring these characteristic X-rays is called X-ray Fluorescence Spectroscopy.

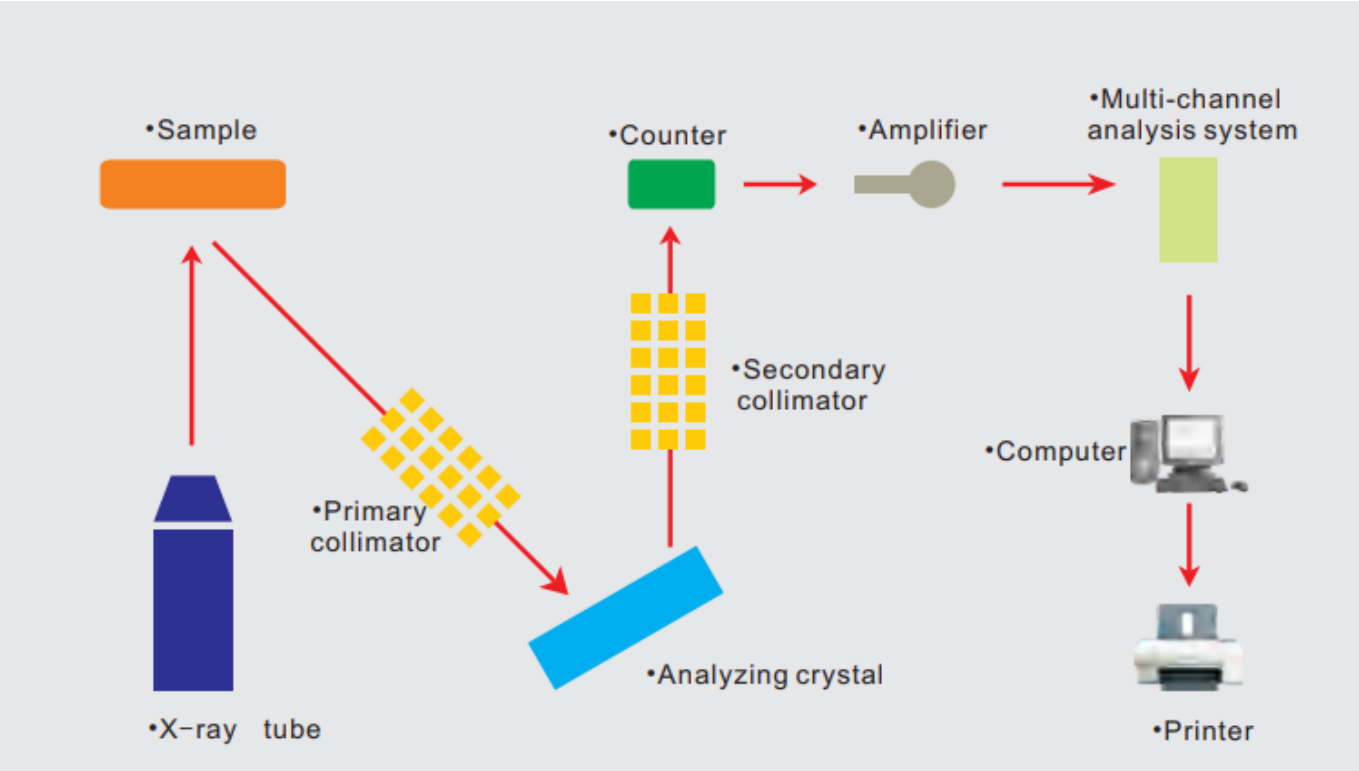
Since the characteristic X-rays of different elements have specific wavelengths, they can be separated using Crystal Diffraction based on Bragg's Equation. This type of spectroscopy is known as Wavelength Dispersive Spectroscopy.

Bragg's Law:

$n\lambda=2d\sin\theta$

In this equation:

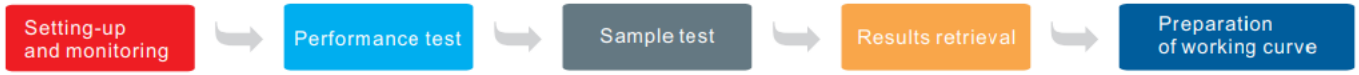
- d is the distance between atomic layers in a crystal.
- θ is the angle of incidence.
- λ is the wavelength of the incident X-ray.
- nis an integer representing the order of diffraction.



Working Principle of Wavelength Dispersive Spectrometer

Software Overview

Software Functions:



Technical Specifications:

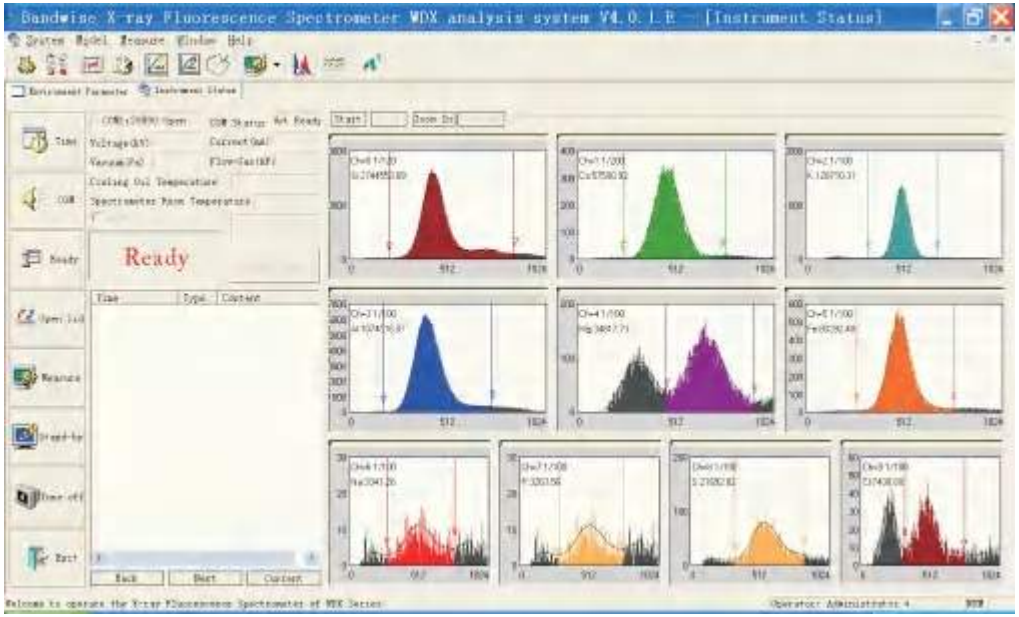
Self-developed software system for the X-ray Fluorescence Analyzer, compatible with Windows operating systems. The system features an easy-to-use interface entirely in Chinese.

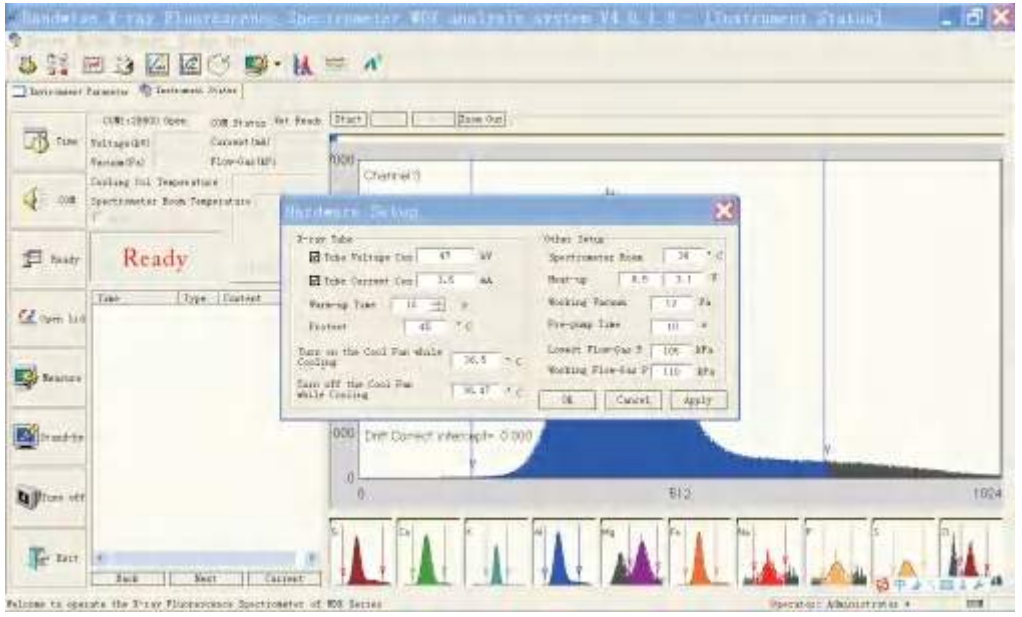
Using innovative full-spectrum analysis technology, it allows for real-time tracing and correction of every spectrum line. This significantly enhances the repeatability and stability of quantitative analysis and provides clear evidence for diagnosing instrument status.

The software includes two quantitative analysis algorithms: the empirical coefficient algorithm and the theoretical a-coefficient algorithm. The latter reduces the number of standard samples required while maintaining high accuracy.

It supports analysis data processing, linear fitting, and various matrix corrections. Characteristic values can be calculated based on analysis results. User interaction is facilitated for setting and modifying parameters, ensuring timely output of analysis data and reports. Comprehensive self-diagnosis measures are also included.

Wavelength dispersive instrument spectrum





Examples of Cement Industry

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	12.708	2.912	3.056	43.305	1.635
Max value	12.74	2.93	3.06	43.34	1.66
Min value	12.69	2.89	3.05	43.30	1.62
Range	0.05	0.04	0.01	0.04	0.04
Standard deviation value	0.015362	0.01077	0.004899	0.01145	0.014318

Relative deviation value(□)	0.120887	0.36986	0.160307	0.02644	0.875708

Cement standard XS05-2

XS05-2	Si	Fe	Al	Ca	K	Na	Mg
Standard value	12.71	3.09	2.86	43.29	0.45	0.28	1.6
Average value	12.706	3.091	2.903	43.273	0.454	0.295	1.62
Max value	12.73	3.1	2.92	43.3	0.46	0.35	1.64
Min value	12.69	3.08	2.88	43.25	0.45	0.27	1.6
Range	0.04	0.02	0.04	0.05	0.01	0.08	0.04
Standard deviation value	0.012806	0.008307	0.011	0.015524	0.004899	0.02377	0.013416
Relative deviation value(□)	0.100789	0.268736	0.378918	0.035875	1.07907	8.057535	0.828173

Examples of Steel Industry:

Results of Agglomerate Measurement

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

No.	Sample No.	Measurement Time	Fe(%)	CaO(%)	MgO(%)	SiO_2(%)	So_3(%)
1	17#	2007-11-09 13:35	53.87	12.10	3.44	5.73	0.040
2	17#	2007-11-09 13:39	53.89	12.08	3.43	5.74	0.040

3	17#	2007-11-09 13:42	53.91	12.08	3.44	5.75	0.039
4	17#	2007-11-09 13:46	53.91	12.10	3.44	5.76	0.040
5	17#	2007-11-09 13:50	53.90	12.07	3.45	5.76	0.039
6	17#	2007-11-09 13:53	53.89	12.09	3.43	5.75	0.041
7	17#	2007-11-09 13:57	53.90	12.09	3.45	5.75	0.042
8	17#	2007-11-09 14:01	53.89	12.09	3.46	5.76	0.040
9	17#	2007-11-09 14:05	53.89	12.09	3.44	5.75	0.039
10	17#	2007-11-09 14:08	53.88	12.08	3.44	5.75	0.040

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

Constituent	Average value	Min value	Min value	Standard deviation value
Fe(%)	53.891	53.850	53.920	0.012
CaO(%)	12.086	12.040	12.120	0.014
MgO(%)	3.446	3.420	3.470	0.010
SiO_2(%)	5.752	5.710	5.780	0.010
So_3(%)	0.040	0.038	0.042	0.001

Converter slag

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

No.	Sample No.	Measurement Time	Fe(%)	SiO_2(%)	CaO(%)	MgO(%)
1	D1-2702A	2007-11-12 16:52	12.75	7.74	50.41	9.11
2	D1-2702A	2007-11-12 16:56	12.73	7.75	50.39	9.12
3	D1-2702A	2007-11-12 17:00	12.71	7.77	50.38	9.14
4	D1-2702A	2007-11-12 17:04	12.73	7.78	50.35	9.14
5	D1-2702A	2007-11-12 17:08	12.74	7.78	50.33	9.15
6	D1-2702A	2007-11-12 17:11	12.76	7.80	50.27	9.18
7	D1-2702A	2007-11-12 17:15	12.76	7.80	50.27	9.18
8	D1-2702A	2007-11-12 17:19	12.76	7.80	50.25	9.18
9	D1-2702A	2007-11-12 17:22	12.77	7.81	50.24	9.19
10	D1-2702A	2007-11-12 17:26	12.76	7.82	50.24	9.23

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

Constituent	Average value	Min value	Max value	Standard deviation value
Fe(%)	12.782	12.710	12.840	0.021
SiO_2(%)	7.818	7.740	7.840	0.011
CaO(%)	50.215	50.160	50.410	0.030
MgO(%)	9.217	9.110	9.290	0.027

TECHNICAL SPECIFICATIONS

Wavelength Dispersive X-Ray Fluorescence Spectrometer QualiX™ W2 Technical Specifications

- High Voltage Supply: 400W (50KV, 8mA)
- X-Ray Tube: 400W thin Be end window X-ray tube by Varian, Rhodium anode (Palladium anode optional)
- 12-Hour Tube Voltage & Current Stability: Within 0.05%
- Measurable Elements: 10 user-defined elements from Sodium (Na) to Uranium (U)
- Detector: Gas flow proportional detector and sealed proportional detector; 10 paths with 1024-channel independent pulse height analyzer
- Vacuum System: Independent pumping station for easy maintenance, achieving a vacuum level lower than 8Pa
- Gas Flow System: High-accuracy gas density stabilizer with pressure stability up to ±0.003 KPa
- Pre-Amplifier: High-speed pre-amplifier circuit enhances analysis efficiency and accuracy
- MCA: Digital Multi-Channel Analyzer (MCA) significantly improves analysis accuracy
- AC Power Supply: 2 sets of 1KVA AC purified stabilized voltage power supplies
- Analysis Accuracy: Percentage content ≤0.05% over 24 hours
- Single Sample Measurement Time: Including sample exchange and vacuum pumping, ≤3-5 minutes
- Temperature Control Precision: ±0.1°C in constant temperature chamber

Configurations:

- P10 Gas (90% Argon + 10% Methane Mixture): 1 bottle of gas is included.
- Vacuum Pump: High-quality vacuum pump made in-house
- Vibromill: Recommended options available or can be self-purchased
- Sampling Machine: Recommended options available or can be self-purchased
- Fusion Machine: Recommended options available or can be self-purchased

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Qualitest USA (Corporate Sales Office)
Toll-Free: 1.877.884.TEST (8378) | Fax: 954.697.8211
E-mail: info@qualitest-inc.com
Address: 8201 Peters Rd., #1000,
Plantation, FL 33324, USA.

Qualitest Canada & International
Tel: +1.905.944.9825 | Fax: +1.905.944.0304
E-mail: sales@qualitest-inc.com
Address: 70 East Beaver Creek Rd., #9, Richmond Hill,
Ontario L4B 3B2, Canada.

Qualitest Latin America (Mexico and LATAM Region)
E-mail: ventas@qualitest-inc.com

Qualitest KSA (Regional Office)
Tel: +966 11 500 6659
Address: Level 7, 3.09, District 3, King Abdullah
Financial District, Riyadh, Saudi Arabia

Qualitest Singapore (ASIA PACIFIC Regional Office)
Tel: +65 6393 5480 | E-mail: singapore@qualitest-inc.com
Address: 50 Raffles Place, Singapore Land Tower,
Level 46, Singapore, 048623.

Qualitest Indonesia (Representative Office)
Tel: +62 21 2985 9522 | Fax: +62 21 2985 9889
E-mail: indonesia@qualitest-inc.com
Address: One Pacific Place Level 11, Jl. Jend. Sudirman,
Kav. 52-53, SCBD Area, Jakarta 12190, Indonesia.

Qualitest FZE (Regional GCC/ME Office)
Tel: +971 4 8819252 | Fax: +971 4 8819262
Email: gcc@qualitest-inc.com
Address: Jafza One, BB 1610, Jebel Ali Free Zone,
PO Box 261440, Dubai, UAE.

Qualitest India
E-mail: india@qualitest-inc.com
Address: 15th Floor, Dev Corpora, Pokhran Road No.1,
Eastern Express Highway, Thane, Maharashtra,
Mumbai, 400601, India

Organizational Member

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