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OES1000VM-I

Optical Emission Spectrometer

OES1000VM-I Optical Emission Spectrometer

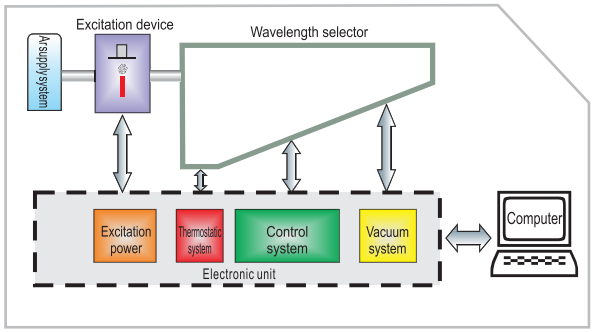
Main Features

- Channels can be added on site, much easier for upgrade
- Multiple matrixes exist within one instrument and excitation energy can be adjusted through software
- Minimum measurable sample diameter is above 9mm, thickness is above 1mm
- Low electromagnetic radiation, harmless to human body

Application Fields

OES1000VM I (Spark) Optical Emission Spectrometer is used in quick quantitative analysis of ferrous metal and nonferrous metal composition. It is best used in production control, quality control and special analytical research, one of the best methods in product quality control during manufacturing.

Working Principle



When composition elements are under excitation, spectrum with the characteristic of the element is emitted. The intensity of this spectrum has functional relation with the element content. Measure the intensity of each element spectrum to calculate the element content in material.

Matrix Alloys Al, Fe, Cu, Pb, Zn, Sn, Ti, Ni, Co, Mg, etc.

Analyzable elements C, P, S, Mn, Cr, Mo, V, W, Al, Si, Ni, Cd, Ti, Fe, Cu, Pb, Zn, Sn, Co, Mg, B, Bi, Be, Nb, Sb, As, Zr, La, Ce, Ga, Ca, Sr, Ag, Au, etc.

Features

- The hardware is highly stable and reliable throughout the whole year
- Up to 64 analytical channels can be simultaneously analyzed within 50s
- Single spectrum chamber, easy to repair and maintain
- Calibration before ex-factory: calibration of matrix effect and interference from overlapping spectral line
- Prepare working curves and calibration curves using internationally certified standard samples, substantially improving analytical accuracy
- Integrated design of optical source, installed next to the Farady cage of the excitation table, effectively preventing electromagnetic wave leakage and stabilizing the instrument
- Apply high-quality vacuum optical system, 38℃ ±0.1℃ thermostatic technology ensures operation stability
- Repeatability≤2.0% (RSD)
- Stability (24h)≤3.0% (RSD)

Technical Specifications

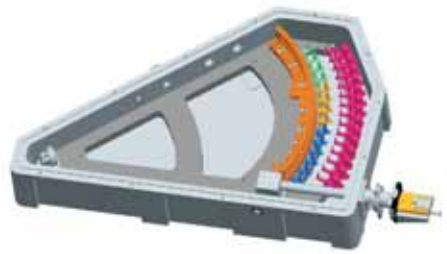
- Wavelength selector: 1m focus, Paschen – Runge device, vacuum model (vacuum degree≤3Pa), thermostatic control (38℃ ±0.1℃), special cast iron material with little deformation
- Maximum channel amount: 64
- Concave grating: 2160gr/mm, reciprocal linear dispersion 0.47nm/mm, wavelength range 170-463nm, radius of curvature 998.8mm
- Slit width: entry slit 20μm, exit slit 70-130μm
- Photomultiplier: Φ13.5mm, 10 side window tube, melted quartz or glass outer shell, tube socket will not generate arc light
- Resolution: depend on the category of optical grating, exit slit and spectrum
- Analysis time: depend on sample category, usually within 50s
- Excitation source: use high voltage electric spark to discharge, discharge frequency 200Hz and 400Hz, discharge gap 3.5mm
- Spectrometer detection: use traditional Section Integral Method and FPGA technique to control the entire operation

Standard Configurations

- 8 analytical channel (standard configuration)
- Analytical software for OES1000VM I
- Measuring control cabinet
- High-voltage electric spark optical source cabinet
- Thermostatic and vacuum systems
- Mono-block rotary vane vacuum pump
- 1KVA AC purified voltage
- 5KVA AC voltage stabilizer
- Laptop plus printer

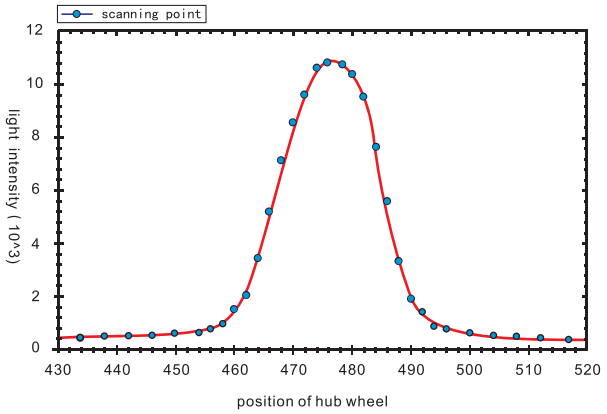
Wavelength Selector: Multi-channel vacuum (spark) spectrometer is composed of: concave grating monochromator and multiple exit slits installed on curved focal plane of concave grating monochromator. One photomultiplier is fixed to each exit slit to detect one spectral line. 64 photomultipliers are installed within OES1000VM I, thus nearly dozens of elements and their content in sample can be detected and analyzed at the same time.

See optical system principle of OES1000VM I as shown in the right picture. Entrance slit, exit slit and concave grating are installed along the circum of Rowland circle. Each radiation from the exit slit is directly delivered or reflected by optical reflector to the photomultipliers.



Testing Example

Curve tracing:



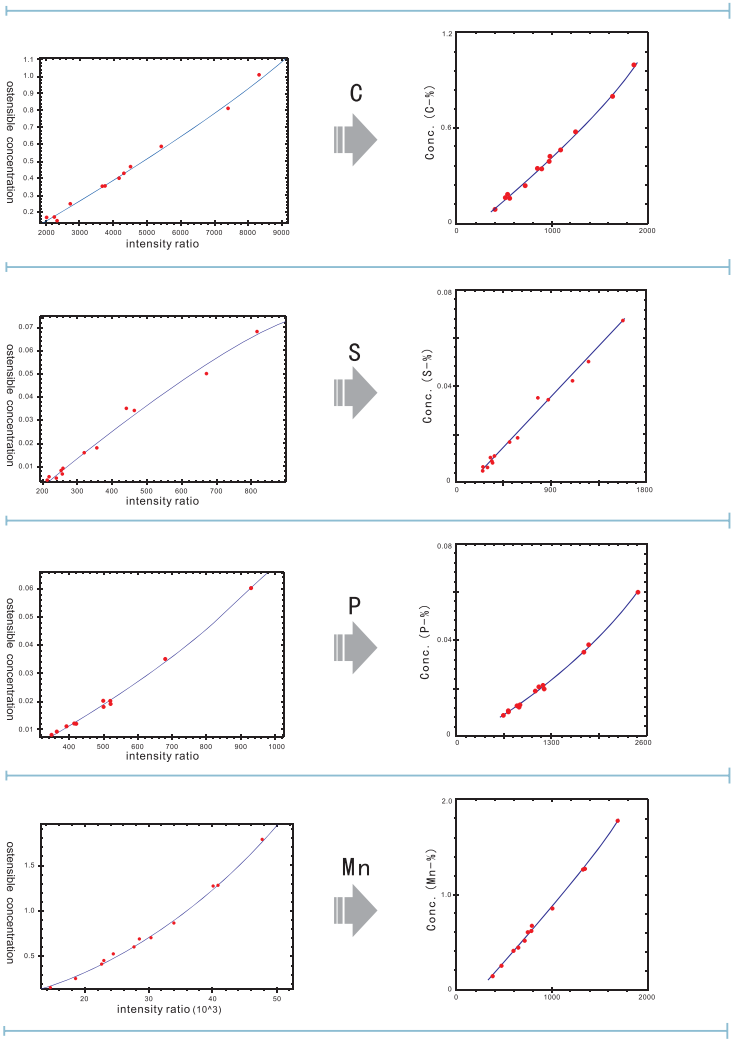
Principle of curve tracing:

Determine the angle between entry and grating diffracted beams based on the wavelength of each exit slit; move the entry slit on Rowland circle to change the wavelength of one certain exit slit – adjust the position of entry slit to let one wavelength pass through one exit slit; inconsistency of relative position of each exit slit shall be below±4μm.

The left diagram shows the curve tracing of Cr 267.716nm: scan the slit position to determine whether the peak value shifts; the computer will display the scanned spectrum, determine peak value position and alter the hub wheel to peak value position till the end of scanning.

Comparison Of Working Curves

Use standard sample of low carbon steel to setup working curves in Optical Emission Spectrometer. Take working curves of C, P, S and Mn for instance as shown below. Work curves acquired by OES1000VM I are as shown on the left: the test results are of international standard.



OES1000VM I – Test results of aluminum alloy E427a

Element	Standard value (%)	Average value (%)	Test value1 (%)	Test value2 (%)	Test value3 (%)
Si*2	0. 217	0. 2165	0. 2221	0. 2179	0. 2096
Fe*1	0. 381	0. 3849	0. 3937	0. 3912	0. 3698
Cu*1	0. 169	0. 1651	0. 1851	0. 1589	0. 1714
Mn*1	1. 01	1. 0112	1. 0110	1. 0127	1. 0098
Mg*1	1. 16	1. 1651	1. 1656	1. 1705	1. 1593
Ni*1	0. 03	0. 0311	0. 0331	0. 0311	0. 0291
Zn	0. 096	0. 0914	0. 0921	0. 0926	0. 0894
Ti	0. 032	0. 0335	0. 0341	0. 0342	0. 0321
Cr*1	0. 029	0. 0290	0. 0288	0. 0288	0. 0294
Al*R	96. 876	96. 8655	96. 8344	96. 8621	96. 9001

OES1000VM I – Test results of carbon steel and middle/low alloy steel A68073-92-2

Element	Standard value (%)	Average value (%)	Test value1 (%)	Test value2 (%)	Test value3 (%)
C	0. 17	0. 1759	0. 1721	0. 1692	0. 1865
Mn	0. 25	0. 2561	0. 2550	0. 2527	0. 2606
Si*1	0. 147	0. 1453	0. 1420	0. 1517	0. 1422
P	0. 06	0. 0593	0. 0545	0. 0613	0. 0621
S	0. 035	0. 0357	0. 0364	0. 0349	0. 0358
Cr*1	0. 417	0. 4192	0. 4264	0. 4110	0. 4201
Ni*1	0. 291	0. 2961	0. 3040	0. 2968	0. 2875
W	0. 54	0. 5420	0. 5512	0. 5410	0. 5337
V	0. 367	0. 3642	0. 3516	0. 3792	0. 3617
Mo	0. 39	0. 3838	0. 3790	0. 3841	0. 3883
Al*1	0. 051	0. 0498	0. 0510	0. 0495	0. 0488
Ti	0. 269	0. 2650	0. 2560	0. 2715	0. 2674
Cu*1	0. 329	0. 3197	0. 3082	0. 3327	0. 3183
Fe*R	96. 684	96. 6879	96. 7126	96. 6644	96. 6870