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Inductively Coupled Plasma Optical Emission Spectrometer Model: ICP-4111

Product description, technical parameters and configuration

ICP-4111 inductively coupled plasma emission spectrometer is an excellent full-spectrum direct-reading spectrometer developed by Tianrui Instrument Company after years of technical accumulation. It is used to determine the content of trace elements in different substances (soluble in hydrochloric acid, nitric acid, hydrofluoric acid, etc.). It has a high degree of automation, simple operation, stable and reliable. At present, the instrument is widely used in various fields such as rare earth, geology, metallurgy, chemical industry, environmental protection, clinical medicine, petroleum products, semiconductors, food, biological samples, criminal science, agricultural research, etc.

Performance advantages

1.Fully automated design

Except for the power switch, all functions of the entire instrument are controlled by a computer, which is reliable, safe and convenient.

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2.Peristaltic pump
The peristaltic pump is a fully automatic design with twelve rotors and four channels. The speed of the peristaltic pump can be adjusted according to the required flow setting; the peristaltic pump smoothly injects and removes waste liquid to ensure that the injection speed is consistent with the waste liquid removal speed. Customers can adjust the speed appropriately as needed to ensure the stability of the injection system.

3.Automatic gas flow control
In the injection system, the carrier gas, plasma gas, and auxiliary gas are all controlled by advanced mass flow controllers (MFCs), which have the advantages of continuously adjustable flow and stable flow, ensuring the stability of the injection system and laying a solid foundation for the stability of the light source.

4.Stable and advanced all-solid-state RF power supply
The RF power supply used in the instrument is an all-solid-state RF power supply independently developed by Tianrui Instruments. It has many advantages such as small size, high efficiency, stable output power, and various protection functions, which further improves the stability and safety of the instrument.

5.Fast and accurate full-automatic matching function
The load terminal adopts the full-automatic matching technology independently developed by Tianrui Instruments, which has the advantages of fast matching speed and high precision, ensuring that the output power is applied to the load to the maximum extent, improving the efficiency of power supply, thereby improving the stability of the instrument and making the entire ignition process simple and convenient.

6.Advanced sampling system
The sampling system is stable and can be equipped with various atomizers and atomization chambers at home and abroad. It can be equipped with high-salt atomizers, hydrogen-fluorine-resistant atomizers, etc. to meet the various needs of customers; at the same time, Tianrui's independently developed automatic sampler makes the test operation more convenient and further improves the test efficiency.

7.Unique optical system
The medium-step grating-prism cross-dispersion method is adopted, and the professional optical optimization design maximizes the light flux while ensuring excellent spectral resolution; there is no moving optical component, which ensures good long-term stability; the ultra-low stray light design combined with the unique optical design greatly reduces the interference of background light and further improves the detection limit; the nitrogen distributed purge light chamber combined with high-quality optical components ensures the measurement of deep ultraviolet region, especially P, S, As and other elements.

8.Precise wavelength positioning

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Intelligent and precise automatic wavelength calibration algorithm can measure without additional peak correction, ensuring accurate measurement while saving a lot of standard solution and measurement time.

9.Excellent performance detector
Adopt large-size CID detector, advanced, mature and stable; large target size, million-level pixels; continuous coverage of 165-900nm range, one exposure, full spectrum display; non-destructive reading (NDRO) function, improves the signal-to-noise ratio of weak analysis lines, improves the accuracy of results, and data acquisition and analysis are better than CCD; excellent linear dynamic range and inherent anti-overflow function ensure that any strong or weak spectral lines can be measured and analyzed within one exposure, while providing flexibility for the method to select the ideal wavelength (second, third or more sensitive lines can be selected to eliminate interference).

10.Ultra-fast test speed
Each analysis line can set any appropriate integration period within the exposure time to optimize the measurement; the intensity integral value of all analysis lines can be read out in one exposure to speed up the analysis; the spectral line can also be specified to read out independently, and the readout time does not exceed 2ms.

11.Powerful software analysis function
The software is easy to operate and intuitive, with qualitative, semi-quantitative and quantitative analysis functions, instrument diagnosis and optimization functions, flexible full spectrum research functions, powerful offline reprocessing functions, scientific and intelligent background correction and interference removal algorithm functions, making the test more professional and accurate.

Technical parameters
RF generator technical indicators
Input power: AC 220V, current 20A
Output power: 700~1600W
Adjustment accuracy: 2W
Frequency stability: <0.05%
Output power stability: <0.1%
Matching mode: automatic matching
Electromagnetic field leakage radiation intensity: Electric field intensity E at 30cm from the chassis: <0.5V/m

Technical indicators of the injection device
Output working coil: inner diameter 25mm, 3 turns
Three concentric quartz torch: outer diameter 20mm; there are various models available according to the size of the central channel

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Imported nebulizer: concentric nebulizer, outer diameter 6mm; multiple models are available, high salt, HF resistance, etc.
Atomization chamber: double-barreled atomization chamber, cyclonic atomization chamber can be selected, outer diameter 57.2mm
Peristaltic pump: twelve rotors and four channels, the speed can be adjusted according to the required flow setting (that is, set according to the injection speed, intuitive and accurate)
Total argon consumption: The total argon consumption is less than 14L/min
Specifications of argon flowmeter and carrier gas pressure gauge: 1. Plasma gas flowmeter (100~1000) L/h (1.6~16L/min)
2. Auxiliary gas flowmeter (6~60) L/h (0.1~1L/min)
3. Carrier gas flowmeter (6~60) L/h (0.1~1L/min)
4. Carrier gas pressure regulator (0.2MPa)
5. Cooling water: water temperature 20~25℃ flow rate>5L/min water pressure>0.1MPa

Spectrometer technical indicators
Grating: medium-step grating, 52.67 lp/mm, 64 blaze angle, using German Schott's Zerodur material with a thermal expansion coefficient close to zero as the substrate, with more outstanding performance
Prism: Ultra-pure Corning UV fused quartz, with a transmittance of 99.6% at 170nm
Wavelength range: 165nm~900nm
Focal length: 430mm
Numerical aperture: F/8, high light flux ensures the detection limit and sensitivity of the instrument
Resolution: <0.0068nm@200nm
Stray light: 10000ppmCa The equivalent background concentration of the solution at As189.042nm is <2ppm
Light chamber: constant temperature, 35±0.1℃
Distributed nitrogen purge, normal purge 2L/min, fast purge 4L/min

Technical indicators of the detection device
Detector type: charge injection detector (CID)
Target surface size: 27.6mm×27.6mm, 1024×1024 addressable detection unit
Reading method: non-destructive reading (NDRO) , full-frame reading (FF) and arbitrary reading integration (RAI)
Linear dynamic range: 108
Wavelength response range: 165nm~1000nm
Electronic shutter: set the integration time of each spectral line individually; the spectral line can be specified to be read independently, and the readout time is <2ms
Quantum efficiency: without any coating, the 200nm ultraviolet region can reach more than 35%
Detector cooling: three-stage semiconductor refrigeration, cooling temperature -45℃
Instrument technical indicators
Observation method: vertical observation
Liquid content: 0.01ppm~several thousand ppm

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Solid content: 0.001%~70%
Repeatability: (i.e. short-term stability) relative standard deviation RSD<0.5%
Stability: relative standard deviation RSD<1% @2 hours
Test speed: The CID readout time for a single spectrum line is only 2ms, and all elements can be measured within one minute
Element detection limit (μg/L): 1ppb~10ppb for most elements
Instrument size: desktop 1300mm*840mm*740mm

Application areas

1. Silicon industry: magnetic material processing industry
2. Metallurgical industry: can analyze As, Bi, Pb, Sb, Sn and other impurity elements that have a great impact on the quality of metal materials
3. Water quality analysis: can detect the eight heavy metals and other elements that pollute water quality
4. Geological and ore analysis: determination of elements such as Ca, Mg, Na, Fe, Cu, Mn, Zn, Co, Ni, Au, Ag in rock samples
5. Application in the field of petrochemicals and light industry: testing more than 30 elements in crude oil, mainly Fe, Na, Mg, Ni, V, Ca, Pb, Mo, Mn, Cr, Co, Ba, As, etc.
6. Medical, health, agricultural environmental protection, commodity, food quality testing

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