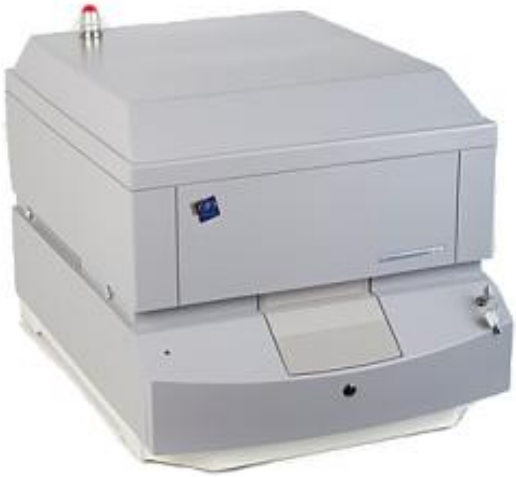
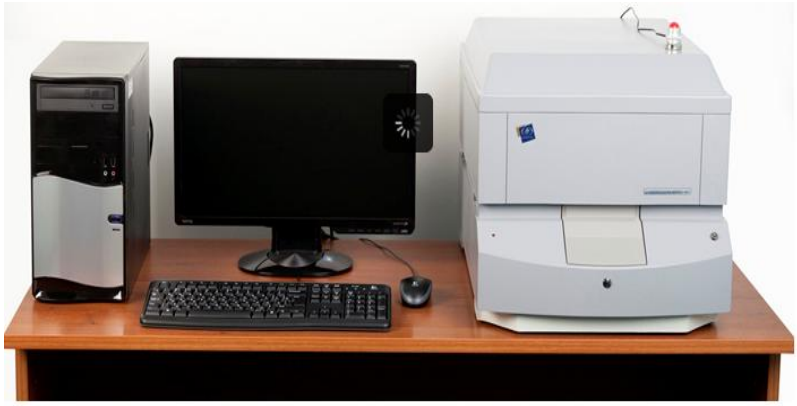
SPECTRON
XRF Spectrometers & Analyzers

SPECTROSCAN MAKC-GV

Vacuum wavelength dispersive X-ray fluorescent WDXRF scanning spectrometer for determination of chemical elements in the range from Na (Sodium) to U (Uranium) in various substances.





"SPECTROSCAN MAKC-GV" WDXRF spectrometer determines elements from Na (Sodium) to U (Uranium) in solids, liquids or powders, in solutions and thin films, deposits on filters.

The spectrometer operation is based on irradiation of the sample with primary X-rays generated by X-ray tube, registration of the secondary fluorescence from the sample elements preliminary diffracted on a crystal, and calculation of the elements concentration with the help of calibration equation, which is a relation between the element concentration and intensity of the registered secondary emission from the element. The spectrometer has high resolution of spectral lines and therefore provides accurate determination of elements in complicated multicomponent substances.

Technical Details

"SPECTROSCAN MAKC-GV" is a desk top WDXRF spectrometer controlled by an external computer.

There are three blocks in it: spectrometer, vacuum pump and closed cycle water cooling system.

The measuring system of the spectrometer is in the vacuum chamber while the samples are at the ambient pressure, so no He is required for the sample chamber and all samples (including liquid and powder) may be studied without any special measures taken.

The Spectrometer is controlled with external computer.

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Analytical parameters	
Determined elements	from Na to U
Energy resolution	9 eV (Si Kα), 60 eV (Fe Kα)

Technical specification	
X-ray tube anode voltage	40 kV
X-ray tube capacity	up to 160 W
X-ray tube anode	Pd (or Cr)
Spectral resolution	Crystal diffraction
Four crystal analyzers	LiF(200), C(002), PET, KAP
Sample changer	10 sample automatic
	2 spinning samples
Power supply	220 V, 50 Hz
Consumed capacity from 220 V mains	850 W
PC interface	USB
No additional gas required	
Closed cycle water cooling system	

Advantages

Non-destructive analysis – all elements in the range from Na (Sodium) to U (Uranium) can be determined from one sample. Desk top spectrometer doesn't require water supply or gas supply systems.

The measuring system of the spectrometer in the vacuum chamber while the samples are at the ambient pressure, so no He is required for the sample chamber and all samples (including liquid and powder) may be studied without any special measures taken.

Spectrum scanning and high resolution of crystal analyzers excludes close lines of different elements overlapping (therefore there is no need in their mathematical differentiation), provides correct background accounting. All these provide accuracy and reliability of analysis.

Automatic sample changer for 10 samples with two spinning samples for analysis of non-homogeneous samples minimizes need of operator activity while measurements.

The spectrometer is delivered precalibrated for customer's analytical tasks, with required accessories set and sample preparation equipment if necessary.

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Application

The major volume of slag generation is by ferrous and nonferrous metallurgy. The slags and tailings are used for additional metal extraction, construction material production, cement and fertilizers production, etc. Chemical composition of slag depends on the steel mark, composition of ore and flux. Usually slag contains from 35 to 47% of silicone oxide, 9-16% of aluminum oxide, 30-50% of calcium oxide, 2-14% of magnesium oxide, about 3% of manganese oxide and about 0.7% of iron. Nonferrous metallurgy slag contains oxides of copper, cobalt, nickel, zinc, lead, cadmium and rear metals besides mentioned above components.

One of the most interesting types of waste treatment is fertilizers production residual processing. Apatite and phosphorite are used for phosphorus fertilizers production. They contain some amount of rare earth elements. The residual is phosphorus gypsum containing up to 5 kg of rare metals per one ton of waste. Such concentration makes its processing profitable. Phosphorus gypsum application in cement industry and road construction is economically and ecologically reasonable.
X-ray fluorescence analysis is convenient for useful elements concentration determination while waste treatment. The greatest advantage is simple sample preparation. Express analysis supports permanent monitoring and control of the waste prqcessing.

Cement industry has shown clear trend to improve production control based on determination of chemical composition of raw materials: tailings, clinker, mineral additives, cement, and soda. The advantage of this technology is not only higher quality control, but more stable burning process with less deviations and saving raw material and resources.

X-ray fluorescence method has advantages compared to other chemical and physical methods: sample analysis without its decomposition, selectivity, express analysis, wide range of element determination.

Ceramics and refractory can be analyzed with XRF method with minimal sample preparation. That is material grinding to the particle size of 50 micron with further pellets pressing. Prepared samples are placed in a spectrometer, and analyzed. Element content is calculated with preliminary obtained calibration curves.

There is another sample preparation method which provides significant improvement of metrological results – that is fusing the sample material with borate flux.

The test method specifies determination of Na_2O, MgO, Al_2O_3, SiO_2, P_2O_5, SO_3, K_2O, CaO, TiO_2, Cr_2O_3, Mn_3O_4, Fe_2O_3, Co_3O_4, NiO, ZrO_2, WO_3, BaO, SrO, HfO_2, HfO_2, Y_2O_3, CeO_2, La_2O_3, SnO_2 in the concentration range from 0.01% up to 100%.

Fused samples provide better accuracy and reproducibility, but there are a lot of cases when pressed pellets are quite sufficient.

X-Ray fluorescence method provides rapid determination of a large number of components in a wide range of concentrations in ceramics and refractory without sample extraction. Sample preparation is either pressing or fusing the sample material dependent on the task.

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Actual basis of geochemistry are quantitative data on the content and distribution of chemical elements and their isotopes in different sites: minerals, ores, rocks, water and gas, living organisms, structural zones of the earth's crust, the crust, mantle and the Earth as a whole, in various space objects, as well as the forms of location and state of the elements in the natural substance. These data obtaining is based on the geological characteristics of the object, the modern physical and physical-chemical methods of elements content and state determination in the minerals, oil, gas and living matter.

X-ray fluorescence method is one of the most important modern methods due to its simplicity, precision and simple sample preparation.

XRFA provides direct elements determination from Na to U (in particular cases from Be to U) in powder, solid or liquid samples. X-ray fluorescence spectrometers are able to determine very low concentrations from mg/kg, as well as high concentrations up to 100% without sample dilution. That is why XRFA is an universal method of analysis providing simplicity, precision with simple sample preparation and almost no consumables.

X-ray fluorescence analysis properties are very useful in geochemical research. There are many sample preparation methods developed including dissolving the samples; preliminary concentrating methods provide low limit of determination of first mg/kg.

This allows to solve a lot of problems in geochemical studies with a single method.

The object of the geochemical studies and prospecting is the geochemical field and its local deviations, which can result in industrial mineral deposit discovery. Geochemical fields are studied with geochemical survey to determine deposits. The study is based on regular measurements of the chemical elements content along the chosen profiles and directions. The objects of the study may include:

- Rocks on the surface, in mine workings or from wells, the products of modern or ancient weathering of rocks and soils;
- Natural surface water and groundwater;
- River, lake or marine sediments;
- Underground atmosphere (soil air), the composition of the terrestrial atmosphere is rarely studied;
- Plant or animal organisms;
- Atmospheric dust or snow.

The result of the geochemical search surveys is identification of real ore areas and estimation of expected resources of minerals.
X-ray fluorescence method is ideal for prospecting and exploration of mineral deposits. A wide range of defined elements from Na to U, with wide content range (from 0.001% to 100%) allows almost any composition sample analyzing. Rapidity of the method, its high accuracy provides large scale analyses of geochemical samples.

The modern test methods specify element content determination in any samples (solid, liquid, aerosols), with certified metrological characteristics.

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