Measure and Save!

POLON-IZOT

XRF SPECTROMETERS

Table of contents

Essential information

The X-ray spectrometers are used for identification of elements in a given substance and determine their concentration. The XRF method is a frequently used as an analytical method in the nondestructive testing. The phenomenon of fluorescence X-ray, used in this method, consists of secondary emission of X-rays from the matter excited to emission.

As a result of the X-ray excitation each element contained in the analyzed sample will emit its characteristic spectrum. Elements are detected based on a characteristic wavelength (energy channel) of the X-ray emission. The quantitative analysis (evaluation concentration of a given element) is then performed by measuring the intensity of the radiation in a specific energy channel.

Added value of POLON-IZOT products

NOur guiding principle is "Measure - And - Save", so guided by it, we create practical solutions for our customers to enable real reduction of production costs and improved quality control. Understanding business needs of our customers and their daily work is very important to us. Therefore, thanks to constant communication and cooperation, our products are adjusted to individual needs.

We deliver the highest quality products by developing not only the product output, but also providing one-stop solutions to the customer's problems. Our staff consists of, among others, experienced programmers, mechanical engineers, electronics engineers, metrologists, and chemical engineers. Having such a team allows us to understand individual needs and deliver products that ensure maximum customer satisfaction. Our team is open to customer needs because all our products are in response to the most important requirements, determined during individual consultations. We have the appropriate technological knowledge and many years of experience that allow us provide support and continuous improvement of the services.

UIn accordance with our guiding principle "Measuring - you save", the reliability of the offered devices is very important to us. We guarantee the quality and functionality of our products as well as quick and effective help in case of problems, such as the application support to the offered solutions.

We believe, that the key to savings in the company is ensuring the possibility of obtaining an accurate result for key processes and thanks to the use of our devices we get the most accurate results. When the production process can be optimized on an ongoing basis we provide solutions on-line enabling constant control of processes and reducing time required for production optimization. We achieve this by using the most effective solutions and making the quickest decisions based on accurate information, that allows our clients achieve real savings.

The penetrating radiation has always been the source of concern for people. Our products meet the strictest safety standards, guaranteeing the level of radiation below the threshold of 0.1uSv / h - i.e. comparable with radiation which occurs naturally in the environment. Most offered spectrometers do not require notification to the NATIONAL AGENCY OF ATOMISTICS, or the implementation of radiological supervision. We believe, devices should be simple and easy to use by end users. The software which controls the operation of our devices is written in Polish or English (we are also able to provide other language versions). Operators of our devices can focus on the merits of their work by applying our uncomplicated products to operate their systems.

What is XRF?

The XRF (X-ray Fluorescence) technique is a fast, non-destructive technique used to determine the chemical composition of samples.

XRF uses the phenomenon of secondary radiation emission X-ray (or X-ray fluorescence) from the sample induced by exposure to high energy X-rays or gamma rays. It is a non-destructive method of characterizing the sample with a high selectivity, and at the same time, a low limit of quantification.

This method uses characteristics for each element the spectrum that it emits after excitation with X-rays. This spectrum is the basis for building calibration models that allow for qualitative and quantitative analyzes. The diagram showing the principle of operation of the XRF spectrometer is shown in Figure 1.

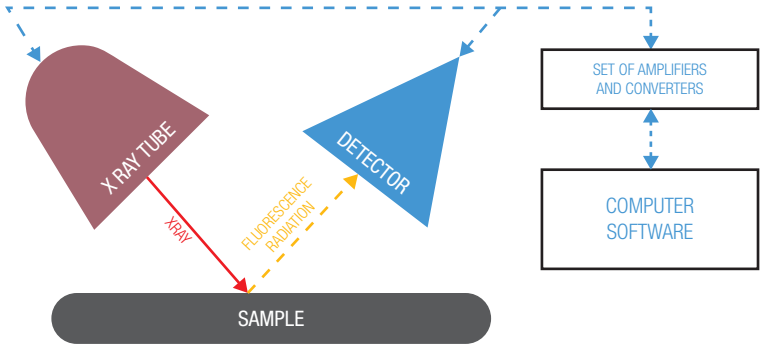


Figure 1 - General diagram of the XRF spectrometer

The high-energy radiation generated by the x-ray tube affects the test sample causing secondary emission X-ray radiation, the spectrum which depends on the elemental composition of the analyzed sample. This fluorescent radiation is then detected by a detector and converted into a digitized signal processing in the software.

X-ray quanta falling on the sample cause the electron to be knocked out of the inner shells of atoms, which leads to the formation of an unstable structure of the atom. A stable state is restored spontaneously by filling the resulting "gap" with a derived electron with a higher electron shell. This phenomenon accompanies emission of the secondary X-ray photon. Filling the resulting "electron gap" can occur through an electron coming from any higher electron shell (Figure 2). The transition from L to K is the most common and we call it the Kα transition, the transition from M to K carries the name Kβ, while the transition from the level of M to L is marked as Lα.

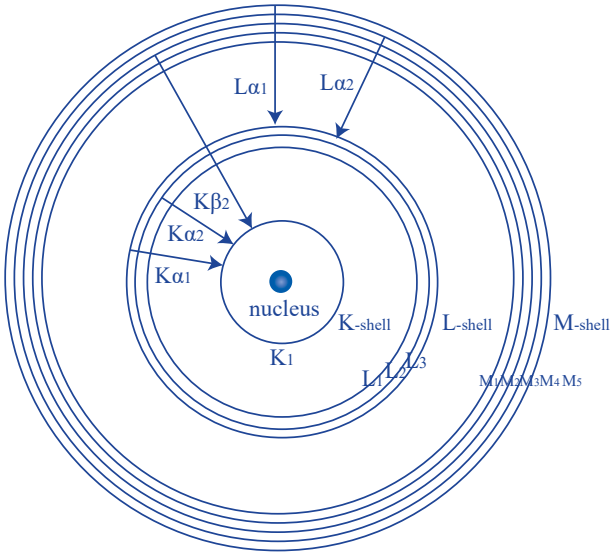


Figure 2 - Electronic transitions

As a result of each of these transitions, a photon of fluorescent radiation is created with a characteristic energy corresponding to the energy difference between the initial and final levels. From Planck's equation it follows that such a photon will have wavelength:

$$\lambda = h \bullet \frac{c}{E}$$

where: h - Planck's constant = 6.6256 10 -34 [J s], c - speed of light in vacuum (m / s), E - energy difference (J)

Detection and analysis of fluorescent radiation can be done using the energy dispersion method – EDXRF (used in our apparatus) or depending on the wavelength WDXRF. The EDXRF method uses a detector with a multi-channel analyzer of the intensity of the emitted radiation, so that the obtained signals are sorted depending on their energy - figure 3. To such a spectrum is assigned energy corresponding to individual energy channels and the elements that are observed in them.

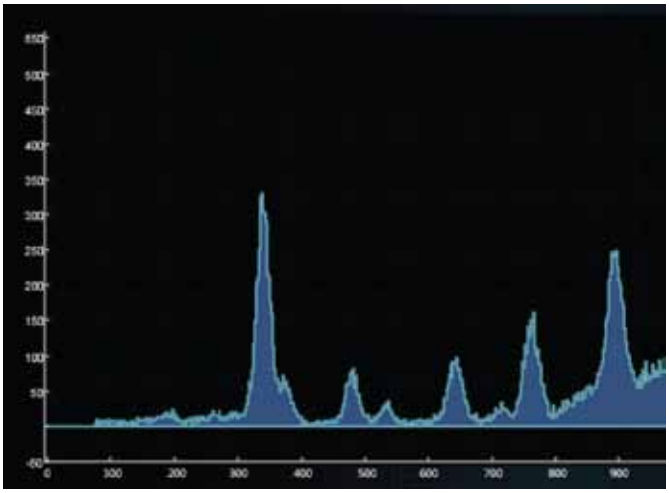


Figure 3 - The spectrum of radiation in individual energy channels.

Radiation safety

Most people associate penetrating radiation with a threat to health or even life. Definition of the radiation in force in Poland comes from the Atomic Law Act and is defined as radiation consisting of directly or indirectly ionizing particles, or both, in electromagnetic fields less than 100 nanometers in length. This radiation is undetectable by our senses. For people who operate devices emitting penetrating radiation (these are all the XRF spectrometers), the most important information affecting their safety is the size of the radiation dose. For any radiation source the key factors are the distance from the radiation source, the time spent near the source and the shield that separates us from the source radiation.

Modern POLON-IZOT devices are manufactured in a way that ensures the lowest possible radiation dose, less than 0.1 uSv / h. Such a dose is many times lower than the dose taken by a human traveling by plane, staying in old stone buildings or during X-ray examinations.

Preparation of samples for testing

One of the reasons for the popularity of XRF spectrometers is a very easy preparation of a sample for testing. However, you should always remember a few basic rules. The analyzed sample must be good representation of the research subject. It should be homogeneous, i.e. contain evenly analyzed elements in all their volume. Please note that the time dedicated to the proper preparation of the sample placed in the measuring device directly translates into the quality of the results obtained.

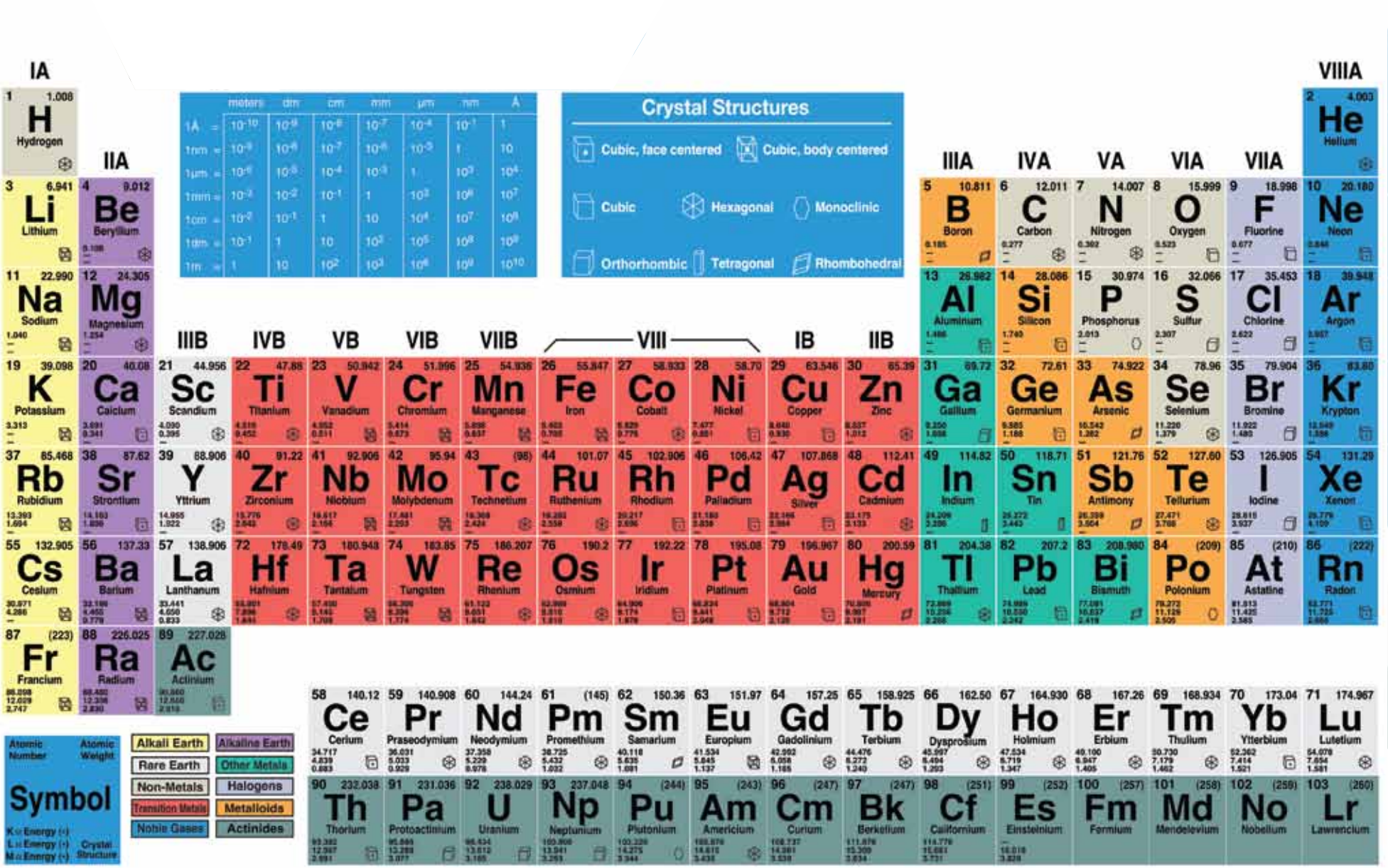
Depending on the model of the POLON-IZOT spectrometer, the sample requires different methods before testing preparation: from placing the sample in the device (or next to its measuring window - on-line spectrometers) through putting it on the appropriate bottle cap or placing the sample in a special cup, until a special tablet is prepared in accessory press.

Method limitations

Like any method of analysis, XRF spectrometry has some limitations of use. Light elements (atomic number <18) emit low-energy secondary radiation that can be suppressed by the analyzed sample itself, and by the air. Therefore, for the analysis of light elements, there are suitable models of spectrometers.

The matrix influence occurs when the analyzed sample contains more than one element. The secondary radiation emitted by other elements can amplify the signal or weaken it at the expense of attenuating the signal by other elements. To eliminate these gain and suppression effects, our software uses advanced algorithms taking into account such dependencies. The different density of the analyzed sample has a similar effect on the absorption of radiation. This impact must also be taken into account by software algorithms. The XRF spectrometry mainly uses secondary radiation from the surface of the analytical sample. If the sample is heterogeneous, i.e. the analyzed elements are not distributed evenly throughout the volume - results may be biased.

The Periodic Table of X-ray energies



XRF spectrometers in the laboratory and industry:

1. Petrochemicals:

- **a.** Measurement of sulfur content in fuels
- **b.** Measurement of the content of elements characteristic of individual elements in lubricants and oils
- **c.** Measurement of the content of active ingredients (elements) in petroleum products

2. Pharmacy:

- **a.** Identification of materials with metallic coatings, e.g. foil, and composite materials
- **b.** Measurement of the content of active elements in medicinal and cosmetic products, e.g. sulfur
- **c.** Quality analyzes of raw materials and products
- **d.** Quantitative analysis of macronutrients in supplements

3. Plastics:

- **a.** Identification of metallized materials
- **b.** Determining the thickness of metallic coatings
- **c.** Identification of alloys and measurement of alloy composition
- **d.** Identification of plastic additives

4. Mining / geology:

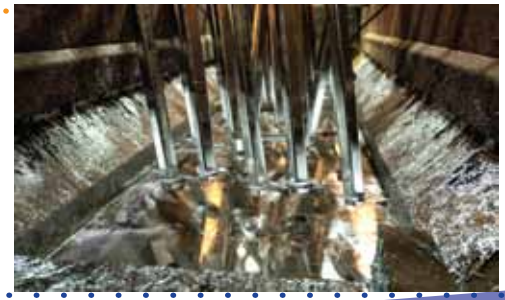
- **a.** Measurement of the content of elements in ores / minerals
- **b.** Optimization of ore thickening processes
- **c.** Optimizing the ore separation / purification / flotation process
- **d.** Evaluation of the quality of the output
- **e.** Analysis of the final product (qualitative and quantitative)

5. Metallurgy (metals and metal alloys):

- **a.** Measurement of elements in ores
- **b.** Measurement of the content of elements in raw materials (scrap, waste, ores)
- **c.** Optimization of the separation / purification process
- **d.** Product quality assessment
- **e.** Analysis of the final product (qualitative and quantitative)
- **f.** Evaluation of alloys

6. Metallurgy (other):

- **a.** Assessment of the thickness and composition of electroplating coatings
- **b.** Alloy analysis
- **c.** Analysis of the composition of electroplating baths
- **d.** Quantitative and qualitative analysis of waste 10



7. Science:

- **a.** Non-destructive testing of the chemical composition of historical objects
- **b.** Confirmation of the authenticity of historical products
- **c.** Quantitative and qualitative analysis of solid and liquid samples
- **d.** Substance identification

8. Building materials:

- **a.** Analysis of the composition of raw materials
- **b.** Control of the composition of finished products (e.g. cement composition)
- **c.** Optimizing the mixing and grinding process

9. Paints and varnishes:

- **a.** Analysis of chemical composition - additives
- **b.** Assessment of raw materials

10. Forensics:

- **a.** Substance identification
- **b.** Comparing and identifying samples of metals, ceramics, glass, etc.

11. Food industry:

- **a.** Quantitative analysis of macronutrients by minerals, e.g. calcium in milk

12. Paper industry:

- **a.** Analysis of covering paper with adhesives and plastics

XRF spectrometers

Selected technical parameters

Spectrometer	PI-100 XRF		PI-500 XRF	PI-300 XRF		PI-1000 XRF	
Place of measurement	Laboratory		Laboratory	Laboratory or at production line		Production line	
Measurement type	Single		Single (sample scan possible)	Single		Continuous monitoring	
Measurement in the air	X		X	X		X	
Measurement in vacuum	X			X			
Measurement in helium atmosphere	X						
Measurement through foil w XRF cups	X						
Measurement Directly in bottles of 50 ml				X			
Direct measurement samples			X			X	
Composition analysis	X		X	X		X	
Quantitative analysis	X		X	X		X	
Qualitative analysis	X		X	X		X	
Control	External computer - PC		External computer - PC	Built-in computer		External computer via TCP / IP	
Measurement range	Mg - Pb		Mg - Pb	S - Zn		Ca - Pb	
Concentration range[1]	10 ppm - 100%		10 ppm - 100%	10 ppm - 100%		100 ppm - 100%	
Radiation source	X-ray tube						
Tube power	4W/10W[2]						
Tube voltage	40 kV / 50 kV[3] 30 kV[4]						
Target material[5]	Ag, Rh, Au, W, Pd, Ta,						
Detector[6]	SDD	PIN	SDD	PIN	SDD	PIN	SDD
Energy resolution	125 - 135 eV	≤ 190 eV	125 - 135 eV	≤ 190 eV	125 - 135 eV	≤ 190 eV	125 - 135 eV

Uwaga!

Podane dane w tabeli są typowymi, inne są możliwe na zapytanie.

1 Depending on the analyzed matrix. The given range is indicative

2 Depending on the options

3 Depending on version

4 Restricted due to legal requirements

5 Selectable

6 Selectable from SDD or PIN

Spectrometer

PI-100 XRF

The PI-100 XRF meter is a classic laboratory spectrometer that enables the measurement of special samples in high transmittance XRF foil cups with bottom.

The camera is equipped with an SDD detector with a resolution of 125 to 140 eV, or a PIN detector with a resolution of ≤ 190eV, and a lamp operating in the range up to 50 keV. Convenient sample chamber with cup rotation allows for precise measurements.

The camera is equipped with English language software that allows you to easily perform quantitative and qualitative analyzes, and determine the chemical elements located in the periodic table, starting from Magnesium (Mg) to Lead (Pb) in the range from 100 ppm to 100%, and in specific applications even from 1 ppm to 100%. This camera is especially dedicated for the following analyzes:

- determination of the concentration of elements in water samples and sewage
- determination of the content of elements in solid samples and powders
- determination of the thickness of metal layers in plastics
- determination of the content of elements in soils
- determination of elements in petrochemical products, e.g. oils, greases
- determination of elements in refrigerants

Spectrometer

PI-500 XRF

The spectrometer is an alternative to portable spectrometers, providing the ability to analyze large samples dimensions (50 cm x 50 cm x 30 cm), and irregular shapes. Thanks to the head lowered from the top, equipped in the distance indicator, the optimal measurement geometry is maintained, and allows for the ability to perform measurements in the chosen one sample site.
The Pi-500 XRF model can be equipped with a system for manually moving the measuring head over the analyzed sample or for automatic setting of the measuring system in the optimal position and even for the scanning of small items (from within the housing).

The devices are equipped with English-language software that allows you to easily perform quantitative and qualitative analyzes. Our spectrometers allow you to determine chemical elements heavier than magnesium (Mg - located further on the periodic table) up to Lead (Pb) in the range from 100 ppm to 100%, so they can be used for measurements, among others such as:

- determination of the content of elements in solid samples and powders
- determination of the thickness of metal layers
- determination of metals content in plastics
- determination of the content of elements in soils
- identification of alloys, foils, etc.
- research on archaeological samples

Spectrometer “at-line”

PI-300 XRF

The PI-300 XRF spectrometer is a standalone device controlled by an intuitive touch interface, with IP54 protection degree, meeting the requirements of the National Atomic Energy Agency in terms of requirements for equipment that uses ionizing radiation. Thanks to our design, the X-ray fluorescence spectrometer does not require an occupancy permit. All results are saved in the database, allowing you to track trends, generating test reports and exporting results to mobile devices.

The use of our spectrometer allows you to determine the sulfur content in fuels or the composition profile in a very short time, in oils and greases.

The content of iron, nickel, chromium, vanadium, copper, and zinc in oils can be used for quick diagnostics of engines and machines from which the tested sample comes. Thanks to the determination of the calcium content, and the sulfur content of oils and greases, it is possible to optimize the composition of the lubricating oils in large engines.

Spectrometer “on-line”

PI-1000 XRF

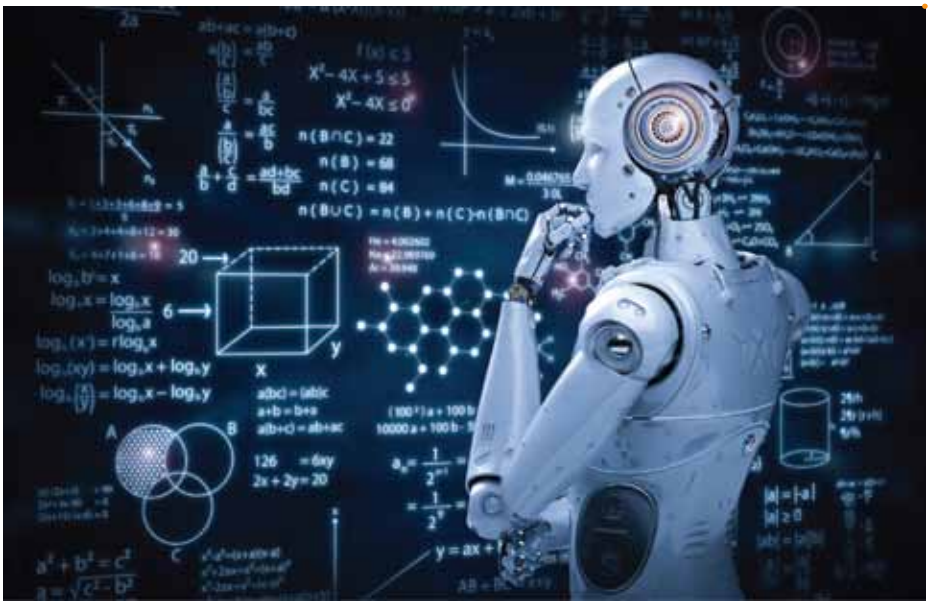
The Fluorescence spectrometers of the PI-1000 XRF series constitute a group of devices in industrial design, intended for continuous quantitative and qualitative analysis of elements with atomic numbers greater than calcium, in solid, loose, and liquid samples. The operation of the meter is based on excitation with a suitable isotope source or X-ray tube characteristic radiation of the elements determined in the sample. It is detected by a suitable detector and then, after amplification, in the built-in multi-channel analyzer, the spectrum is created on the basis of which the system A microprocessor equipped with specialized programming performs a quantitative and qualitative analysis of the tested medium.

On the basis of the calibration performed, the results are given in the form of percentage or weight concentration or thickness of the coating. On-line spectrometers are used to measure the elemental composition, among others metal products or plastics artificial, but also in the measurement of the concentration of elements in open or closed tanks, industrial waste or water treatment installations. They are also helpful in the quantitative determination of individual elements in the mine output directly on conveyors, galvanization enrichment process control and the like.

Advantages of industrial spectrometers:

- ongoing control of the percentage of metals: copper or other selected metals, e.g. silver Ag in the transported ore or flotation slurry by conveyor belt
- lack of supervision
- adaptation to continuous operation in automatic mode
- the results of the percentage content of individual metals are calculated during the determined integration (as standard, every 100 seconds), displayed on the meter display and archived together with the measurement time in the form of 100-second results and 15minute averages
- the results are sent to a cooperating computer
- fast radiometric analysis enables optimal regulation of the flotation process and also gives immediate information (acoustic and / or optical) if the set parameters of the technological process are exceeded
- working time - continuous.

Devices on individual order



We are a Polish manufacturer of measurement systems, and we can adapt our standard products or make specialized control and measurement devices for individual customer orders. Each inquiry is individually consulted and valued. Our team consists of designers, electronics, mechanical, and automation engineers and programmers, as well as chemical engineers, biologists, metrologists, which allows for enabling of the development of solutions tailored to individual needs. If you have any questions, please contact biuro@polonizot.pl

OUR SERVICE!

We offer:

- Comprehensive sales and after-sales service
- Warranty service
- Post-warranty service
- Installation and commissioning of devices
- Training of personnel in equipment operation or safety issues (e.g. working with isotope devices)
- Periodic inspections
- Service contracts
- On-line, at-line and laboratory modernization of control and measurement devices
- Modernization of technological lines
- Transport of isotope sources in accordance with ADR and PAA
- Warehousing of isotope sources
- Comprehensive supervision of isotope sources in control and measurement devices (IOR-01)
- Supervision of industrial and laboratory equipment using ionizing radiation.

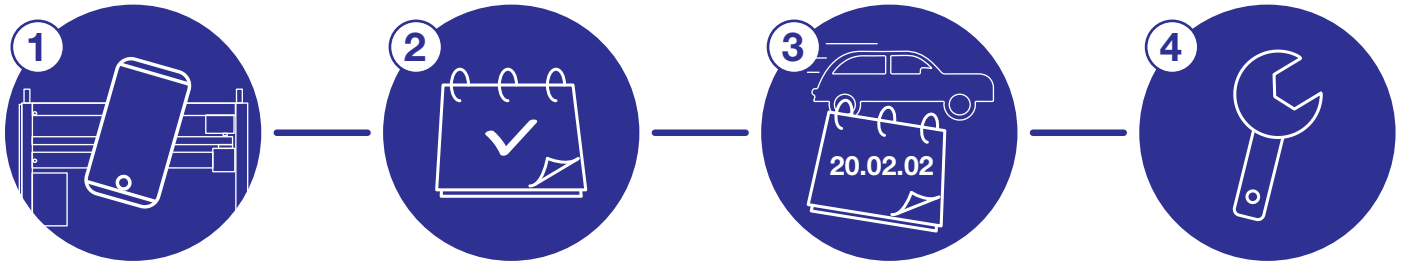
We have a permit from the Polish National Atomic Energy Agency (PAA) to perform activities in accordance with the Atomic Law Act consisting of:

I. - starting devices generating ionizing radiation - XRF spectrometers

II. - manufacturing, installing and servicing devices containing radioactive sources

We have UDT f-gas qualifications in accordance with the Act:
REGULATION (EU) No 517/2014 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 April 2014 on fluorinated gases greenhouse gases and repealing Regulation (EC) No 842/2006

Our priority is to provide timely service and an individual approach to each service request.



NOTIFICATION SERVICE

SERVICE OFFER / ORDER

MAKE AN APPOINTMENT / VISITS

REPAIR SERVICE DOCUMENTED PROTOCOL

Measure and Save!

Our portfolio - examples

Thickness and grammage gauges

On-line, industrial version

Laboratory version

Optical defect analyzer Density meters

Dust concentration meter, including explosives

Non-contact measurement of density through the installation pipe

Dust concentration meter, including explosives

Radioactive contamination analyzers

Contamination meter
surface and dose rate

MAZAR (Gamma spectrometer)
- radionuclide analyzer in environmental
samples, including food

Contamination monitoring
system wheeled and rail vehicles

Contact

POLON-IZOT

POLON - IZOT sp. z o.o.
ul. Michała Spisaka 31
02 - 495 Warsaw
tel. +48 22 724 74 64
www.polonizot.pl
e-mail: office@polonizot.pl

POLON-IZOT is a Polish manufacturer of measuring equipment for laboratories and industry. We are the continuator of the activity the world-famous company POLON United Works of Nuclear Devices, founded in 1956 and functioning as the Office of Nuclear Devices Nuclear Technique.

Therefore, we can be proud of over 50 years of technical achievements. Our mission is to create our own advanced technical solutions for measuring equipment both on-line and at-line, or typically laboratory products.

We are prepared to manufacture measuring and control equipment on individual orders.

We have a permit from the National Atomic Energy Agency (PAA) to perform activities in accordance with the Atomic Law Act consisting of:

I. - starting devices generating ionizing radiation - XRF spectrometers

II. - manufacturing, installing and servicing devices containing radioactive sources

We have UDT f-gas qualifications in accordance with the Act:

REGULATION (EU) No 517/2014 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 April 2014 on fluorinated gases green-house gases and repealing Regulation (EC) No 842/2006

Measure and Save!

www.polonizot.pl