Bruker AXS

S4 PIONEER

- Spectrometry Solutions

think forward

WDXRF


BRUKER
S4 PIONEER

S4 PIONEER –
Performance you trust

The S4 PIONEER brings you the advantages of two different worlds. You have the superior analytical performance of a sequential wavelength dispersive X-ray spectrometer – such as the highest resolution and the best reproducibility and sensitivity, in particular for light element analysis – combined with the advantages of space saving and cost efficiency.

The S4 PIONEER can be used in any environment, whether it is in the clean environment of the lab, or the rugged surroundings of the production site. It provides you with the features you expect from a space saving spectrometer. The S4 PIONEER not only meets the demands for space saving, but also brings you an efficient and economical solution to high power excitation at 2.7 kW with a simple connection to an external cooling water system. The external water supply can be from your city or plant tap water, or a water chiller system. Water consumption is automatically minimized based on the generator power setting, and is typically one-third that of standard X-ray spectrometer systems. Short term variations in water flow and flow interruptions are compensated for.

S4 PIONEER

little in:

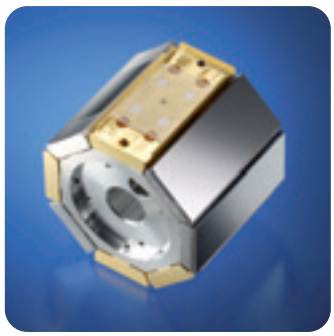
- Measuring time
- Space installation requirements
- Effort for setup and calibration

gigantic in:

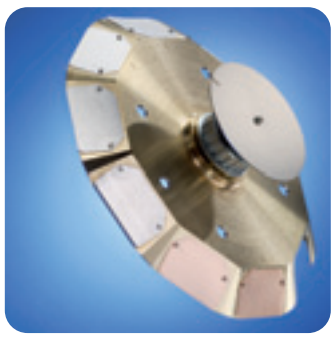
- Sample throughput
- Measuring speed
- Integrated intelligence
- Analytical flexibility & sensivity
- Reproducibility


Collimator masks


Vacuum Seal


Automatic crystal changer


Range of detectors


Filter wheel


Mobile on castors


Sample changer


Collimators

XRF – source of speed and power

The primary advantage of X-ray fluorescence (XRF) analysis is that it is independent of the chemical bonding of the elements in the sample.

Other methods, such as ICP and AAS, require time-consuming, expensive and hazardous sample preparation techniques. XRF, however, can directly analyze each element without destroying the sample. With XRF, measuring any type of solid or liquid is as easy as 1-2-3.

Why is XRF so easy?

In XRF, the sample is excited with a primary X-ray beam, causing the sample to fluorescence. The primary X-rays eject electrons out of the inner atomic shells (K- and L-shell). The resulting "vacancy" is filled by an electron from an outer atomic shell.

This electron transition takes place only between the inner shells of the atom, which are not involved in chemical bonding. Due to the independency of chemical bonding, the samples can be analyzed directly without advanced sample preparation. This makes XRF the best method for elemental analysis.

How does XRF analyze elements?

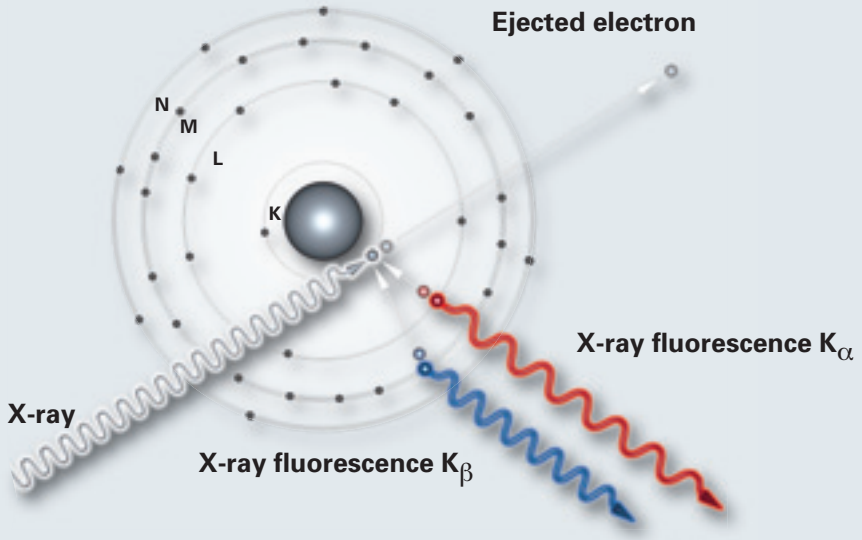
During electron transition, an electron drops from a higher to a lower energy atomic shell to fill the vacancy. The difference in energy is released as X-ray fluorescence radiation. This radiation has a characteristic wavelength for each element. XRF uses these different characteristic wavelengths or energies for elemental analysis.

What XRF techniques are available?

There are two different techniques. Energy dispersive X-ray fluorescence (EDXRF) analysis simultaneously acquires all X-ray energies emitted from the sample. The characteristic energies are separated using a single X-ray detector in a fixed position. In contrast, wavelength dispersive X-ray fluorescence (WDXRF) analysis separates the characteristic wavelengths with a very high degree of resolution. Optimized analyzer crystals and detectors are used to separate and count the emitted X-rays. WDXRF is unsurpassed in terms of analytical accuracy and precision.

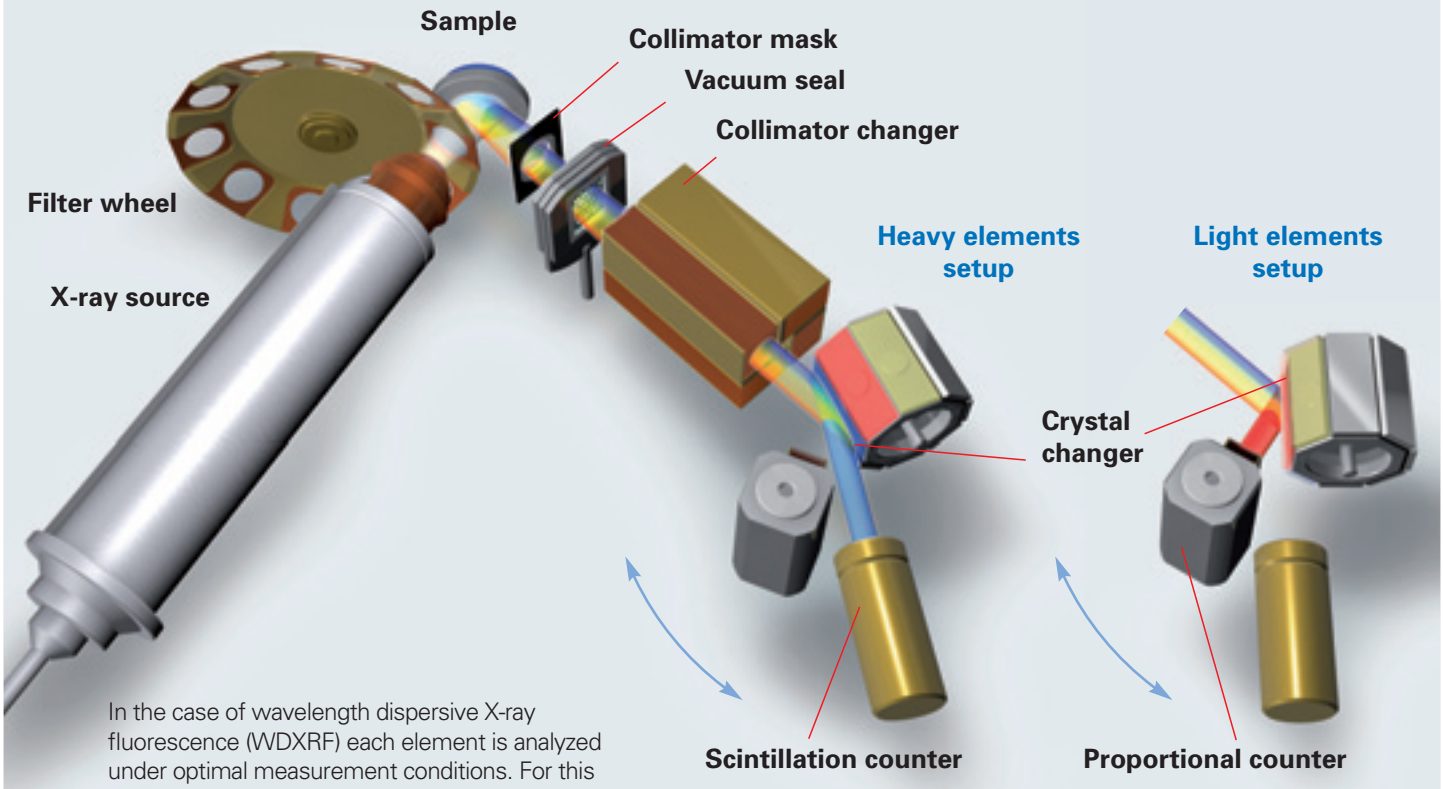
- Optimal analysis of all elements with ultimate precision and accuracy
- Independent of chemical bonding
- Direct, non-destructive analysis of solid, powder and liquid samples
- Easy sample preparation within minutes
- Safe method, no hazardous chemicals needed

How does X-ray fluorescence (XRF) work?



- The sample is bombarded with X-rays. This excites the sample to generate X-ray fluorescence. The X-rays "shoot" individual electrons out of the atoms of the elements, primarily out of the inner atomic shells K and L. The resulting vacancies are filled up again by electrons from higher energy shells. The excess energy of these electrons is then emitted in the form of X-ray fluorescence radiation. This radiation is characteristic for each element like a fingerprint and independent of the atom's chemical bond. The intensity of the radiation is proportional to the concentration of the element in the sample.

Wavelength dispersive X-ray fluorescence (WDXRF) with the S8 TIGER



In the case of wavelength dispersive X-ray fluorescence (WDXRF) each element is analyzed under optimal measurement conditions. For this purpose individual combinations of measurement parameters are set corresponding to the concentration range and to prevent line overlaps:

- The X-ray source and primary radiation filter guarantee that each element in the sample is optimally excited.
- The masks cut out unwanted signals, e.g. from the sample cup.
- The vacuum seal separates the sample chamber from the goniometer chamber. During loading the seal is closed and the goniometer chamber remains under vacuum. Therefore only the small volume of the sample chamber needs to be evacuated for solids or flushed with helium for liquids. During the measurement of liquids the vacuum seal stays closed to protect the components in case of spillage, safes helium and enhances the stability.
- The collimators are used for improving resolution.
- The analyzer crystals play a crucial role. They break down the multiple frequency fluorescence spectrum into the specific wavelengths for the elements. This signal separation is crucial for the outstanding resolution and sensitivity of WDXRF.
- And finally, the detectors: For the detection of light elements a proportional counter and for the heavier elements a scintillation counter is used. Both detectors are perfectly suited to the respective energy range.

- Precalibrated for all types of materials
- Intelligent measuring strategies applying the best parameters
- Totally flexible interactive data evaluation
- Automatic correction of spectral overlaps

Sample input – fast, easy and reliably

Standard loader with 60 cups

Mixed loader for different sample holder

Online loading with conveyer belt

- Fully integrated matrix correction with fundamental parameters individually calculated for each sample ("variable alphas")
- Simple and fast optimization with material specific standard samples

Just one mouse click and you'll explore the whole periodic table – S4 PIONEER with SPECTRA*plus*

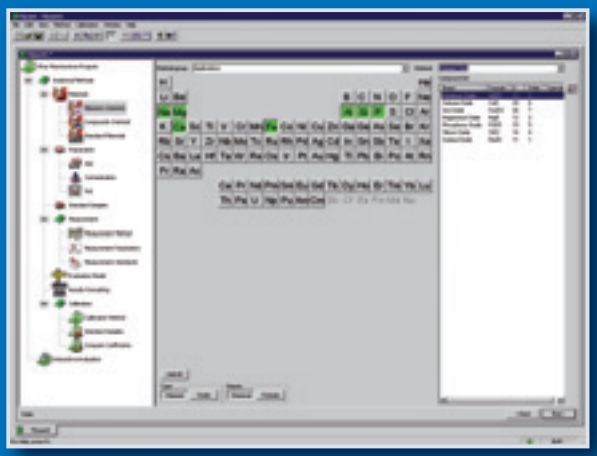
A daily measuring routine in XRF means:

Loading and unloading of samples and starting measurement jobs. In relation to both, we kept, above all, your comfort in mind. A large sample magazine and a safe measuring routine guarantee high sample throughput, freeing you for your other responsibilities in the lab.

Measurement jobs are quickly defined and started with minimal operator input. Youn can select or create a measuring job even faster and easier than sample preparation. For example, you just define the elements and the required analytical accuracy. SPECTRA*plus* automatically selects the best measuring conditions and evaluation methods for you. No special technical training or expertise is required to achieve precise results. Start the measurement and the analytical results are automatically printed in just a short time. Internal data communication in SPECTRA*plus* is based on the TCP/IP Client/Server Principle. Therefore, the complete functionality of SPECTRA*plus* is available on any computer within your network. This means that your spectrometer can be controlled or analytical data can be evaluated by SPECTRA*plus* from any computer within your network or, for example, from your portable PC, wherever you are, via modem.

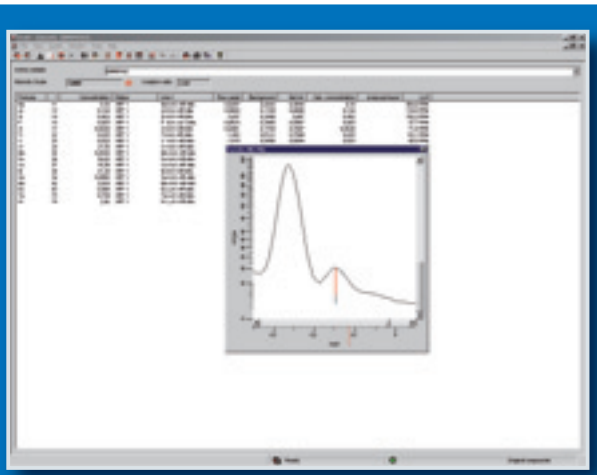
Standardless analysis

Standardless analysis with a minimum of user input or specific calibrations for the highest accuracy or lowest detection limits – S4 PIONEER and SPECTRA*plus* offer seamless integration of qualitative, standardless ("semiquantitative") and quantitative methods.
The fully integrated Analytical Intelligence is based on decades of experience in XRF analysis.

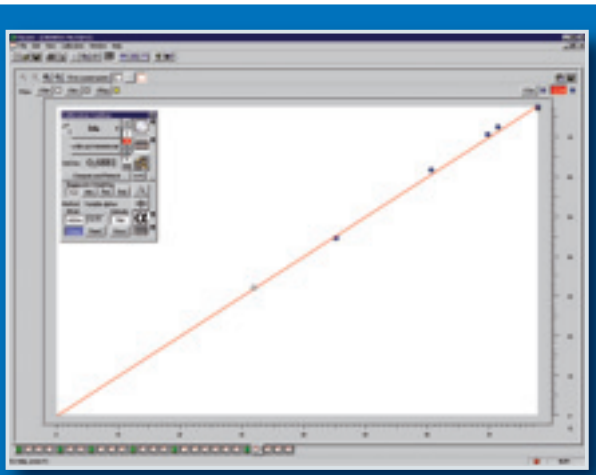


1) Wizard for step by step creation of calibrations: From material definition, sample preparation to optimized measurement conditions for standards

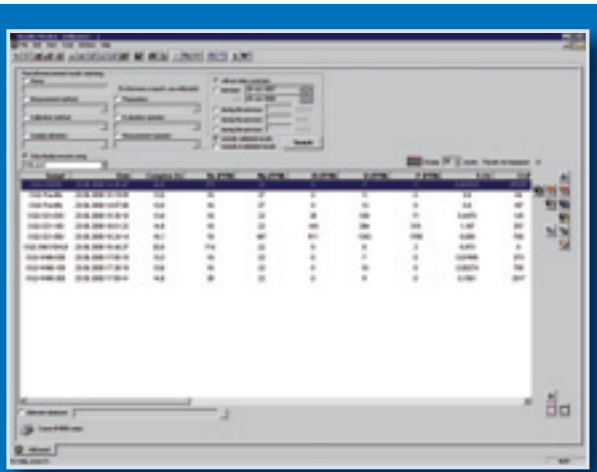
4) Database of all sample data for powerful search, LIMS integration and seamless combination with other analytical methods like XRD



2) Evaluation of samples with interactive graphical display of scan data including peak and background intensities, analytical lines



5) Calibration curve with selected element specific line, standard deviation, matrix and line overlay correction



3) Result Monitor to display, summarize and export data (clipboard, html, xml, txt)

6) Easy-to-use loader display for routine operation. Priority measurements can be started

Technical Data	
Analysis range	Beryllium to Uranium
Concentration range	Concentrations from sub ppm to 100%
Sample form	Powder, solid, liquid, paste, coating, slurry, film, filter deposit, etc.
Sample size	Liquids, loose powders: up to 50 mL Solids: up to 51 mm (2") Ø , 47 mm (1.8") in height
Collimator	Automatic collimator changer (up to 4): 0.46° (default), 0.23° (default), 2°, 1°, 0.17°, 0.12°
Masks	high precision masks available 34mm (default), 28 mm, 23 mm, 18 mm, 8 mm
Analyzer crystals	Automatic crystal changer (up to 8) Included: XS-55, PET, LiF (200) Optional: XS-B, XS-C, XS-N, XS-PET-C, XS-CEM, LiF (220), LiF (420), ADP, Ge, TlAP, InSb
DynaMatch™	Linear intensity range more than 10 million cps
Vacuum pump	Integrated
Gas for analysis of liquids and loose powders	Helium or nitrogen, at reduced or normal atmospheric pressure
Excitation	End window Rh X-ray tube, 75 µm Be window 2.7 kW 60 kV max. 100 mA max.
Power requirements	208 V 60 Hz (1P/3P), 230 V 50/60 Hz (3P)
Compressed air	Not required
Detector gas	P10 gas (10 % methane, 90 % argon)
External cooling water	Cooling water Water consumption automatically regulated and minimized, short term interruptions are compensated
Dimensions (height x width x depth)	131 cm x 84 cm x 99 cm 51.6" x 33.1" x 39" 450 kg
Quality & safety	DIN EN ISO 9001:2000 CE certified Fully radiation protected system (BfS)

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