



S2 RANGER

● Spectrometry Solutions

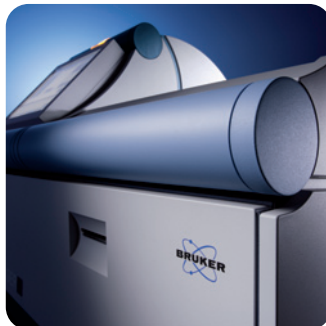


S2 RANGER with sample changer and tray for 28 samples





TouchControl



Rugged design



Industry certified



Integrated printer



Magnetic gripper



Adjustable screen



All-in-one system



XFlash detector



Fully protected



Automatic loading



Manual loading



Small sample chamber

S2 RANGER with single sample loading



S2 RANGER – Leading the performance class

Time is money!

And so as not to take up too much of your time, we have done something slightly unusual. We have placed a short description of users who will not purchase our system right at the beginning of this brochure. If you find yourself here, then we part ways now and thank you for spending a moment.

Here is the short check:

You can stop reading if you are not interested in reliable, stable results.

Also please lay this brochure aside if you are only interested in investigating a single element or a single sample type, both today and for the next ten years.

If you are merely looking for the cheapest system and you do not care about actual operating costs, stop reading right here.

If you like working your way through fat manuals or enjoy never ending training lessons, you can close the brochure at this point, please.

So, you're still reading!

Excellent, then we sincerely welcome you to the performance class. Our S2 RANGER is obviously just the right solution for you and your demanding elemental analysis applications.

Say goodbye to extensive instruction and welcome to TouchControl™



Results

- Free language selection – English, German, French, Spanish, Portuguese, Russian, Chinese ...
- No training required
- Tailored results for process and quality control
- Maximum data integrity due to user access levels

This is how easy multielement analysis can be.

What do you think of when you hear the term multielement analysis? Inserting a sample into a spectrometer, moving to the computer, programming it with a whole series of measurement conditions, and interpreting a confusing table of numbers? If so, you are quite right – with other systems, that is how X-ray fluorescence (XRF) usually works.

With TouchControl XRF works better and easier by far. Simply insert your sample, start your measurement on the integrated touchscreen and get color-coded results. TouchControl means no time-consuming training, no need for fat manuals, no tangled cables, and no complicated setups – just efficient work and excellent results right away.

TouchControl is as easy as 1-2-3. Here are the three steps to successful elemental analysis:

1.



- First, insert your sample and select the desired application. It goes without saying that the list of applications can be configured freely. You determine the access rights of users to specific applications.

2.



- Next, type in relevant sample information. The name of the sample is sufficient, but the sample quantity or information on the sample preparation can be specified if you like.

3.



- Last, start the measurement simply by touching the screen and get your results. With a sample changer you can automate the analysis of up to 28 samples.

This is how clearly analysis results can be presented.

The measurement results that you receive on the touchscreen are tailored exactly to your needs. In addition to concentrations, ratios and totals can be automatically displayed for production control. And if quality control sets quantitative limits for a sample, the sample status is indicated by a traffic light symbol, showing red, yellow or green.

Now you know everything you need for your daily work with the S2 RANGER!

Tailoring your own system made easy

We have already shown you how fast and simple your daily work can be thanks to TouchControl. But what about calibration, the selection of measurement parameters, analyzing standards and setting up drift corrections?

Or, to put it in different terms, how can the S2 RANGER be adapted to special tasks? Two options: you can either rely on us and use one of our special, ready-made application packages, or you can create your own application.

The requirements of the cement industry, petrochemistry and geology are each entirely different. This is precisely why we have developed a tool of unparalleled flexibility for the creation of your own application, tailored according to your standards: SPECTRA EDX.

This is how easy it can be to create individual applications.

Step by step the SPECTRA EDX guides you to your goal: fast, easily and reliably, like a navigation system.

Let's start with the first step: defining the standards, which will serve as references for the measurement. Simply enter the names of the standards, the concentrations of the elements and the sample quantity and preparation parameters. The information is stored in a database and can be reused any time.

Next step: setting up the measurement. Based on your inputs, SPECTRA EDX automatically proposes a measurement method, which already takes into account all the information and covers the range of elements required. You can simply adopt this method, or adapt it to your special requirements. The process continues in the same simple way: insert standards and start measuring.

As you have probably guessed, now comes step three: calibrating the system. The calibration curve is calculated for each element. Numerous tools are available even for the most sophisticated calibrations. SPECTRA EDX can correct matrix effects via theoretical, empirical and variable alphas. You can modify your calibration settings whenever you like and check the effects on the calibration curve.

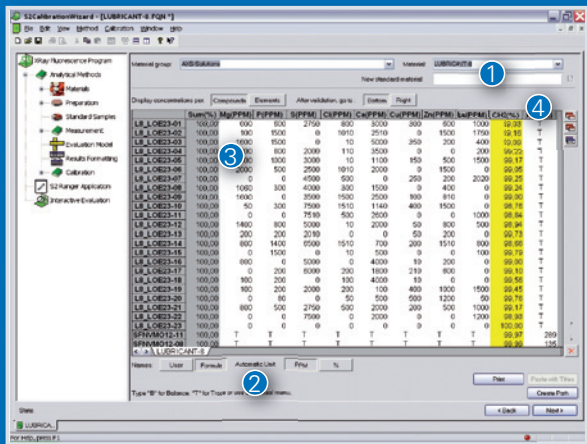
Lastly, to have your application appear as a button on the integrated touchscreen, simply give it a name. And that's it!

- ① Name a new standard
- ② Select units – ppm or %
- ③ Type concentrations of standards – T for trace and B for bulk matrix
- ④ Data import and export

- ① Automatically generated measurement ranges for different elements
- ② Total measurement time and atmosphere (He, vacuum or air)
- ③ Edit predefined measurement ranges or create a new one
- ④ Consistency check of the measurement settings

- ① Toggle between selected elements
- ② X-ray intensity without corrections
- ③ Intensity with corrections applied
- ④ Standard deviation of the calibration in ppm

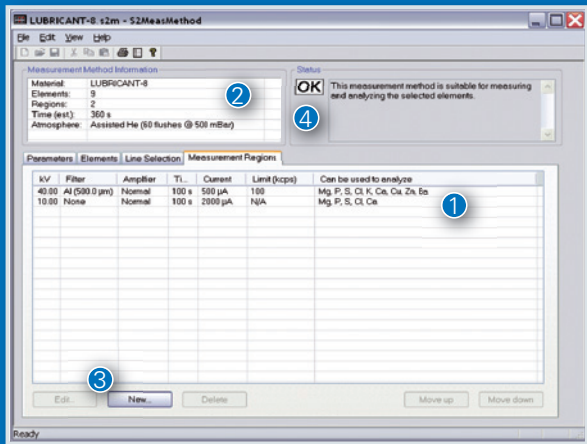
- ① Name the button for the application
- ② Change sample shape and color for loader display
- ③ Consistency check of the application
- ④ Save and create the touchscreen button



Standards

Convenient data input

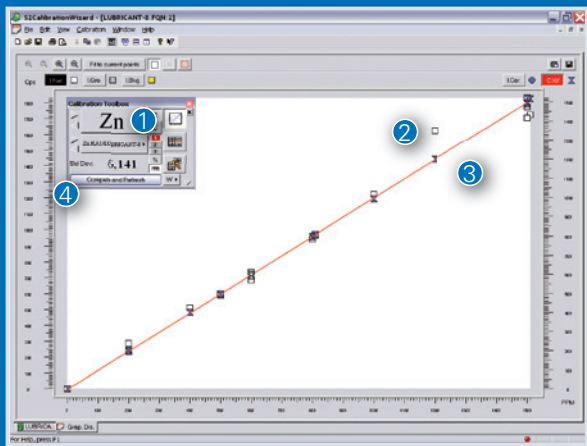
- Tree-guided workflow
- Fast spreadsheet editing
- Import & export of composition data
- Definition of sample preparation



Measurement

Integrated analytical intelligence

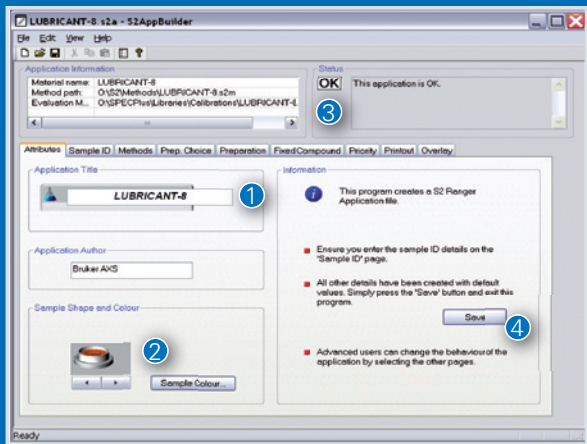
- Best excitation voltage preselected
- Optimized filter settings
- 4 modes – air, vacuum, reduced and atmospheric He
- Fixed current or fixed count rate settings



Calibration

State-of-the-art fundamental parameter evaluation

- Direct correlation of intensity vs. concentration
- Correction for line overlaps
- Internal standard
- Theoretical, fixed and variable alphas



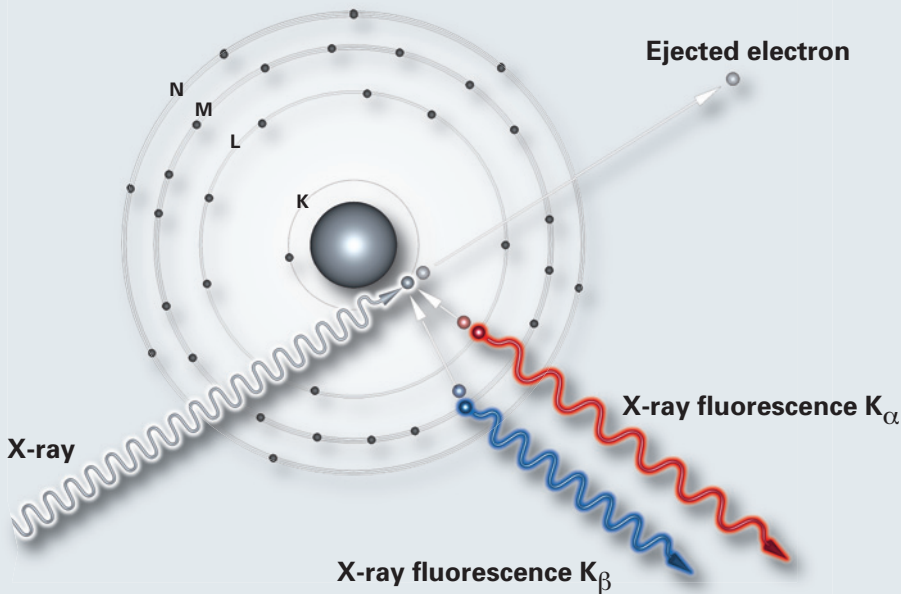
Application

Easy TouchControl integration

- One-button methods
- Variable sample preparations
- Color-coded quality limits
- Automatic module calculation

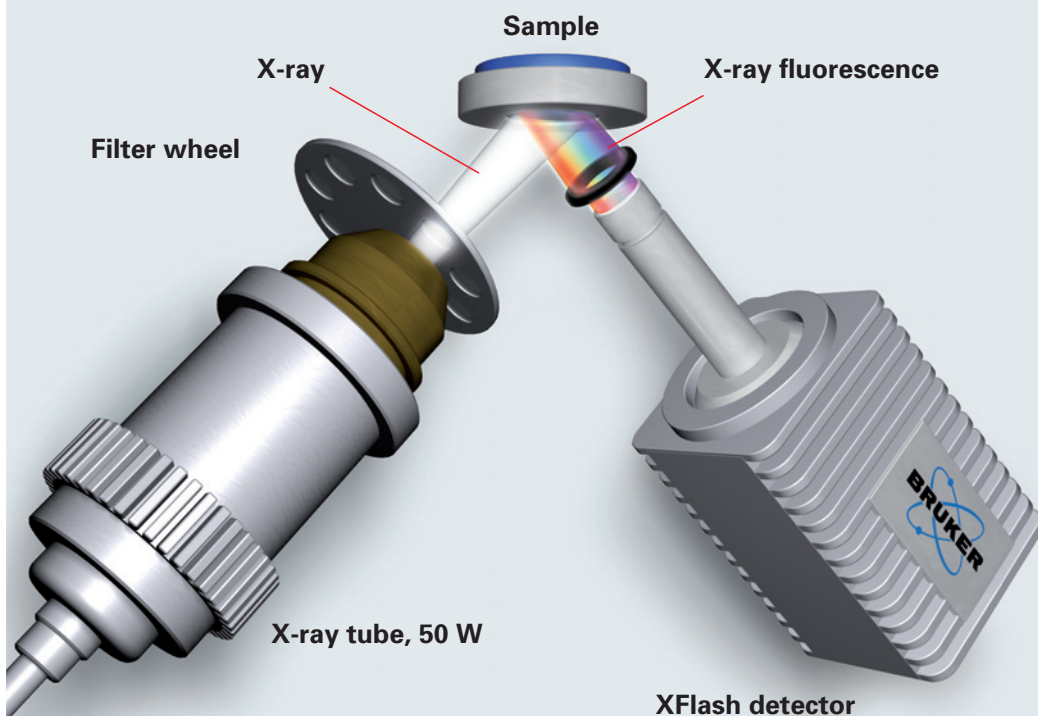
How does X-ray Fluorescence (XRF) work?

Bromine atom



- 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 virtually independent of the atom’s chemical bond. The intensity of the radiation is proportional to the concentration of the element in the sample.

Energy-dispersive XRF with the S2 RANGER



- The S2 RANGER uses a 50 W X-ray tube to directly excite the X-ray fluorescence in a sample. By specifying the high voltage and choosing a filter, an elemental or energy range is selected. In order to analyze lighter elements, the sample chamber is either evacuated by means of an integrated vacuum pump or it is flooded with helium. The XFlash detects the X-ray fluorescence radiation of the sample. The multi-channel analyzer divides up the different energies and accumulates counts to form an intensity vs. energy spectrum.

XFlash[®] detector – best resolution and count rate – can get the most out of 50 W power

- Highest excitation power in benchtop EDXRF class
- Unrivalled XFlash detector 145 eV with 100 000 cps at Mn K_α
- Peltier cooled SDD technology
- Smallest sample chamber for instant switch and lowest He consumption

Not to overwhelm you with technical details or confuse you with cryptic jargon, suffice to say that, if there were a world champion in the category “performance, functionality and quality of results”, it would be S2 RANGER!

50 watts of pure X-ray power.

Our S2 RANGER applies up to 50 watts of X-ray power directly to the sample. This has the following advantages:

- no need for moving parts such as primary optics or monochromators,
- elements at very low concentration levels are excited,
- and higher intensity sets the stage for maximum precision.

Award-winning XFlash technology.

Thanks to our outstanding XFlash detector we are in a position to fully exploit the entire output of the 50 W X-ray tube and can convert this into stability and sensitivity.

Owing to its Silicon Drift Detector (SDD) technology, the XFlash is empowered for maximum count rates and the best possible energy resolution:

- High count rates facilitate reliable results very fast.
- High count rates minimize statistical errors and lead to very accurate results.
- Optimal energy resolution permits different elements to be clearly separated and guarantees that even traces can be detected alongside the main components.
- Due to Peltier cooling, no liquid nitrogen is required for cooling; this minimizes hassle and significantly reduces operating costs.

Unsurpassed EDXRF light element performance.

The brand new XFlash LE detector features enhanced light element analysis with the S2 RANGER. So the system achieves more than eight times the sensitivity for sodium and more than 4 times for magnesium compared to standard silicon drift detectors (SDD). Thanks to the high transmission window even X-ray fluorescence lines from elements such as carbon, oxygen and fluorine can be recorded.

Reduced to the max – S2 RANGER.

The small sample chamber of our S2 RANGER has three crucial advantages:

- short beam path means maximum intensity at the detector,
- fast evacuation with the integrated vacuum pump ensures high sample throughput,
- and in the case of liquid samples, only the sample chamber needs to be filled with helium, thereby cutting operating costs.

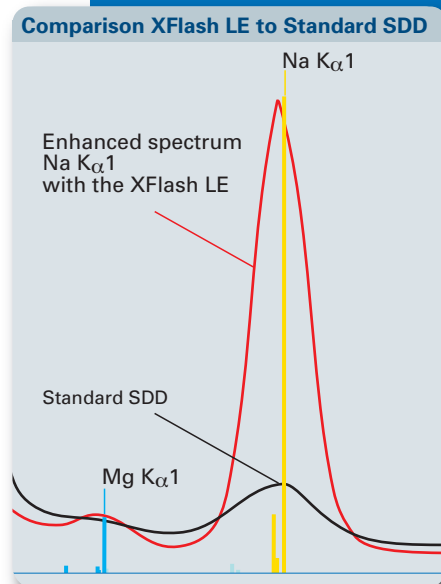
That’s it for the technological basis of our S2 RANGER and the secret of our success – but the best is yet to come.



50 W X-ray source



Award-winning XFlash technology



- Fully equipped benchtop analyzer with minimum space requirements
- Perfectly matching components for reliable operation
- GLP/GMP compliant user access level control
- IQ/OQ procedures for norm compliant analysis



All-in-one design

S2 RANGER – all in one – integrated PC, printer, vacuum pump and touchscreen monitor

Do you remember the good old days when you worked with a "really big" spectrometer? Back then you didn't just have a monitor, mouse and keyboard, you also had an external PC, a separate printer and a noisy vacuum pump. And as if that weren't enough, all of this had to be purchased, set up, installed and maintained.

If you are wondering why such peripherals are missing in our pictures of the S2 RANGER, you do not need to conjure them up, because they are already built in: A complete PC, touchscreen, printer and vacuum pump. Everything you need, truly an all-in-one machine!

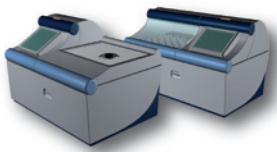
What are the advantages of the all-in-one design?

Firstly, all you really need to operate the S2 RANGER is a standard power outlet and, if necessary, helium gas for liquid samples. This means no extra devices, no extra costs, no extra time and effort, and no extra risk!

Secondly, all the components of our S2 RANGER work together perfectly and are well protected inside the housing. After all, you must be able to rely 100% on your analytical results.

To ensure your trust that the system stays that way, we have designed the S2 RANGER as a robust standalone system. Regardless of whether it is in the laboratory, directly next to the furnace or in a remote mine, our S2 RANGER never lets you down.

Although it is self-sufficient, you always have complete control of your S2 RANGER, anywhere in the world. This is because your S2 RANGER is fully network capable. You can therefore access all results and system controls via the Internet or Intranet. If need be, our service staff can remotely check your S2 RANGER, identify problems at an early stage and take preventive action.



Status display



Language selection



Thermal printer



Sample changer


































































Vacuum chamber



Integrated PC	Integrated Touchscreen	Integrated Printer	Integrated Vacuum System
Windows® XP with user access rights	Easy operation – no training required	Direct printout of sample report	Integrated vacuum pump for light elements measurement
TCP/IP interface for network integration	Free language selection	Customizable layout	Lowest He consumption for liquid samples
Hard disk for secure data storage	Database for results		Small chamber for fast evacuation or gas exchange
DVD writer for backup	Spectrum for results check		Separate sample changer for continuous loading
	Status display		
	User management and access levels		

S2 RANGER – one for all – all kinds of samples, all elements and all concentrations – from ppm to 100 %

-  General Requirement
-  Advanced Requirement

								
S2 RANGER Performance	Cement	Minerals & Mining	Geology	Metals	Slags & Foundry	Chemistry	Pharmaceuticals	Petro-chemistry
Long term stability								
Low detection limit								
All concentrations								
Multi-element analysis								
Universal standardless calibration								
Standard based calibration								
Ease-of-use								

We have already shown you the insides of an S2 RANGER. Now we will show you how to discover the insides of your sample with the S2 RANGER.

The X-ray fluorescence (XRF) analysis provides very precise answers to two crucial analytical questions: Which elements – and how much of them – does your sample contain?

If you have a sample of unknown composition, as a rule you will proceed as follows with your S2 RANGER: Insert sample, start multielement analysis and that's it! Was that too fast for you? Ok, here it is in a little more detail.

Using the S2 RANGER the entire XRF spectrum of the sample is measured at once. The excellent energy resolution of the XFlash detector permits all of the elements from sodium to uranium to be measured and clearly separated from one another. This means that with a single measurement you receive a reliable qualitative multielement analysis of your sample. We now know which elements are present in your sample, but still not the amounts.

EQUA ALL – the universal calibration with variable alphas – for quantitative results.

Thanks to EQUA ALL software you can pull off the feat of qualitative multielement analysis and, at the same time, get quantitative results from a completely unknown sample. EQUA ALL is the method for standardless analysis and is included with your S2 RANGER. It comprises a unique universal calibration created by us by means of innumerable certified standards. The interaction of the various elements – the so-called matrix effect – is corrected with the aid of the variable alphas – thus enabling the intensities to be correlated directly with the element concentrations. Voilà: the quantitative multielement analysis of an unknown sample has been achieved!

Top performance and long term stability with your own calibration.

If you know exactly which element and how much of it your sample must contain, then you require above all maximum accuracy and maximum stability. The high precision quantitative analysis of a sample requires first and foremost for the S2 RANGER to be calibrated with standards. This is the best way to get the most out of your system. As a result you obtain a measurement method of your own, ready to be used on your touchscreen.

Besides individual calibration, here two good friends guarantee success: our 50 W X-ray tube and our XFlash detector. Their excellent performance not only brings about unparalleled stability, it also permits reliable quantification of the concentrations of elements down to a few ppm.

- Flexible multielement analysis – full range of elements measured
- Qualitative identification of elements by line position
- EQUA ALL – the universal calibration for standardless analysis
- Best quantitative results with standard based calibrations



Element selection on the touchscreen

So many samples, so little time

As you already know, one main advantage of the XRF is that almost all elements of the periodic table can be measured quickly and easily in all concentrations. However, one thing is clear:

Good quality samples are the basis of good measurement results!

This sounds reasonable but other analytical methods keep silent on this subject. Why is that so?

Quite simply, the way to good samples is significantly easier, more reliable and hence considerably cheaper using XRF analysis. The advantage of XRF over other methods is its ability to handle a wide variety of samples, including powders, liquids and solids. Unlike other methods, there is no need for elaborate dilution, digestion, or enrichment, nor must the instrument be recalibrated constantly.

Nevertheless, even for XRF samples must be selected and prepared correctly. This begins with representative sampling, goes through homogenization and ends with a smooth measuring surface.

So you can see that, unlike other methods, sample preparation for XRF is by no means sorcery. But if you still need a little help, we do not leave you out in the cold. We are glad to advise you on selecting the correct equipment and setting up sample preparation geared for your material. Ultimately, you obtain optimal procedures that your staff can follow and perfect results, measurement after measurement. After all this is what counts!



Sample preparation

- Direct analysis of solids, powders and liquids
- Safe method – no hazardous materials needed
- Lowest cost of operation
- Simple recipes for reliable results

- Fast and easy with pressed pellets
- Most accurate results with glass beads
- Cup loading for loose powders and liquids
- Solids with clean and smooth surfaces



- Use weighed amount of sample

Sample preparation – simple recipes, not rocket science

We are by no means telling you a secret if we point out that the most frequent form of sample preparation for XRF is the creation of pressed pellets. The reason for this is clear, since the method is ingeniously simple and fast: Weigh out sample material, grind and press it, and put the pressed pellet into the S2 RANGER. To ensure that you obtain reliable and reproducible results, all you have to do is, find the right recipe and then stick to it every time!

To obtain the most accurate results for major and minor components you can melt the powder together with a fluxing agent. After it cools down you have a glass disk of homogeneous composition.

Preparation of liquid samples is the easiest of all. For this purpose you use a cup covered with a transparent plastic film. Fill the cup with the predefined quantity of liquid and then place the cup into the S2 RANGER. By the way, this method is also ideal for loose powder.

Lastly, here is the preparation method for all solid samples such as metals or ceramics: cut, mill, grind or polish – anything that creates a smooth and clean sample surface is fine. If the sample already has an appropriate surface, you can insert and measure it.

So you can see that sample preparation for XRF analysis is certainly not alchemy. Rather it involves following simple recipes. For your convenience and with a little “magic”, it can also be fully automated.



- Pour flux melting agent into mortar



- Weigh sample amount



■ Add grinding tablets



■ Mill in grinding vessel



■ Finished powder material



■ Pour powder into sample press



■ Get pressed pellet



■ Add sample to flux material



■ Mix sample and flux



■ Pour material into crucible



■ Heat crucible in melting furnace



■ Casting mold with finished glass bead



■ Cover bottom of liquid cup with transparent film



■ Check for holes



■ Pipette sample amount to defined weight



■ Clamp metal cut



■ Check sample height at molding cutter



■ Mill



■ Check surface



Pressing
5 min

Prepared Samples



Pressed pellets



Melting
10 min



Glass beads



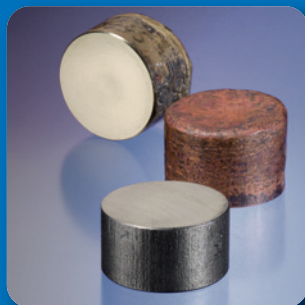
Dripping
15 sec



Sample cups



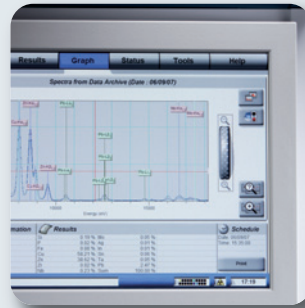
Polishing
1 min



Metal cuts

Analytical Results

Presentation variations



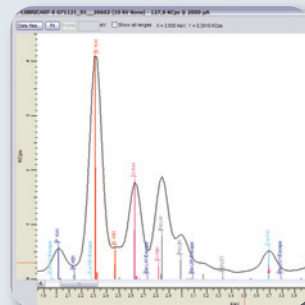
EDXRF Spectra



Printout

Element	Concentration (%)
Al	0.17%
Si	0.09%
S	0.04%
Ti	0.03%
V	0.12%
Cr	0.05%
Fe	30.01%
Mn	0.01%
Ni	0.04%
Cu	0.05%
Zn	0.18%
Pb	2.60%
Ag	0.00%
Au	0.00%

Results table



Lines in SPECTRA EDX

Technical Data

Elemental range	Sodium to uranium (Na – U) with standard XFlash® Carbon to uranium (C – U) with XFlash® LE
Concentration range	From ppm to 100 %
Sample types	Powders, solids and liquids
Sample size	Liquids, loose powders: up to 50 ml Solids: 40 mm (1.56") Ø ring for sample changer Solids: 75 mm (3") for manual loading
Sample preparation	Direct, sample cups, pressed pellets, and fused beads
Sample changer (optional)	28-position tablet Constant loading during measurements Up to 40 mm (1.56") Ø and height, max. weight 200 g
TouchControl™	Integrated 12" TFT touchscreen
X-ray tube	Pd anode Max. power 50 W, max. voltage 50 kV, max. current 2 mA
Primary beam filters	9-position automatic filter changer
Detector	XFlash® Silicon Drift Detector Resolution <129 eV at Mn K _α and 100 000 cps Peltier cooled (no need for liquid nitrogen)
Vacuum pump	Integrated
Helium flushing	Integrated – extra helium supply required
Operation Modes	Vacuum for solids, helium flushing for liquids and loose powders, air (> Ti)
Printer	Integrated thermal printer
Network	Built-in modem and Ethernet port
Automation	Data exchange to LIMS possible
Power requirements	110/240 V, 50/60 Hz, max. consumption 1 kVA
External cooling water	No cooling water
Dimensions	65 cm (25.4") x 80 cm (31.3") x 60 cm (23.4"), 96 kg (211 lbs) (height x width x depth, weight)
Quality & safety	DIN EN ISO 9001:2008; CE-certified Machinery directive 2006/42/EC Electrical equipment 2006/95/EC; Electromagnetic Compatibility 2004/108/EC Meets "Safety Category No. 3" as defined by the EN954-1 standard and the requirements defined by the DIN 54113 standard Fully radiation-protected system; radiation < 1 Sv/h (H*) German type approval (PTB) for X-ray safety; Conform to ICRP, IAEA, EURATOM

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