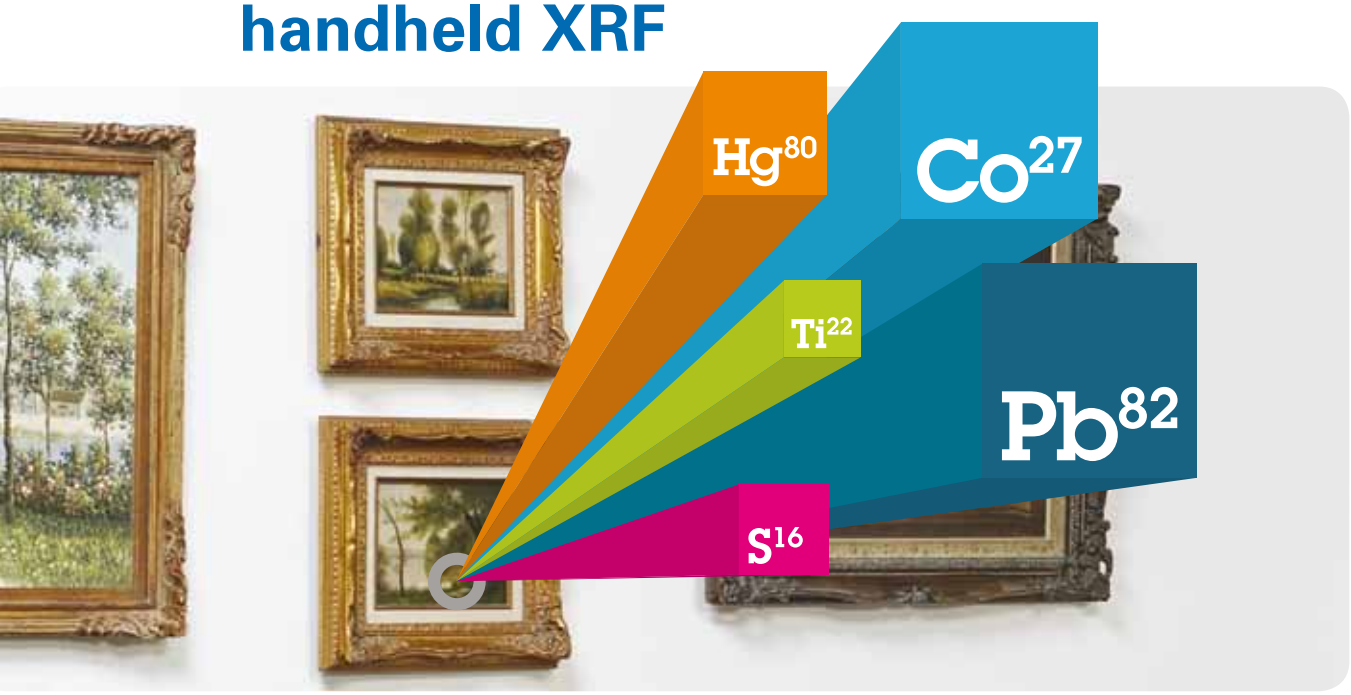
Tracer Family

- Handheld XRF for Research, Teaching, Art and Archeology

Welcome to the innovators in handheld XRF



The Bruker Tracer family of XRF (X-ray fluorescence) analyzers has become the defacto standard for art and archeology investigations because of its unique flexibility. The Tracer family is also the preferred choice for research or teaching. This system is unique in its flexibility for the investigation of non-uniform substances and for training new scientists in the field of XRF. The system can be used in the laboratory or the field, controlled by a PC or PDA.

In art and archeology, the Tracer lends itself to a wide variety of uses such as determining the provenance of objects of cultural value or obtaining elemental data for geochemical survey—often a critical tool in supporting authentication, establishing source provenance, etc.

In art conservation and restoration, elemental composition can be determined reliably and sensitively, ensuring that an appropriate course of treatment can be established, whether it be via finding a close match of pigments and other materials or verifying previous conservation efforts. Safe repatriation of cultural artifacts according to NAGPRA[1] regulations is also made possible through analysis for toxic heavy metals such as Hg, As, and Pb that have been used to preserve objects in museum settings.

For research and teaching, the Tracer family provides the utmost in flexibility and transparency in excitation parameters, allowing students to learn firsthand how changing XRF excitation parameters will affect analysis results.

Coupled with the powerful desktop software that provides a complete live spectral display to give you instant insight into the specimen under observation, the Tracer is a complete teaching tool. Further, the results software can be customized to allow a basic test for the presence or absence of a particular element, or a complete analysis to provide concentration data.

The complete control of excitation conditions, real time viewing of data as it is acquired, and powerful software for the analysis of results allows investigation of samples ranging from completely inhomogeneous samples like paintings or certain geological samples, to homogeneous samples like precious metals or obsidian. The results will range from qualitative to semiquantitative to completely quantitative depending on the nature of the sample being analyzed and available calibrations.

1. Native American Graves Protection and Repatriation Act, Public Law 101-601–Nov. 16, 1990

The Tracer

Introducing Tracer

There are many reasons why the Tracer family has become the defacto standard for leading conservation scientists around the world. It combines the power and flexibility you would expect from a benchtop, laboratory-quality instrument with the convenience of a handheld—thanks to some pioneering, user-oriented innovations.

The most outstanding innovative features include the same vacuum technology that we originally developed in partnership with NASA for the space shuttle program; powerful laptop-based analytical software; live-time spectral display; and customizable filters and secondary targets, designed to optimize your analysis to fit the experiment objective.

This technology continues to work wonders for a broad range of clients—we are happy to supply confidential references on request.

The Benefits at a Glance

- The capabilities of a bench-top instrument, with the convenience of a handheld
- Powerful laptop-based analytical software
- Customizable filters and secondary targets to optimize analysis (Tracer III models)
- Live-time spectral display
- State of the art design that allows the detection of light elements such as Mg, Al, Si, S, P and Cl
- Proprietary XFlash® SDD technology for increased count rate and improved resolution (Tracer-SD models)
- Vacuum technology developed in partnership with NASA provides ultimate light element sensitivity
- Knowledgeable and helpful support staff

Tracer III-SD

This is the first ever handheld instrument to use Bruker's proprietary XFlash® SDD technology—something that has previously only been available in large laboratory analyzers. The dramatically enhanced speed and sensitivity are a result of the very high count rate and typical resolution of 145eV at 100,000 cps (counts-per-second). Like the Tracer III-V+, the Tracer III-SD has a manual filter/secondary target.

Tracer IV-SD

The Tracer IV-SD also contains the Bruker XFlash SDD for high count rate and resolution. The Tracer IV-SD features a computer-controlled five-position filter wheel that facilitates the development of multi-condition measurement protocols to provide coverage of a wide range of elements within one analysis.

Tracer III-V+

The Tracer III-V+—based on an SiPIN detector—is currently used by hundreds of universities and museums that share spectra and calibrations. The use of vacuum technology developed in partnership with NASA enables the analysis of a much wider range of elements than was previously possible in a handheld device. It enables quick and easy analysis of elements which generate low energy X-rays such as Mg, Al and Si. The software provided with the Tracer analyzers provides full spectral analysis, using Microsoft-based analytical software. In order to supply complete control of excitation, the filter/secondary target can be changed manually for the optimum excitation for your analysis objective.

Tracer IV-GEO

The Tracer IV-GEO contains a large area Bruker XFlash® SDD for the highest sensitivity possible in a handheld XRF analyzer. This analyzer also has a five position computer-controlled filter wheel. As this configuration has the greatest sensitivity and widest elemental coverage, it is supplied standard with GEO-QUANT Mobile, a geological calibration that measures both the major and minor elements.

Configurations

Accessories

Vacuum Environment

Adding the portable battery-operated vacuum pump will substantially improve the detection of light elements from Mg to Cl and will improve the detection limits for elements from K to Fe. This pump will easily achieve a vacuum of a few torr which eliminates the atmosphere between the sample and detector. This will increase the count rate by a factor of 10 for Mg and a factor of 2 for P. The vacuum environment, while not required, will provide the best sensitivity avaliable for the light elements.

Tripod

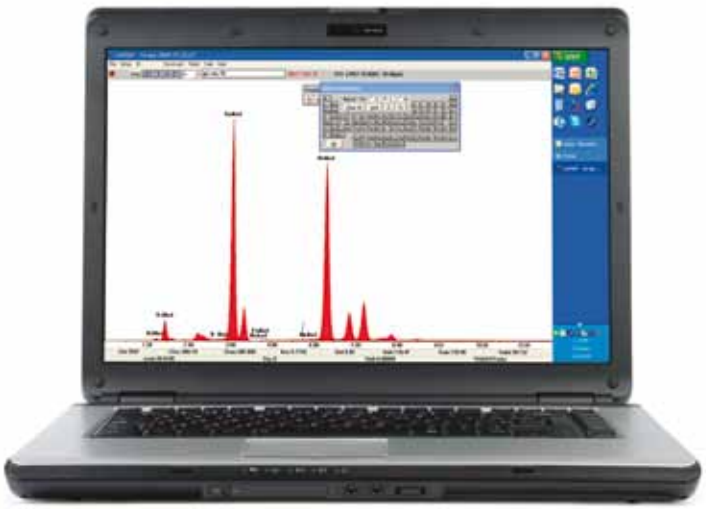
A tripod is supplied with the standard Tracer III systems. This tripod supports the analyzer, is articulated on all three axes, and provides precision adjustments so that the analyzer can be located less than a millimeter away from the sample without touching it. The tripod makes it very easy to take multiple measurements of exactly the same spot on an artifact without the need and inaccuracy of holding the analyzer in your hand.

Radiation safety

It's worth noting that Tracer contains zero radioactive material, which means much easier licensing requirements, safe transportation, no disposal restrictions[1] and no need for a wipe test every six months. For extra security, the system also comes in a lockable case and is password protected. A sample sensor checks that the sample is correctly in place before X-rays are generated and a cover is supplied to minimize X-ray exposure when measuring small parts.

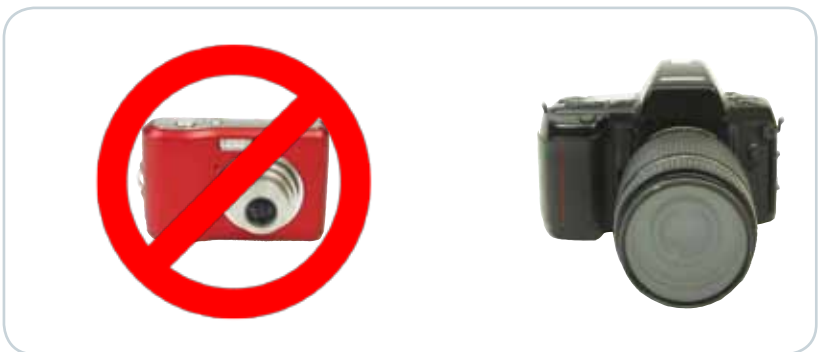
1. No restrictions related to radioactive material disposal, however, local WEEE restrictions may apply

Software Environment



Unlike other XRF systems, the Tracer family is designed to conduct elemental analysis of non-uniform samples and provide the tools necessary to analyze the results in detail. This is not an application for point-and-shoot analyzers; complete control and complete analysis tools are essential for understanding of the results. Remember, the results are a function of many factors such as the sample density, the X-ray energy, the homogeneity of the sample, and the excitation energy. The Tracer III analyzers allow the manual insertion of any filter necessary to adjust the excitation along with the control of the current and voltage of the X-ray tube. In addition, this level of control and analysis makes this system ideal for training new students in elemental spectroscopy and X-ray fluorescence.

In addition to the flexibility of the Tracer family to measure non-homogeneous materials, software is supplied which allows the user to prepare calibrations for quantification of well-characterized homogenous materials.



The software environment for the Tracer family gives the user complete control of all measurement parameters to achieve the maximum sensitivity for analysis of your elements of interest. In addition, live viewing of the data as it is acquired and the spectral identification feature assists the user in determining elements that are present within the sample. The software provided includes:

Control

Software that allows the user to control current and voltage of the X-ray tube is provided with the analyzer. This—combined with the unique ability to design and use specific filters for specific applications—allows the complete control of the excitation parameters of the experiment.

Spectrum Analysis Software

The spectrum display and analysis program provides live spectral display for observation during data acquisition, allowing the user to know immediately if the proper conditions are being used. In addition, the software provides complete element identification capabilities. The software provides substantial semi-quantitative information such as the peak integrals. For comparing spectra and report generation, the software provides the ability to display multiple spectra and scale one spectrum to another. Any spectra collected in the field using the PDA can be imported to your PC and manipulated using this program.

Calibration Software

Software is provided which allows the creation of calibrations based on your set of standards for those applications where homogeneous materials of known type are being analyzed. This software allows the user to modify the factory calibrations or create their own. Both factory and user created-calibrations can be loaded on the PDA and then used in the field in handheld mode.

Applications

Art Conservation & Archaeological Science

The Tracer family of products is the instrument of choice for art conservation, archeological science, and related research applications. A completely nondestructive elemental analysis tool, the Tracer lends itself to a wide variety of applications such as analysis of paints and pigments, source provenance and source grouping of lithic materials such as obsidian and basalt, analysis of soils, ceramics sourcing, and much more. From research in prehistoric trade via lithic sourcing to analysis of pigments for authentication of paintings, elemental chemistry unlocks a wealth of information for the archeological researcher or art conservator, making the Tracer a critical tool.

Elemental composition is frequently used in the study of archaeological and historical materials to ascertain provenance and fabrication technology. It can help to distinguish non-original materials and, in some cases, to spot fakes. It is increasingly used in conservation, where knowledge of elemental information proves very useful in determining the course of treatment.

Safe repatriation of cultural artifacts is also made possible by the ability to detect toxic preservatives such as As, Pb, and Hg in concentrations as low as trace levels in order to assist museum staff and conservators in NAGPRA compliance.

Research and Teaching

The Tracer family of analyzers is also the preferred choice for research or teaching of X-ray fluorescence (XRF) and its applications. The Tracer is a lab-quality XRF instrument in a handheld shell, featuring fully user-definable excitation parameters.

This flexibility allows student to explore the differences in spectral data that result in adjustment of voltage, current, and secondary target or filter, furthering the students' understanding of how XRF works. This is essential in developing a thorough understanding of XRF, since XRF results are a function of many factors including the sample density, the X-ray energy, the homogeneity of the sample, and the excitation energy. Being able to adjust parameters as one would on a laboratory instrument allows students to learn in depth how different excitation parameters must be selected for different experimental objectives. The opportunity to experiment with different excitation parameters gives students the ability to experience firsthand how their data is influenced by the various parameters active in XRF analysis.

Geological and Geochemical Research

The Tracer IV series should be your choice for your geological or geochemical research investigations. Equipped with the XFlash® SDD (Tracer IV-GEO contains a large area SDD for added sensitivity) combined with the patented NASA vacuum technology that will provide the best sensitivity for both the major components as well as the minor and trace elemental constituents. The Tracer IV can be equipped with GEO-QUANT Mobile, a geological calibration derived from the GEO-QUANT calibration available on the large laboratory analyzers supplied by Bruker.

Attribute	Tracer III-V+	Tracer III-SD	Tracer IV-SD	Tracer IV-GEO
Customer Application				
Alloy Analysis Non-standard Alloys	++	+++	+++	+++
Routine Mining			+	+
Restricted Materials			+	+
University/Research Oriented	X	X	X	X
Art/Archeology	+++	+++	++	++
Research/Teaching	++	+++	++	++
Mining Research/Geochemistry	+	++	++	+++
Hardware Specifications				
Detector	SiPIN	SDD	SDD	Large Area SDD
Typical Resolution	195 eV @10,000 cps	145 ev @ 100,000 cps	145 ev @ 100,000 cps	150 ev @ 100,000 cps
Tube Target	Rh	Rh	Rh	Rh
Filter/Secondary Target	Manual (4 provided). User can make their own.	Manual (4 provided). User can make their own.	User Selectable Automatic 5 Position	User Selectable Automatic 5 Position
Accessories				
Enclosed Benchtop Stand	X	X	X	X
Miniature Sample Table and Instrument Stand	X	X	X	X
Miniature Battery Operated Vacuum Pump	X	X	X	X
Data Analysis, Calibration, Spectral Sorting and Real-Time Viewing Software	X	X	X	X
Tripod with Articulating Mounting Arm	X	X	X	X
Other Information				
User Calibrations Allowed	X	X	X	X
User Control of X-ray Tube Volgate and Current	X	X	X	X
Laptop Control	X	X	X	X
PDA Control	X	X	X	X

Note: Many features listed are optional - check with your salesperson for exact configuration and pricing

Support

Brukers' applications staff has many years of experience working with our customers in the fields of art, conservation, archeology and research and teaching. They will work with you every step of the way beginning with their first visit, when they will work with you to determine the best configuration and settings to meet your experimental objectives. When the system is installed, a member of the applications staff will come to your facility to train you and your staff to operate and calibrate the analyzer so that you can extend the use of your analyzer to additional objects. If you need help in preparing new calibrations or making particularly difficult measurements, our staff is only a call or e-mail away. Many of our staff are also teachers, and can conduct student-geared workshops or help determine the best way to teach a concept or meet a particular educational objective.

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