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PXRF

TRACER 5

Portable XRF Analyzer for
Cutting-Edge Researchers

Innovation with Integrity

Elemental Analysis from Fluorine to Uranium

Bruker's TRACER 5 handheld XRF analyzer provides unprecedented capabilities for sophisticated users. It synchronizes advanced technology with power, function, precision, and accuracy to provide dynamic, field capable elemental analysis from everyday point-and-shoot testing to the complexities of cutting-edge materials research. Elements as light as fluorine and sodium can be measured. The user can control current and voltage settings as well as utilize user changeable collimators and custom filters. The TRACER 5 enables scientists to visualize, identify, and analyze the relative elemental content of almost any substance on earth and beyond.

Highlights

- Rh target X-ray source with interactive control of current and voltage
- Latest graphene window SDD technology
- Selectable measurement spot sizes (3 mm and 8 mm)
- Patented SharpBeamTM front end geometry for improved analysis precision
- Helium purge capable
- 5 position automatic filter changer
- Manual filter / secondary target option
- Internal sample camera for accurate measurement positioning
- Integrated processor and data storage
- Wi-Fi and USB connectivity to PC
- Bruker Instrument Tools (BIT) PC software package enables instrument control, measurements, and communication
- Live spectra directly on the TRACER 5 and on PC with BIT and ARTAX
- ARTAX PC software for comprehensive analysis including multiple spectra comparisons as well as Bayesian inference and deconvolution modeling

Figure 1
TRACER 5 interactive user interface for control and results

Advanced Handheld XRF Technology

The TRACER 5 handheld XRF spectrometer is based on the principle of energy dispersive X-ray fluorescence (XRF) for non-destructive elemental analysis of materials.

Design and Performance

The TRACER 5 utilizes a high-performance graphene window silicon drift detector (SDD). It incorporates this latest detector technology with a 50 kV (4 W) rhodium end-window tube and SharpBeam™ front-end geometry providing maximum count rate and a scatter-minimized, clean spectrum. Combined with a helium beam path, it enables detection of elements lighter than any other handheld XRF analyzer on the market.

Operator Friendliness

Designed as both a "point and shoot" and "cutting-edge research" analyzer, the TRACER 5 requires minimal setup and operator training. Equipped with both user level and supervisorlevel access, a manager can choose to grant basic operator control or full functionality. This two-tier approach and intuitive interface make the TRACER 5 perfect for both beginning users, as well as power users.

The user interface has been designed to provide intuitive operation, including interactive control of measurement conditions. Results can be clearly viewed as composition, pass/fail, and live spectra. Data management and transfer are exceedingly easy to use via Wi-Fi or wired USB.

Ultimate Flexibility

The TRACER 5 can be configured with factory ready calibrations which incorporate preset power, filter, collimator setting, beam path atmosphere, and measurement time. It also provides user control of all those settings for a fully lab-like instrument experience. Operators can select optimum excitation voltage and current settings, filter material, collimator spot size, and beam path atmosphere of air or helium.

The TRACER 5 is designed with IP54 to withstand field operation in all environments, including humid and dusty conditions. The TRACER 5 can be operated at wide temperature range of -10 °C to 50 °C (14 °F to 122 °F).

The TRACER 5 incorporates an Easy Access™ rail mount to provide easy mounting for numerous accessories including a tripod, extension pole, soil foot, smartphone, and collapsible desktop stand kit.

Figure 2
TRACER 5 desktop stand kit with safety shield in place

Comprehensive Features

Latest Graphene Window

The TRACER 5 incorporates a large area graphene window silicon drift detector (SDD). The graphene window replaces the traditional 8 µm beryllium window. This groundbreaking window is one of the first commercial uses for graphene, an advanced material composed of atomic layers of carbon atoms arranged in hexagonal lattices.

While the graphene is extremely thin, its unique structure makes it extremely strong. The graphene window has higher transmission of X-rays throughout the energy transmission for light elements such as fluorine, sodium, magnesium, silicon, and aluminum. The improved light element sensitivity enables lower detection limits and faster analysis.

SharpBeam™ Optimized Geometry

Every TRACER is precision built with Bruker's patented SharpBeamTM Optimized Geometry including benefits, such as:

- produces a sharp, defined measurement spot
- improves measurement precision
- reduces power requirements
- reduces stray scatter
- increases battery life
- reduced instrument weight.

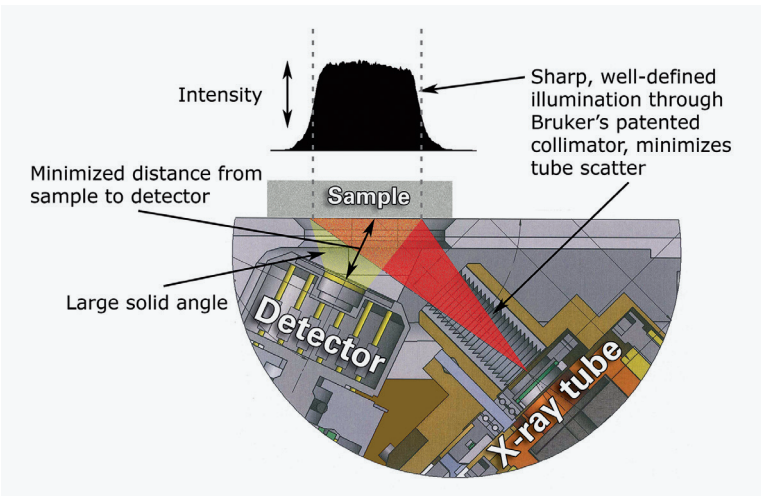

Figure 3
SharpBeamTM Optimized Geometry

User Changeable Collimators and Custom Filters

The TRACER 5 is designed with a portal to enable manual use of changeable collimators and filters. A TRACER 5 is supplied with two collimators, one which generates an 8 mm oval spot and one a 3 mm oval spot. Use of the 3 mm collimator provides a measurement area for the isolation of a small feature to be tested. The larger 8 mm spot size is preferable for inhomogeneous materials and bulk samples.

In addition to its 5-position filter wheel with industry-standard handheld XRF filters for preset factory calibrations, the TRACER 5 also enables use of custom filters for unique sample analysis. To adapt custom filter materials, various manual filter accessories are available.

Figure 4
Portal for user changeable collimators (3 mm bottom left and 8 mm bottom right) and custom filters

Integrated Camera

The TRACER 5 is equipped with an internal CMOS camera to provide sample visualization and precise alignment of the target sample area using an oval spot or a reticle projected onto the sample image. Up to five images can be stored with each spectrum for later identification of the sample area analyzed.

- camera features ensure accurate measurement positioning, even for very small 3 mm spots
- up to five images per assay can be saved to provide visual measurement records
- images can be easily imported into reports

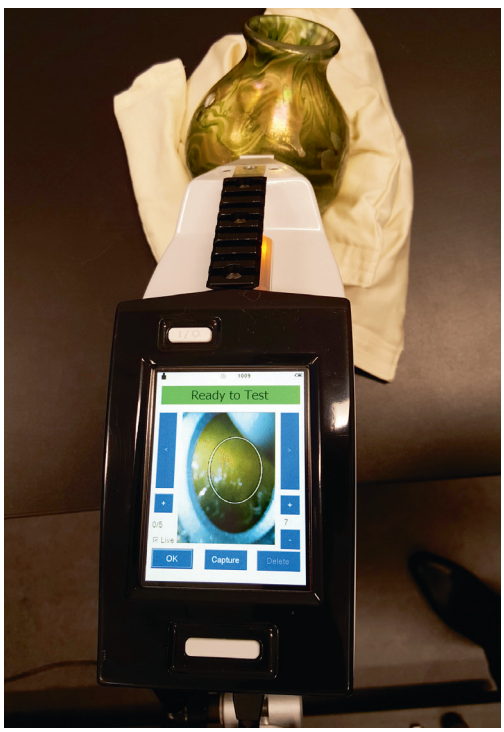

Figure 5
Integrated camera for targetting sample areas

Selectable Beam Path – Air or Helium

Atmosphere will impact the results obtained in an XRF measurement, especially for light elements like F, Na, Mg, Al, Si, and P. Any material between the sample and detector will absorb some of the low-energy X-rays emitted by the sample before they arrive at the detector to be counted.

Air is the standard atmosphere for measuring heavy metals in multiple matrices, heavy elements (Ti to U) in multiple matrices, and light elements (Mg to Zn) in heavy metal alloy matrices.

To get the best signal for light elements, air needs to be removed between the sample and detector. This can be accomplished by purging with helium through a port connection (Figure 6) that significantly improves measurements for very light elements (F to P) in multiple matrices.

ARTAX PC Software

The ARTAX PC software provides the ability to visualize, identify, and analyze the relative elemental content of almost any substance. This easy-to-use spectral analysis software enables the determination of how elements interact within their sample set. It provides a project management data base which can contain hundreds of thousands of spectra and can be organized in a logical structure for a given project.

Users can apply their own subject matter expertise to guide analysis while the software applies advanced mathematics involved in Bayesian analysis of the spectra. Outputs from ARTAX software are in Excel format, so they can be imported into any of the analysis programs already in use.

Figure 6
Port connection (red circle) to purge with helium

Applications and Calibrations

Bruker's TRACER 5 handheld XRF analyzer with its advanced and unique features and software enables elemental analysis of almost any substance. It can be used for in-situ measurements and set up in a desk top stand for small or prepared samples. It can be configured with both unique and common factory pre-loaded calibrations which provide results as identified metals and alloys, elemental composition, or pass/fail. The TRACER 5 also enables comprehensive compositional and spectral analysis for specialized applications including:

Archaeological Studies

The TRACER 5 not only helps investigate homogenous samples, but also complex, heterogeneous, and non-uniform samples. This is especially important for archaeological research to identify, compare, and quantify elements of sample materials in the context of their environment. The TRACER 5 helps provide immediate information for dynamic scientific insight into found objects, artifacts, and their surroundings including ceramic, bone, obsidian, glass, metal, and soil.

Art Conservation and Authentication

The Bruker TRACER 5 handheld-XRF is the benchmark portable analytical solution for cultural heritage elemental analysis used by experts the world over in laboratories, galleries, and on-site locations. It's an essential tool for meeting multiple objectives in the analysis of fine art, architecture, objects, adornments, sculpture, and more:

- Research and interpretation
- Determine of original materials
- Authentication of origin or context
- Guidance for conservation and restoration

Semiconductor Manufacturing

The TRACER 5 enables measurements of fluorine compounds which are used for a variety of semiconductor manufacturing applications including chemical vapor deposition, plasma etching, and cleaning.

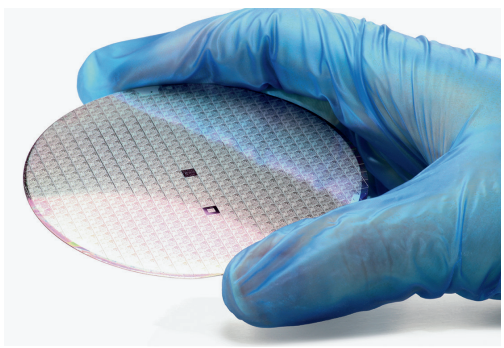

Figure 7
Drill core analysis

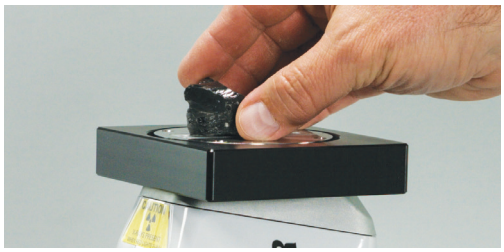

Figure 8
Analysis of obsidian

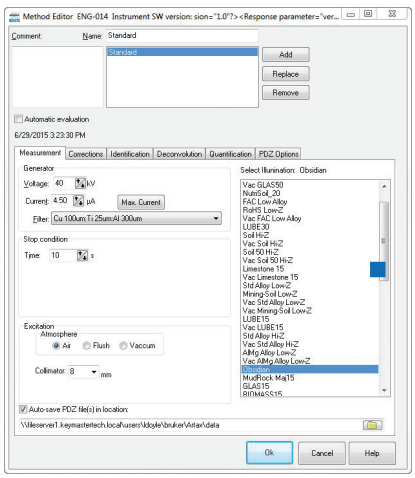

Figure 9
PC software with measurement setting control, drop down menu of preloaded calibrations, and data processing options.

Natural Resource Investigations

The TRACER 5 provides comprehensive field portable solutions for natural resource research. It helps to measure and map majors, minors, and target elements of ores, cores, drill cuttings, soil, and sediment:

- Chemostratigraphy and quantitative characterization of geologic samples
- Compositional oceanographic studies for exploration, utilization, and preservation
- Environmental assessments for heavy metals, mineral nutrients, and sodicity in soils and plants

Materials Research and Education

The TRACER 5 flexibility to analyze both uniform and non-uniform materials with and without standard reference samples makes it a perfect choice for both research and teaching. The TRACER 5 helps provide students experiential, value-driven science with near-instant feedback to engage them in the classroom, on field trips with real-world samples, and even in the lab.

Factory User-Ready Calibrations

A wide range of unique and common factory calibration options is available for the TRACER 5. These calibrations can be customized to perfectly fit specific requirements. Customers can also create and modify their own custom empirical calibrations with Bruker's EasyCal PC software.

TRACER 5 common calibration examples are:

- Alloys and Metals
- Precious Metals
- Heavy Metals and Nutrients in Soil; Plants
- GeoExploration; Limestone
- Consumer Safety Restricted Materials

TRACER 5 unique calibration examples are:

- Ancient Copper Alloys
- Customized Ceramics
- Glass
- Mudrock
- Obsidian

Technical Specifications	
Detection	Graphene (g) window silicon drift detector (SDD), 20 mm^2 detector area, typical resolution < 140 eV at 450,000 cps
Excitation	Rhodium (Rh) thin window X-ray tube; X-ray generator 6 - 50 kV with 4.5 - 200 µA, max. 4 Watt output; operator adjustable current and voltage
Collimators	User changeable collimator, 3 mm and 8 mm collimators (spot size) supplied
Filters	Operator controlled, motorized 5 position primary beam filter wheel; manual insertion filter/secondary target slot for factory or user made filters
Beam path	Capable of selectable beam path of helium or air
Elemental range (Detection)	Air: Sodium (Na) to Uranium (U); Helium purge: Fluorine (F) to Uranium (U)
Color CMOS camera	Internal VGA CMOS camera (640 x 480 pixels) with ability to store up to 5 photos per assay
Dimensions	L x W x H: 27.3 cm x 9.4 cm x 29.5 cm (10.75 in x 3.7 in x 11.6 in)
Weight	1.9 kg (4.1 lbs) with battery or 1.6 kg (3.6 lbs) without battery
Display	9.4 cm (3.7 in), LCD (TFT active matrix), 640 x 480 pixels, resistive touchscreen
Software	Full control OS on analyzer and on PC software; control of all excitation parameters and live spectra displayed on analyzer
Data storage and transfer	Direct storage on USB Thumb Drive; data transfer to PC via USB or Wi-Fi; Bluetooth connectivity for accessories
Power	Li-Ion battery (7.2 V nominal), battery charger, AC adapter (9 V DC @ 3 A)
System safety	Password protection, sample proximity sensor, low count rate (backscatter) shutoff
Operating environment	-10 °C to 50 °C (14 °F to 122 °F); Humidity: 10% to 90% relative humidity non-condensing. IP54 dust and splash resistant
Optional accessories	There are a variety of optional accessories available for the TRACER 5. Please refer to the Accessories brochure for complete details. ▪ Tripod kit ▪ Benchtop stand with safety interlock ▪ Desktop stand kit ▪ Manual filter kit and accessories ▪ Helium purge kit ▪ Field sample preparation kit

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