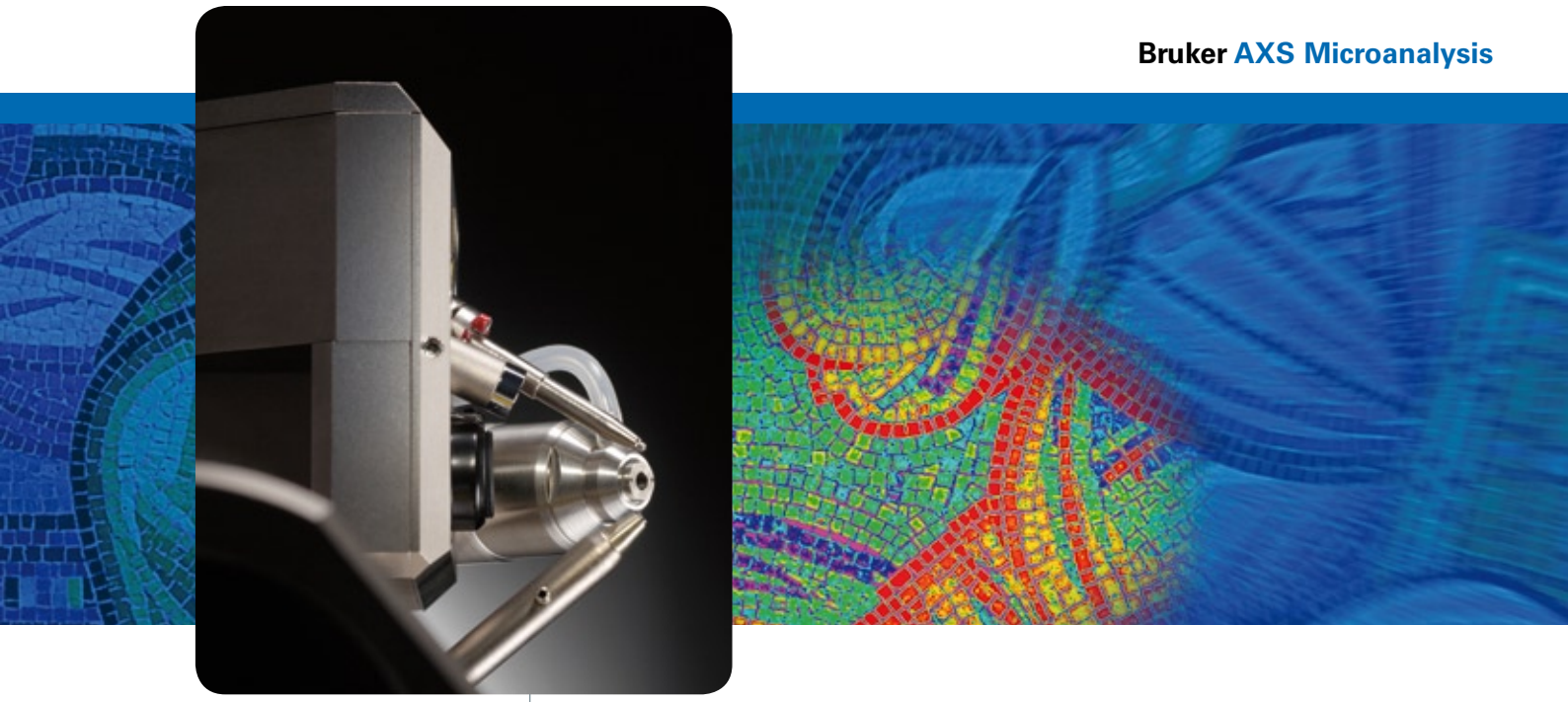
BRUKER

Bruker AXS Microanalysis



ARTAX

- Portable µXRF Spectrometer

think forward

µXRF

ARTAX – Elemental Analysis for the Art Community and More…

The ARTAX is the first portable X-ray fluorescence (XRF) spectrometer designed to meet the specific requirements for non-destructive elemental analysis.

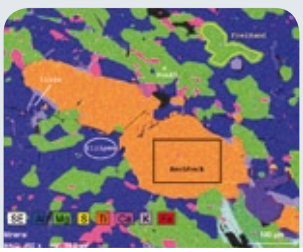
The ARTAX® series

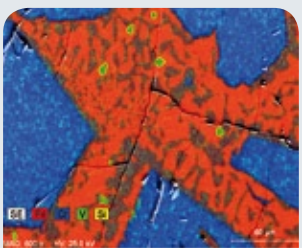
Non-destructive elemental analysis is strictly required for testing many kinds of samples. Origin or age determination of unique and valuable art objects. Investigations on objects that secure evidence in forensic sciences. Final testing of industrial products Materials research, especially when a limited amount of sample material is available or material recovery is essential. Micro X-ray fluorescence analysis (µXRF) is the most suitable technology for these requirements. µXRF delivers the most detailed information possible on the materials composition and/or structure. Objects are not damaged or altered by µXRF analysis. The analysis can be done at the location of the object of interest with a mobile spectrometer configuration. Bruker AXS offers a complete range of µXRF spectrometers. Different configurations are available to meet your application and budgetary requirements.

The ARTAX is the first portable X-ray fluorescence (XRF) spectrometer designed to meet the specific needs of non-destructive elemental analysis.
ARTAX is suitable for multielement analysis of Na(11) to U(92) and offers a spatial resolution down to 70 µm. Fast, high-resolution elemental analysis is possible with ARTAX because of its innovative measuring head design.
The ability to combine ARTAX options into a system uniquely tailored to your needs ensures maximum flexibility for a wide range of applications.

- Archeometry
- Restoration and conservation
- Process-related quality control
- Forensic sciences
- Research and development of advanced materials

	X-Ray Microanalysis (EDS)	**Micro X-ray Fluorescence Analysis (µXRF)**	**X-Ray Fluorescence Analysis (XRF)**
Capability	High resolution element mapping in the sub-µm range	Non-destructive spatial investigation of element distribution	Elemental analysis of bulk samples
Limitation	Destructive sample preparation required	Analytical range of 10 µm to 10 mm	No information about spatial element distribution
	nm - µm	µm - mm	mm - cm





Features and benefits

Portable instrument design
Direct, on the spot examination of valuable or immovable objects

Compact, open system
Enables the examination of large and uneven objects. No sample preparation required

Polycapillary lens for beam focusing
Highest spatial resolution possible. Extremely high fluorescence intensity reduces measurement time

XFlash® Silicon Drift Detector (SDD)
Liquid nitrogen as cooling agent not required. High count rate results in short measurement times

Helium purging
Immediate measurement of light elements from Na(11) to Ar(18). Avoids vacuum, which might damage fragile samples

XYZ stage
Reproducible positioning of the measuring head

The heart of ARTAX – the measuring head

The ARTAX is equipped with a measuring head

featuring the most advanced technology for precise and fast data acquisition. Outstanding components include the XFlash® Silicon Drift Detector (SDD) and an innovative exchangeable excitation source.

The polycapillary lens

of the ARTAX creates a microspot (< 100 µm) of primary X-radiation with high intensity. Polycapillary lenses are an ensemble of several thousand glass capillaries which form a united monolithic structure.
In comparison to a pinhole collimator, the fluorescence intensity of a poly-capillary lens is increased by a factor of more than 1000.

The XFlash® energy-dispersive detector

analyses the X-ray fluorescence.
This Peltier cooled silicon drift detector operates nitrogen-free with high-speed, low-noise electronics. It has significantly better energy resolution and higher count rates than PIN diode detectors. This allows fast measurements during line scans and element mappings.

The integrated CCD camera

shows a magnified image of the sample region under investigation.
A white LED illuminates the sample to optimise the image quality and contrast. Pictures are automatically stored for documentation purposes.

	PIN diode	XFlash®
% dead time		
at 2,500 cps	> 20 %	< 0.5 %
at 25,000 cps	> 75 %	< 6 %
Energy resolution		
	> 200 eV	< 159 eV

The excitation source

is fitted with a high precision lock, which allows the fast exchange of the X-ray tube housing. This enables you to choose the most suitable excitation and quickly exchange the X-ray optics. Including warm-up, the switch of the tube can be done in less than 15 minutes.
Mo or W? Both! An X-ray tube with a W target generates 2 to 5 times larger peak areas for K-line elements above 20 keV (e.g. Ag, Sn, Sb) than one with a Mo target. In contrast, the Mo tube has the major advantage of significantly better light element detection. The ARTAX allows the fast and easy application of both W and Mo X-ray target materials for advanced analysis of any kind of sample.

Change your excitation source – it's as simple as that!

The exact position of the beam on the sample

and the exact distance between object and spectrometer is controlled via a laser diode. The laser spot is adjusted to the focus of the mini-lens and is visualised by the camera.
The movement of the measuring head is controlled by a XYZ stage, which is suitable for fast line scans and element mappings. Powerful software creates area images of the element distribution across the sample.
The open design of the spectrometer head together with a distance of about 10 mm to the sample enables access to uneven or structured samples.

Easy integration of additional warning lamps, door interlocks, etc.
Integrated flow controller for the He purge control and „empty bottle" alarm

Successful in art, forensics and industry

Altarpiece with metal leaf applications

Thin layers of gold and silver approximately 1 µm thick were investigated by single point measurements with a W target tube and 0.65 mm collimator. The W target guaranteed high sensitivity for silver traces. Layers of pure silver, 23½ carat „Rosenobelgold" and historical gold sorts like green gold (30 % Cu) and „Zwischgold" (Ag and Au layers hammered together) were characterized.

Göttingen Barfüßer altarpiece (1424)

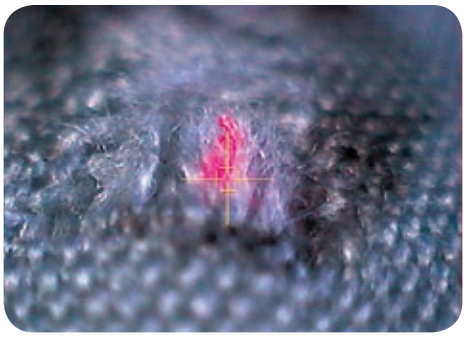
Johann Sebastian Bach Serenade

Iron gall inks in manuscripts

Thin ink layers on paper are very inhomogenous and do not allow reproducible point measurements. Therefore, line scans of 10 measurements each were acquired and subsequently accumulated for calculation of the average element content. The excitation through the Mo tube and polycapillary lens allowed the analysis of fine ink strokes. The amounts of trace elements like Zn, Cu and Mn were calculated, leading to an origin and chronological classification of the work.

Fabric with particles attached after gun shot

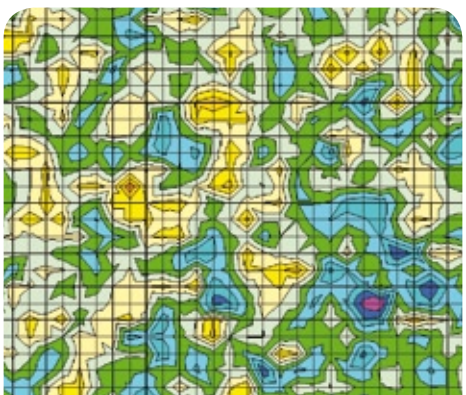
2D mapping of a 2 x 2.5 mm fabric (20 x 25 measurements, 100 µm step-width, 5 s per point) with Mo tube and polycapillary lens. Identification of particles down to 10 µm in size. Particle distribution across the fabric allowed the exact determination of the incidence angle of the gun shot.



Fabric with gun shot residue

A polymer mould with fine structures formed by Cr, Cu and Fe

2D mapping of a 3 x 3 mm area (30 x 30 measurements, 100 µm step-width, 3 s per point) with Mo tube and polycapillary lens. The element distribution of the key elements was measured, leading to the determination of relative concentrations across the sample.



Chromium distribution in a polymer mould

Three Solutions – No Analytical Compromise

The outstanding performance of the ARTAX

is based on the design of the measuring head and the integration of the most modern components. The same measuring head is included in all ARTAX systems. This guarantees the highest data quality – without compromise.

- Exchangeable excitation source with air-cooled X-ray tube
- Liquid nitrogen-free XFlash® Silicon Drift Detector, 159 eV resolution
- Integrated CCD camera with sample illumination and laser spot
- Compact control unit including high voltage generator
- ARTAXControl for semi-quantitative XRF analysis

Users have different requirements regarding their µXRF spectrometer: the number of samples, the analytical procedure, the need of mobility and financial resources. Consequentially Bruker AXS offers three ARTAX configurations, each fully upgradable at any time.

ARTAX configurations

- ARTAX 200 – Small labs with a limited number of samples, independent conservators, high need for mobility
- ARTAX 400 – Labs with intermediate demands, need for 1D and 2D mappings
- ARTAX 800 – Labs with highest demands, numerous samples, fast sample thoughput

The ability to customize your ARTAX as needed ensures that it will meet your requirements now and in future.

Accessories for the ARTAX systems

- Second excitation source, tube housing, X-ray tube, collimator or polycapillary lens
- Additional filter assembly for improving the signal to noise ratio
- Collimator set: 0.2 mm, 1.0 mm, 1.5 mm
- Acrylic glass shielding for protection against scattering

Nondestructive analysis of the composition of enamel applications of the Dreikönigsschrein (Three Magi Shrine), Cologne Cathedral. Works were performed in October 2007 by the Rathgen Research Laboratory, National Museums of Berlin in collaboration with the cathedral chapter of Cologne and the support of Bruker AXS Microanalysis GmbH.

The photographs were made available by kind permission of
Gemäldegalerie Alte Meister Dresden
(Piero di Cosimo, „The Holy Family", page 2)
Landesmuseum Hannover (Göttinger Barfüßer altarpiece, page 6)
Rathgen Forschungslabor, Staatliche Museen zu Berlin
(Three Magi Shrine of the Cologne Cathedral, page 7)

ARTAX systems

ARTAX systems	200	400	800
Basic system			
Compact control unit with high voltage generator, 50 kV, 50 W	✓	✓	✓
Option for light element detection starting from Na Helium purging of the excitation and detection paths	option	✓	✓
Measuring head			
Colour CCD camera, 500 x 582 pixel, ca. 20 times magnification Dimmable white LED for sample illumination Laser spot for reproducible positioning of the measuring head	✓	✓	✓
Detector			
Peltier cooled XFlash® Silicon Drift Detector, 10 mm² active area Energy resolution < 159 eV for Mn-Kα at 10 kcps Max. count rate > 100 kcps, dead time < 10 % at 40 kcps	✓	✓	✓
Exchangeable excitation source			
X-ray tube housing with precision lock for simple exchange Incl. electro-mechanical shutter, two absorption filters	✓	✓	✓
Air-cooled Mo X-ray fine focus tube*, max. 50 V, 1 mA, 40 W Exchangeable collimator, 650 µm	✓	✓	–
Air-cooled Mo X-ray micro focus tube*, max. 50 V, 1 mA, 30 W Polycapillary lens for micro excitation spot (intensity gain > 1000) Lateral resolution < 100 µm, for excitation up to Sb K-line	–	–	✓
Mounting			
Tripod for free positioning of the system, incl. rolling scates Free rotatable arm and variable height adjustment (500 to 1500 mm)	–	✓	✓
XYZ stage with stepper motors, 50 mm range ARTAX 1D and 2D mapping software	–	✓	✓
Light-weight tripod, optimally suited for mobile use	✓	option	option
Software			
ARTAXControl semi-quantitative XRF software for hardware control and data evaluation	✓	✓	✓
ARTAXQuant standards-based software	option	option	option
Notebook computer	✓	✓	✓

* W, Rh, Cu and Cr tubes available on request

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