HORIBA
Scientific

X-RAY ANALYTICAL MICROSCOPE

XGT

XGT-7000V

Explore the future   Automotive Test Systems **I** Process & Environmental **I** Medical **I** Semiconductor **I** Scientific   **HORIBA**
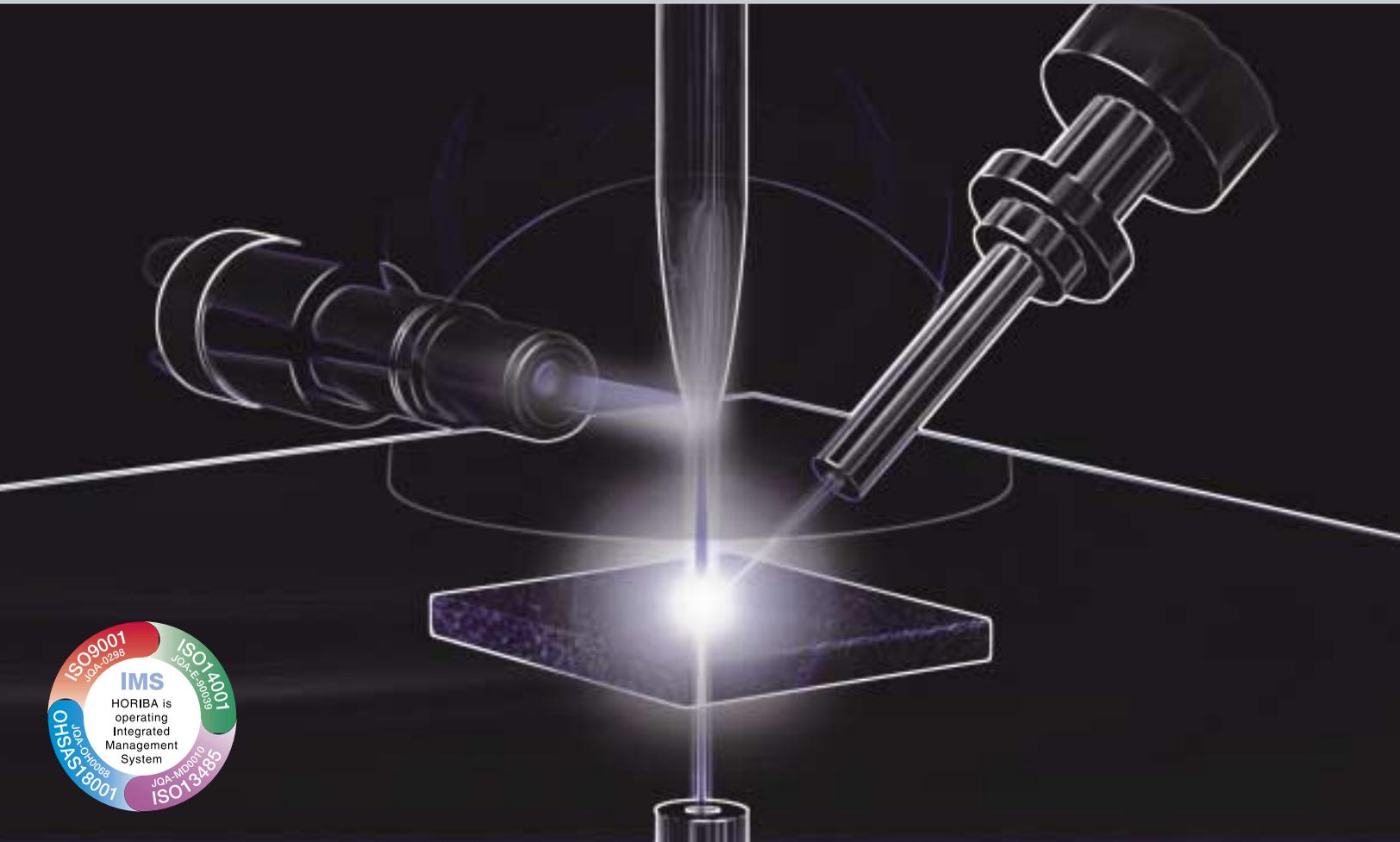
Seamless transition from optical visualisation to element distribution

The XGT-7000V x-ray fluorescence (XRF) microscope combines optical visualisation with high performance elemental analysis and imaging. No sample pre-treatment is necessary - simply insert the sample, and within three mouse clicks the analysis can be started. Dual Vacuum modes ensure the highest sensitivity to light elements (Full Vacuum) or atmospheric pressure analysis for fragile/biological materials (Localised Vacuum). Intuitive software guides the user through every step - from initial sample set up through to comprehensive data analysis routines.

Whole image

25 × magnification

It takes just three clicks to move from sample observation to 10 μ m analysis

The unique HORIBA mono-capillary X-ray optics lie at the heart of the XGT systems.
They provide high intensity X-ray beams with diameters ranging from 1.2 mm down to 10 μ m.
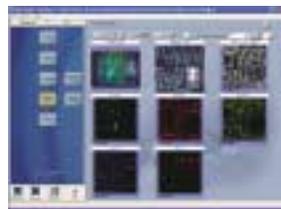
100 × magnification
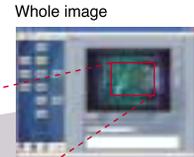
10μ m analysis is easy -
simply locate the analysis region and start the measurement.

Acquire a spectrum to see what elements are present

Analyse for concentration

See the element distribution

Principle of X-ray Fluorescence

X-ray fluorescence is a non-destructive analytical technique which allows qualitative and quantitative characterisation of solids, liquids and powders.
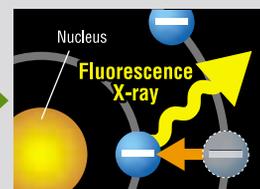Micro-XRF combines these properties with microscopic analysis, so that individual particles and features can be analysed, and element distribution images can be generated.
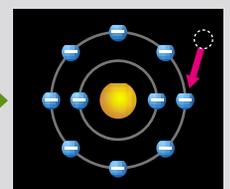
Nucleus

Primary X-ray   Electron
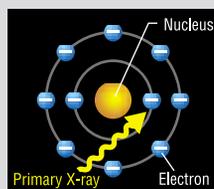
1 Absorption of primary X-ray
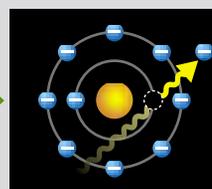
2 An electron is knocked out by the primary X-ray
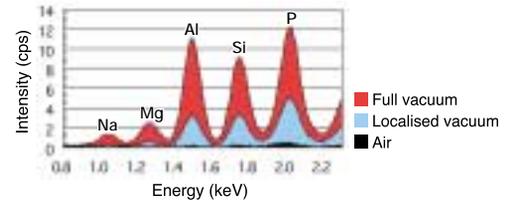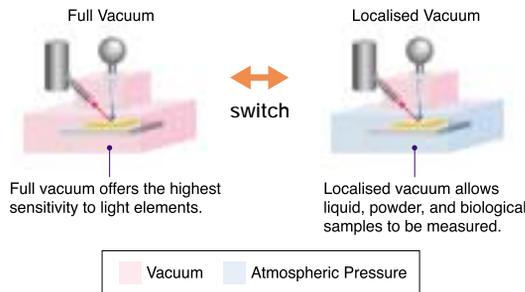
Nucleus

Fluorescence X-ray

3 Unstable State   Energy is generated when an outer-shell electron falls back to the inner shell=Fluorescence X-ray

4 An external electron is taken in and the molecule is stabilized.

Chamber

The spacious sample chamber allows samples of all shapes and sizes to be accommodated. The integrated XYZ stage ensures easy handling. Within seconds the user can switch between the Dual Vacuum modes available within the sample chamber. These allow chamber conditions (and measurement results) to be optimised for different samples.

Full Vacuum

Localised Vacuum

switch

Full vacuum offers the highest sensitivity to light elements.

Localised vacuum allows liquid, powder, and biological samples to be measured.

Vacuum   Atmospheric Pressure

Intensity (cps)

Energy (keV)

Al   P   Si   Mg   Na

■ Full vacuum
■ Localised vacuum
■ Air

Full vacuum provides lower detection limits for light elements.

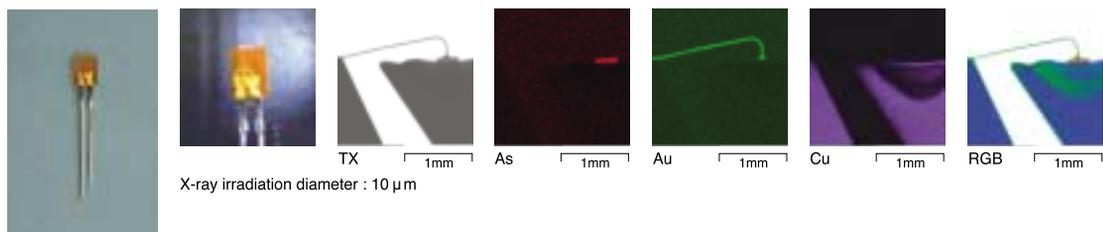|	XGT spot	
	10μm	100μm
Na	1.36%	0.61%
Mg	0.41%	0.18%

Sample: Silica glass

Software

The XGT-7000V is operated via intuitive software which leads the user through experiment set up, acquisition and data analysis. A full complement of acquisition modes and qualitative/quantitative analysis functions ensures the maximum versatility for the user. The SLICE software module* offers comprehensive spectral data archiving and searching functions.   *option
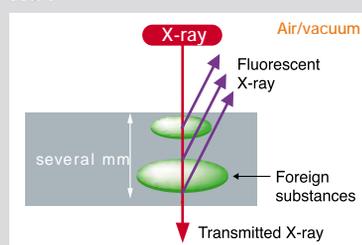
Navigator window	Smart Map	SLICE software

Option
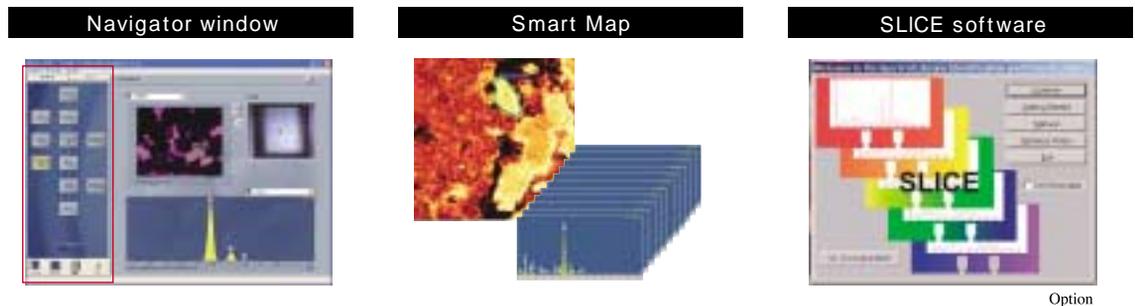
XRF and Transmitted X-ray Imaging

X-ray irradiation diameter : 10μm

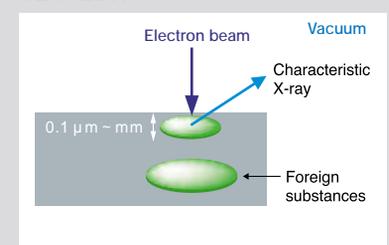TX   1mm   As   1mm   Au   1mm   Cu   1mm   RGB   1mm

Comparison with SEM/EDX

The use of an electron beam for SEM/EDX analysis means the technique is suitable for surface analysis only.
The XGT-7000V benefits from the penetrating nature of the primary x-ray beam, allowing visualisation and characterisation of features not visible by eye, and higher detection limits compared with SEM/EDX since more atoms are analysed.
Above all, the XGT-7000V offers increased ease of use, and is suitable for analysis of even large samples, with or without a vacuum.
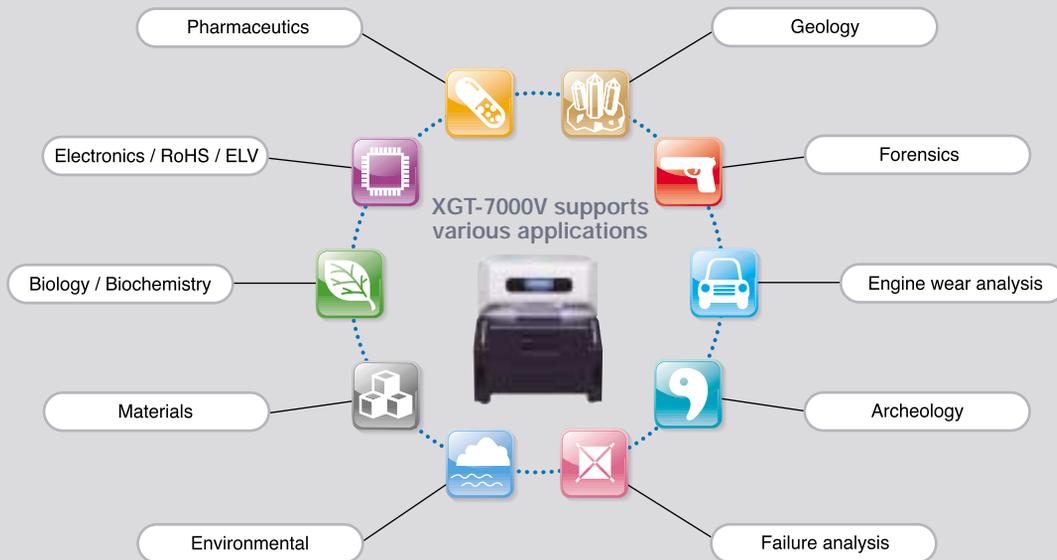
XGT

X-ray   Air/vacuum

Fluorescent X-ray

several mm

Foreign substances

Transmitted X-ray

SEM/EDX

Electron beam   Vacuum

Characteristic X-ray

0.1μm   mm

Foreign substances

Applications

Pharmaceutics

Geology

Electronics / RoHS / ELV

Forensics

XGT-7000V supports various applications

Biology / Biochemistry

Engine wear analysis

Materials

Archeology

Environmental

Failure analysis

A comprehensive software platform

Easy operation

An intuitive navigator window leads the user through the experiment, from sample set up, through acquisition, to complete data analysis.


Complete acquisition options

The XGT-7000V offers the user a wide choice of acquisition methods.
- Single point analysis
- Multi-point analysis
- Automated multi-point analysis with coordinate file import
- Hyperspectral elemental imaging
- Transmitted x-ray imaging

Hyperspectral imaging

A full spectrum is acquired at each and every pixel of the XRF image
Element images can be created at will after acquisition
Spectra can be generated from user defined regions within the image, allowing subsequent qualitative and quantitative analysis.
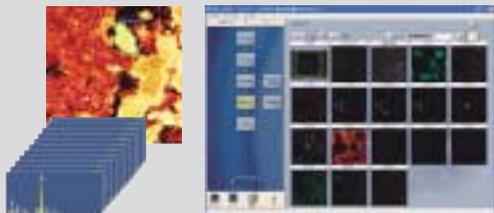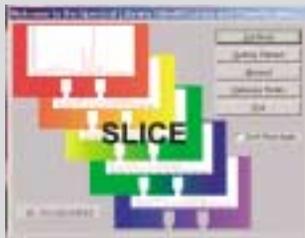

Full data analysis capabilities

With the data collected, the XGT-7000V software offers a complete data analysis package.
- Qualitative (Auto ID)
- Quantitative
  (Standardless, Single Standard, Calibration)
- Multi-layer thickness analysis
- Spectrum generation
- Match
- Compare and Overlay
- RGB composite image
- Report generation

SLICE   Option
spectrum archiving and searching

SLICE (the Spectral Library Identification and Classification Explorer) has been developed by xk Inc. in collaboration with the FBI, as a comprehensive archiving and searching tool for elemental spectra (XRF and SEM/EDX).
- Database of more than 5000 spectra
- Full record keeping for each material (spectrum, image, composition, acquisition parameters)
- Comprehensive searching algorithms and spectrum matching
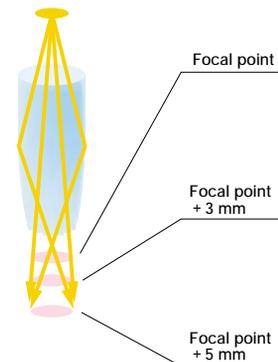- One click link from XGT-7000V to SLICE
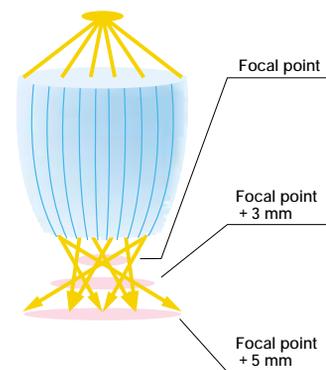

The spac

Mono-cap

Mono-capillary

Focal point

Focal point 3 mm

Focal point 5 mm

Poly-capillary

Focal point

Focal point 3 mm

Focal point 5 mm

The spacious sample chamber allows samples of all shapes and sizes to be accommodated.
The integrated XYZ stage ensures easy handling. The user has complete control over sample movement and the analysis position via three integrated colour video cameras.
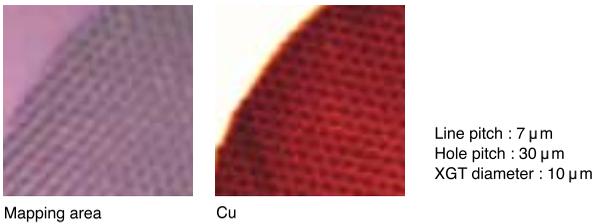
The HORIBA X-ray Guide Tube (XGT) provides x-ray beams with high intensity and microscopic diameters - ranging from 1.2 mm down to a unique 10μ m. They allow fast and easy elemental analysis of individual particles and features.
The exclusive use of mono-capillary optics in the XGT-7000V ensures analytical clarity with parallel beams which are optimised for micro-XRF analysis. These allow "focus free" analysis - even with rough samples precise, well-defined elemental images can be obtained. Acquisition times are kept to a minimum because time consuming "autofocus" procedures are not required.
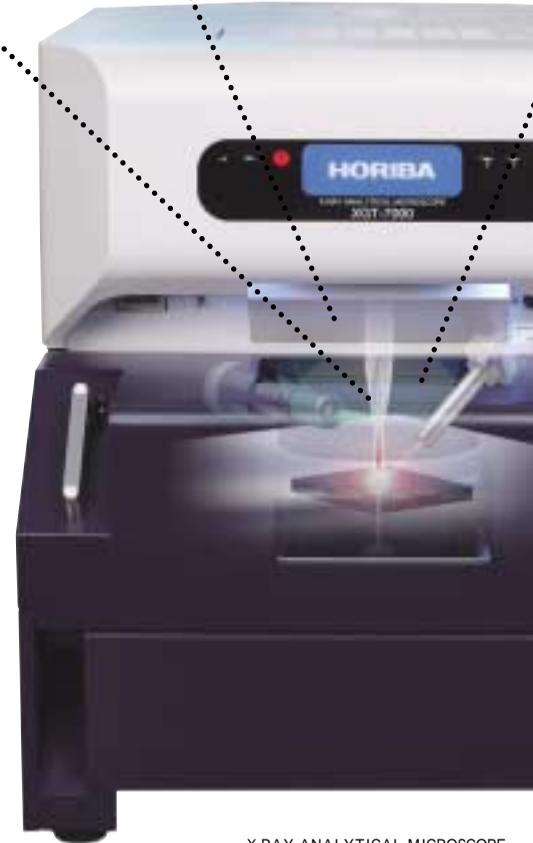
Application Rough or unevenly shaped sample

Mapping area   Ni   Sn
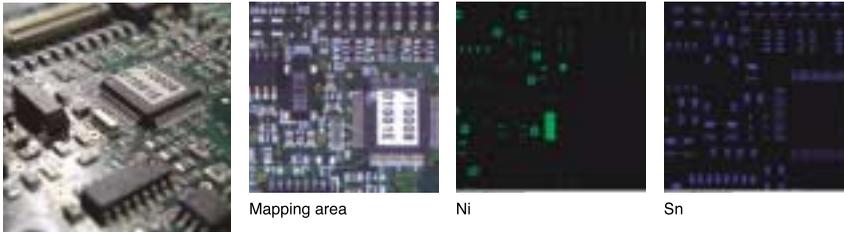
Application Copper mesh

Mapping area   Cu

Line pitch : 7μ m
Hole pitch : 30μ m
XGT diameter : 10μ m
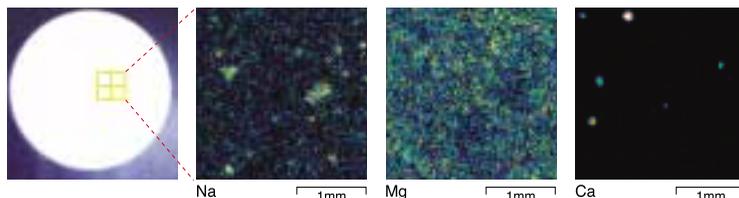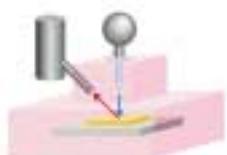
Application Engine wear

X-RAY ANALYTICAL MICROSCOPE
XGT
7000V

The Dual Vacuum modes of the XGT-7000V offer the user versatility for a wide range of samples. Even samples which cannot withstand full vacuum conditions can be analysed by using the Localised Vacuum mode, which retains the sample at atmospheric pressure.

Application   Tablet

Full Vacuum

The Full Vacuum mode offers the highest sensitivity to light elements. It provides optimised analysis conditions for pharmaceutical tablets, mineral sections and light element alloys.

Na   1mm   Mg   1mm   Ca   1mm

Fast switching

Application   Clam

Localised Vacuum

With the Localised Vacuum mode it is possible to analyse biological materials and other samples which cannot be subjected to a full vacuum. The XRF images below are from a clam - they show the general internal structure of the organism, together with ingested iron sand particles.

Fe   10 mm   S   10 mm   Ca   10 mm   P   10 mm
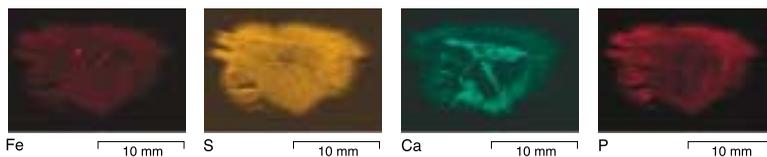
SmartMap

The XGT-7000V's SmartMap software gives unlimited analysis flexibility. The XRF datacube which is acquired during a mapping experiment contains both spatial and spectral information. After the acquisition the user can generate element images at will, or extract spectra from specified regions within the map. Thus it is possible to both examine element distribution and perform qualitative/quantitative spectral analysis from a single dataset.
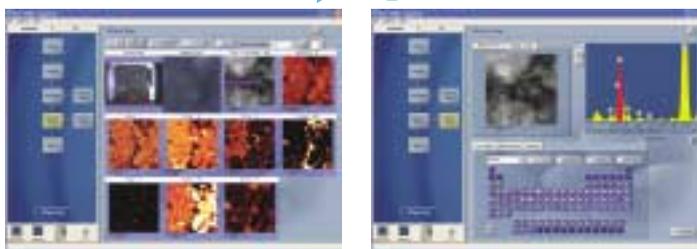
Generate a spectrum from a user defined region within the element image.
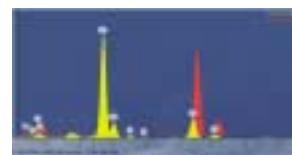
Spectra from different regions can be compared in order to identify their differences in elemental composition

Element images can be generated during acquisition, or at any time afterwards. Simply select the element and view its distribution image.

Multi-point analysis

The software controlled sample stage allows the user to define a number of experiments, including multi-point, line, and grid analyses.

PCB board

A maximum of 1000 points can be specified for multi-point analysis. Once the points are defined on the whole sample image and/or the high magnification image the spectra are automatically collected.
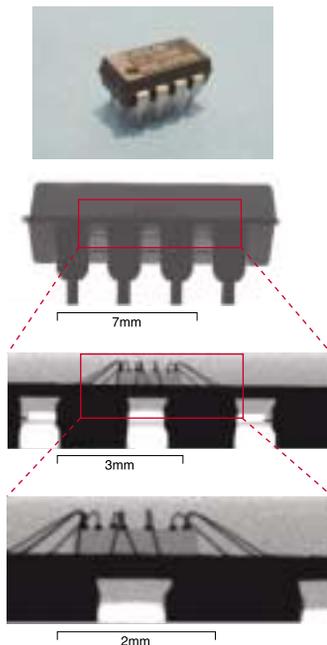

Comparing spectra
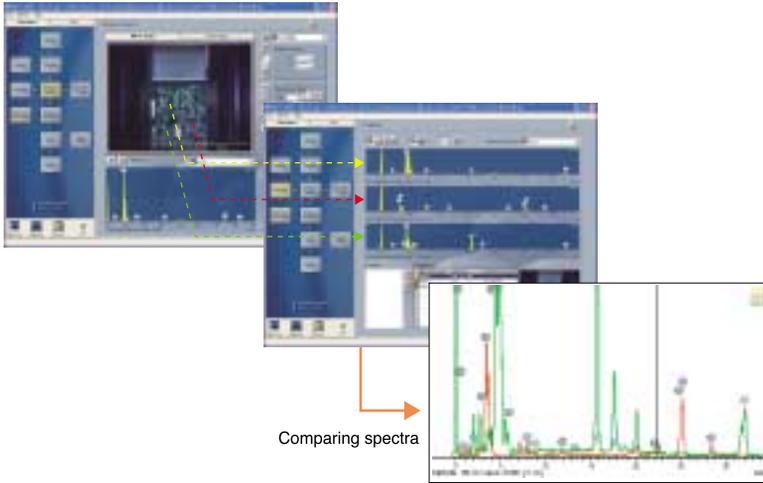
X-ray transmission image

With the XGT-7000V the penetrating nature of X-rays can be harnessed to view the internal structure of a sample - without having to open it up. The collimated beams generated by the X-ray guide tube allows unevenly shaped samples to be imaged with high resolution.

IC chip

7mm

3mm

2mm

FORENSIC SCIENCE

Forensic scientists generally require fast and non-destructive analysis of a very wide range of materials. Often these materials are presented in very small quantity, as evidence collected from a crime scene. The elemental "fingerprint" which XRF reveals is used to identify unknown materials, match crime scene materials to those found on suspects and provide vital information on explosive/gunpowder constituents. Furthermore, XRF mapping allows gun shot residue patterns to be observed, and paint cross sections to be characterised.

Glass

Microscopic glass fragments are often found at crime scenes and on the clothing of criminal suspects. By analysing the glass it is possible to gain valuable evidence linking a suspect to a specific crime scene. The images show a 100 μ m particle viewed with the XGT-7000V's optical microscope, and spectra from two particles which illustrate clear compositional differences.
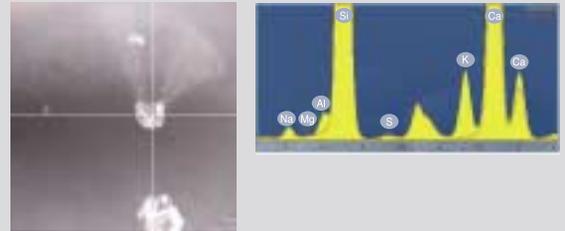
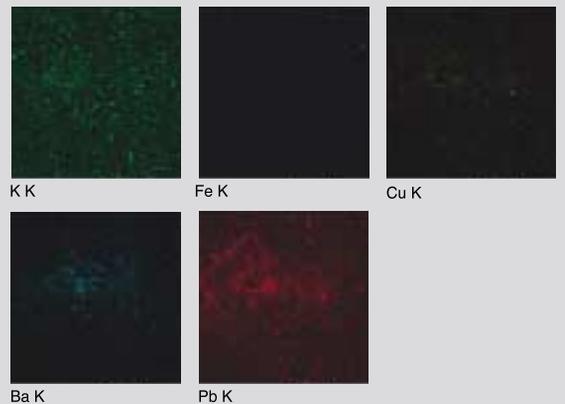**GSR(Gun Shot Residue)**

GSR is a mixture of explosives, propellants and metal fragments expelled from the gun barrel during firing.
Analysis of GSR composition and patterning provides information on the gun and bullets, and the proximity of the weapon when fired. Matching GSR materials on a victim and suspect can be used to assist prosecution.
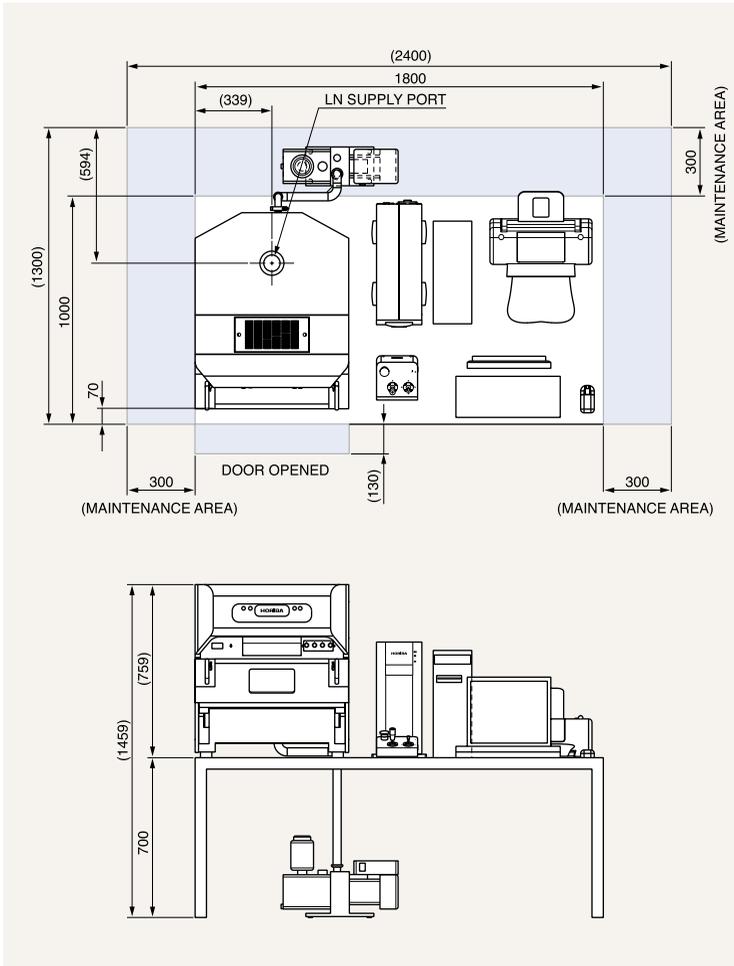

White light image

K K   Fe K   Cu K

Ba K   Pb K

Outer dimension Unit: mm

(2400)
1800
(339)   LN SUPPLY PORT
(594)
(1300)
1000
300 (MAINTENANCE AREA)
70
300 (MAINTENANCE AREA)   DOOR OPENED   (130)   300 (MAINTENANCE AREA)

(759)
(1459)
700

Specification of XGT-7000V

Detection range	Sodium (Na) to Uranium (U)
X-ray tube	50kV, 1mA, Rh target
Fluorescent X-ray detector	High purity Si detector - other options available on request
Transmitted X-ray detector	NaI (Tl) scintillator

X-ray guide tube	High intensity mono-capillary
	Two beams can be configured, with motorised switching:
	    10µ m / 20µ m / 50µ m / 100µ m / 400µ m / 1.2mm /
	    1.2mm with primary filter wheel

Vacuum	Dual vacuum modes:
	    Full vacuum
	    Localised vacuum (sample at atmospheric pressure)

Optical image	Whole sample image: 2x magnification Coaxial high magnification image: 100x magnification
Sample stage	Motorised XYZ XY mapping area: 100 mm × 100 mm
Sample chamber	500 mm × 450 mm × 80 mm
Signal processing	Digital pulse processor
Acquisition	Single point / Multipoint (point, line, grid) / Multipoint from coordinate file (with positional referencing)*
Qualitative analysis	Peak Auto-ID / KLM marker / Peak search / Spectrum Compare / Spectrum Match / Report
Quantitative analysis	FPM (standardless) / FPM with single standard / Calibration curve / FPM Multi-layer thickness* / FPM batch analysis / Auto Quant for multipoint acquisition* / Report
Mapping function	Hyperspectral XRF imaging Transmitted X-ray image / Elemental image / RGB composite image
Other function	Data export to Excel

* Option

HORIBA continues contributing to the preservation of the global environment through analysis and measuring technology.

⚠ **Please read the operation manual before using this product to assure safe and proper handling of the product.**

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