FISCHERSCOPE® X-RAY Product Line

X-Ray Fluorescence Measuring Instruments for the Measurement of Coating Thickness and Material Analysis

Coating Thickness

Material Analysis

Microhardness

Knowledge, Competence and Experience you can rely on

Since 1953, FISCHER has developed and produced innovative measuring technologies for the measurement of coating thickness, materials analysis, microhardness measurement and materials testing. Measuring technology from FISCHER is currently employed all around the world – wherever accuracy, precision and reliability are required.

As one of the pioneers in using X-ray fluorescence for industrial measurement, FISCHER quickly recognised the tremendous potential of this method for measuring coating thickness and began developing and manufacturing industrial-strength measuring instruments. The first FISCHERSCOPE X-RAY made its market debut in the early 1980s.

Material Testing

Since then, FISCHER has continued to shape this technology with innovative solutions, which today are state-of-the-art. One example is the transparent observation window, which allows the user to view the sample from the same direction as the primary beam. Also, the stage that automatically extends upon opening of the hood (the "pop-out function") was first implemented by FISCHER. In the software field, FISCHER was the first company to utilise spectra evaluation based entirely on fundamental parameters.

FISCHER enforces exacting quality standards in its manufacturing processes and performs meticulous inspection on supplied parts, ensuring the consistently high reliability of FISCHERSCOPE X-RAY instruments.

Today, with over 10,000 units in operation worldwide, the name FISCHERSCOPE X-RAY is synonymous with powerful, reliable and durable X-ray fluorescence measuring instruments.

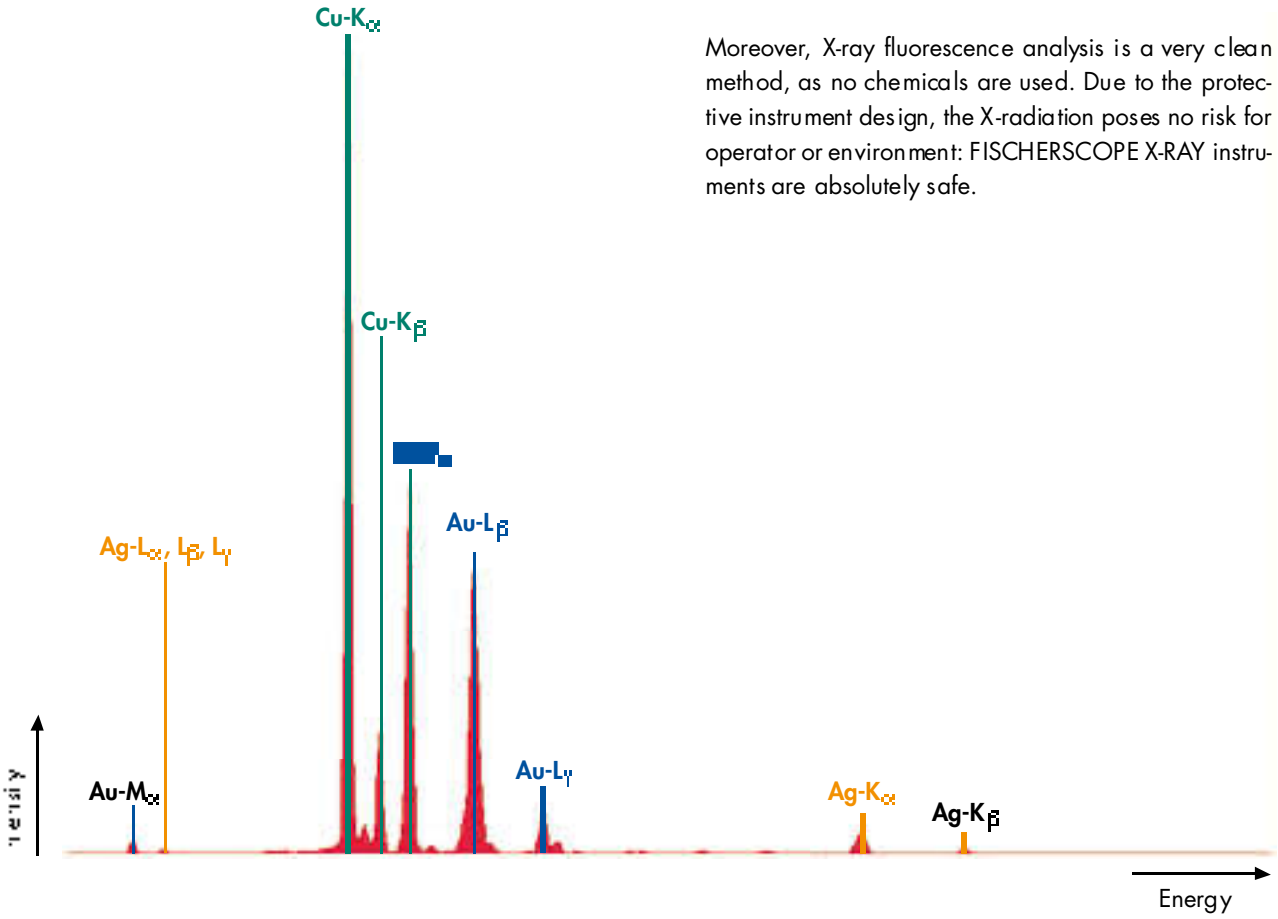
Across the globe, industry, research and science depend on the reliability and accuracy of this equipment. FISCHER consistently rises to the challenge with its dedicated development strategy for producing modern measurement systems and innovative software. Because ultimately, only that which has been designed with the utmost care and built to precise, exacting specifications can be expected to perform optimally. And only then does it deserve the name FISCHER. You can rely on that.

X-ray fluorescence analysis (XRFA)

The Energy Dispersive X-Ray Fluorescence Analysis (ED-XRFA) is a method for measuring the thickness of coatings and for analysing materials. It can be used for the qualitative and quantitative determination of the elemental composition of a material sample as well as for measuring coatings and coating systems. In both laboratory and industrial environments, this method is now well established and can be readily utilised with modern equipment.

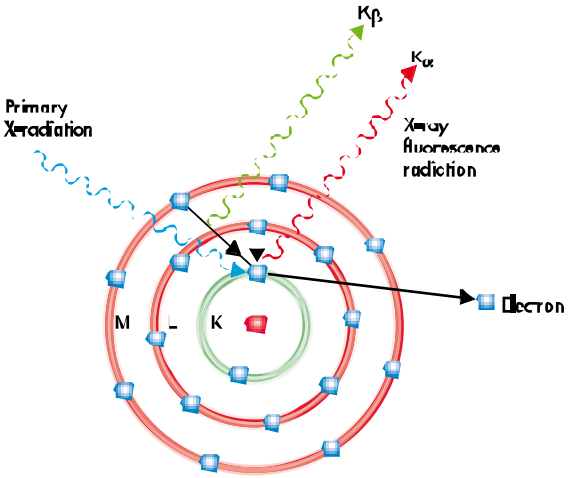
ED-XRFA is a very universal method offering some outstanding advantages. It covers virtually all technically relevant elements and works non-destructively and without contact. Measuring times range in the seconds, rarely longer than one minute. Measurements can be combined quickly and easily without extensive sample preparation. With ED-XRFA, it is possible to measure both thickness and chemical composition of homogeneous materials and coatings. Even traces of harmful substances can be detected in the widest variety of samples.

Moreover, X-ray fluorescence analysis is a very clean method, as no chemicals are used. Due to the protective instrument design, the X-radiation poses no risk for operator or environment: FISCHERSCOPE X-RAY instruments are absolutely safe.



The Principle

X-ray fluorescence analysis has its basis in the phenomenon that when atoms in a material sample are excited by the primary X-radiation, electrons from the innermost shells are released; the resulting vacancies are then filled by electrons from the outer shells.



During these transitions, fluorescent radiation is generated that is characteristic for each element. This is read by the detector and provides information on the composition of the sample.

Applications

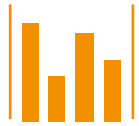
Because ED-XRFA is capable of determining the composition of materials and measuring thin coatings and coating systems, there is a wide variety of applications for this technology. Examples include:

- In the electronics and semiconductor industries, thin gold, palladium and nickel coatings are ascertained on contacts or on traces.
- In the watch and jewellery industries or in precious metal refining, accurate knowledge of the composition of precious metal alloys is required.
- For quality and incoming goods inspections, exact compliance with material specifications is essential. In the photovoltaic industry, for example, the composition and thickness of a photovoltaic film determines its efficiency, while in contract electroplating, it is necessary to measure the coatings of mass-produced parts.
- For manufacturers and importers of electronic goods, it is critical to be able to monitor compliance with the Restriction of Hazardous Substances (RoHS) Directive.
- The toy industry is also dependent on the reliable detection of harmful substances.

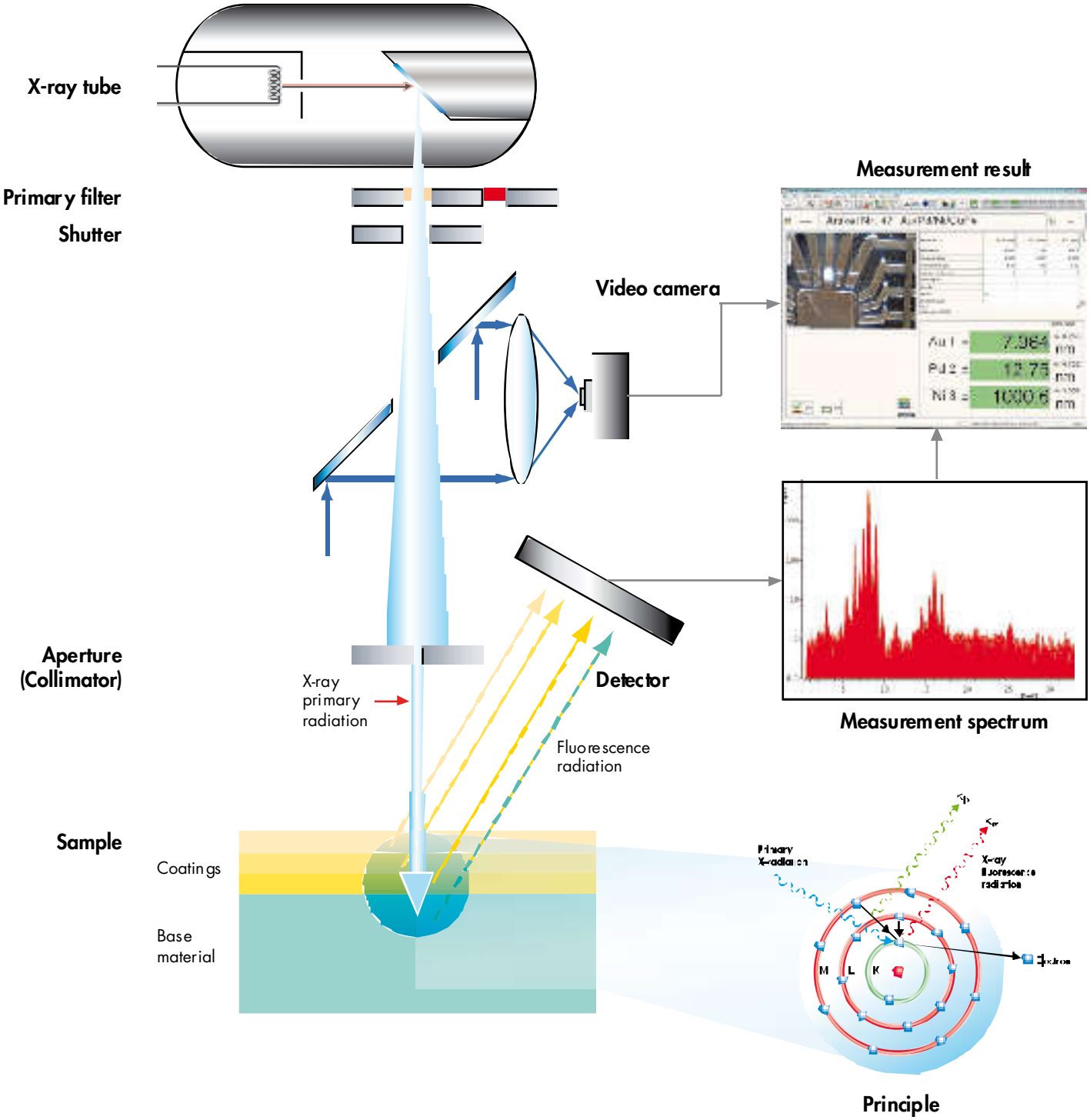
FISCHERSCOPE X-RAY measurement systems are optimally suited for all these purposes.

Advantages of the X-ray fluorescence analysis (XRFA)

- Fast and non-destructive measurement of coating thickness (single and multiple layers)
- Analysis of solids, powders and liquids
- Trace analysis of harmful substances
- High precision and trueness
- Very broad range of applications
- Accurate measurement irrespective of magnetic and electric properties of base material
- Very simple sample preparation: little to none
- Safe method without the use of environmentally hazardous chemicals
- No consumables required, therefore cost-effective



FISCHERSCOPE® X-RAY Measurement Systems



Proportional counter tube

Silicon PIN detector

uses ingenuity and solid, continuous development to create robust and high-precision X-ray measuring instruments that work reliably in both laboratory and everyday industrial settings. We at FISCHER have committed ourselves passionately to this mission, which is reflected in the wide variety of FISCHERSCOPE X-RAY instruments we produce.

For example, systems with X-rays that radiate from bottom to top are ideal for quick and simple measurements on mass-produced parts, but for specimens like silicon wafers, which must be measured without contact, the correct choice is an instrument that measures from top to bottom.

On the other hand, for automated measurements on individual pins of leadframes or to determine inhomogeneities with a high spatial resolution, an instrument with a tiny measurement spot and a precise, programmable XY-stage is needed.

For the rigorous demands of in-line measurements in a running production line, entirely different configurations are of interest, such as the direct attachment of a measuring head onto a vacuum chamber.

To meet all these requirements, the building blocks described below are used in various combinations. Perfectly matched to their intended purposes, FISCHERSCOPE X-RAY measurement systems are engineered for optimal performance in practical application.

Radiation source

The primary X-radiation required for X-ray fluorescence analysis is generated using an X-ray tube in which a heated cathode emits electrons which are accelerated to a very high speed by applying high voltage.

The X-radiation is created when these electrons strike the anode material of the tube, typically tungsten or molybdenum. To ensure that the X-ray tubes work reliably for years to come, each individual piece must pass extensive incoming inspection tests.

The X-ray generator developed by FISCHER integrates the shielded, oil-cooled tube with the high voltage generation, which results in excellent stability and long service life.

Primary filter

Specially tailored to optimise the energy distribution of the primary X-radiation for a given application, absorbing any undesired spectral components of the radiation. Depending on the instrument type, either individual fixed filters or removable multi-filters are employed.

COATING THICKNESS

MATERIAL ANALYSIS

X-ray tube

Multiple aperture

Shutter
The shutter is located directly in the beam path and is opened only for the duration of the measurement. In its closed state, it prevents the primary radiation from entering the measuring chamber. Monitored by the safety system, it opens only when the housing is completely closed, thus ruling out the risk of radiation for the operator.

Video camera
FISCHERSCOPE X-RAY measurement systems are equipped with a high-magnification camera optics that enables the setting of specimen measurement locations with minute accuracy. Because the software depicts the measurement spot in a realistic size, even very small parts can be positioned precisely. To avoid parallax error, the camera looks through a complex optical system along the primary X-ray beam exactly perpendicular to the sample, ensuring that measurements are taken at the correct location.

Aperture
The use of an aperture (collimator) restricts the cross-section of the primary X-ray beam, creating a measurement spot with a predefined size, which allows precise adjustment of the size and shape of the X-ray beam to the specimen geometry. Depending on the measurement system, individual fixed apertures or exchangeable multi-apertures are employed.

For measurements on very small objects such as the bond areas on leadframes, the aperture is substituted by a special X-ray optics with mirror or polycapillaries, which already provides for both a very small measurement spot and high excitation intensity.

Detector
The X-ray detector measures the energy distribution of the X-ray fluorescence radiation emitted by the sample. Detector types that are optimal for their respective purposes are available for various applications.

Proportional counter tube (PC)
- Large area sensitive to radiation, allowing for high count rates even with very small measurement spots Energy resolution (FWHM) ΔE/E approx. 8%.
- Cost-effective
- Typically used for routine measurements of coating systems and for alloys with few elements

Silicon PIN detector (PIN)
- Significantly better energy resolution than the proportional counter tube (FWHM for MnKα approx. 180 eV)
- Ideal for samples with many elements and/or coatings, e.g. in the analysis of gold or in incoming goods inspection.

Silicon drift detector (SDD)
- Best possible energy resolution (FWHM for MnKα approx. 140 eV) also with very high count rates >100 kcps
- Ideal when many elements – even in close proximity – are to be analysed, e.g. gold and platinum, or in trace analysis

Spectrum
The radiation emitted by the sample is depicted in the signal spectrum, the lines of which identify the elements contained in the sample. From this spectrum, the FISCHER WinFTM Software computes the desired parameters, such as coating thickness or element concentrations.

XY-stage with pop-out function

Laser pointer for positioning

Housing with C-slot

Sample support and stages
Whether for quickly placing and measuring a sample or for performing automatic measurements of complex components, FISCHERSCOPE X-RAY measurement systems are furnished with appropriate sample supports, ranging from simple, plane probe supports or manually operable XY-stages through to high-precision, programmable XY-stages.

Positioning aids
Simple and fast sample positioning saves time and money. For this reason, all instruments with an XY-stage feature a laser pointer as a positioning aid, which greatly streamlines the localisation of the measurement spot. Specific user-defined sample supports further facilitate the placement of specimens.

Housing
For measurements on large, flat components such as printed circuit boards, some instruments feature a cut-out in the housing, the so-called "C-slot". This allows for the measurement of such parts even with the hood closed.

Calibration standards
While the standard-free, fundamental parameter-based measuring method provides for precise measurement results, high-quality calibration norms ensure traceable measurements. FISCHER manufactures and sells traceable calibration standards according to highest quality standards. FISCHER's own DKD calibration lab ensures the traceability of internationally recognised measurement standards.

As the first institution in Germany, since July 2003 FISCHER has been licensed and accredited as a DKD Calibration Laboratory for the measurand "mass per unit area" according to DIN EN ISO/IEC 17025.

This entitles FISCHER to issue [DKD/DAkkS] Calibration Certificates in the name of the German Accreditation Service [Deutscher Kalibrierdienst] for mass per unit area calibration standards used in adjusting X-ray fluorescence instruments for measuring coating thickness.

Safety
FISCHERSCOPE X-RAY measurement systems are engineered to eliminate risk to both operators and the environment. The design ensures that the X-radiation is restricted to only certain areas inside the instrument. Solid shielding and a corresponding housing design ensure that no harmful radiation leaks from the unit. Two independent safety circuits further ensure that no radiation escapes to the outside, even when the cover is opened.

All FISCHERSCOPE X-RAY instruments are developed and built according to the latest standards and are used in compliance with the German X-ray ordinance.

COATING THICKNESS

MATERIAL ANALYSIS

Calibration standard

Calibration foil

Pure elements calibration standard

WinFTM® Software

Every X-ray fluorescence measurement device requires powerful software to make it a solid state measuring instrument. Therefore, the FISCHERSCOPE X-RAY instrument's potential for providing optimal measurement results can only be realised in conjunction with FISCHER's innovative WinFTM Software.

WinFTM Software is the fundamental tool of a FISCHERSCOPE X-RAY instrument, enabling the collection of information regarding coating thickness and composition from the measured X-ray spectra, regardless of whether the specimens are pure element coatings, alloy coatings, combinations thereof or alloys of many elements.

Here, FISCHER accesses new ways, implementing in WinFTM numerical effective algorithms rather than based on a file-like physical model. For this reason, all measurements can also be carried out standard-free.

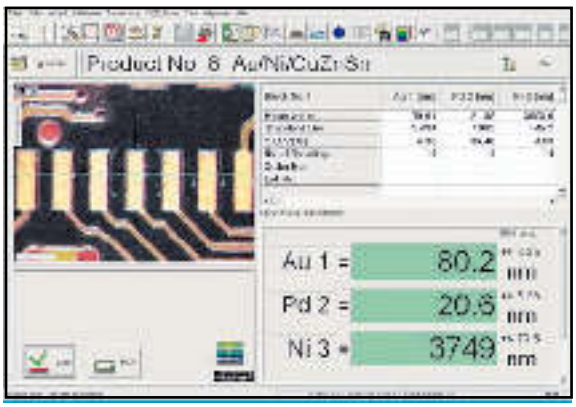
But WinFTM is more. It is also the command centre for user-friendly operation and optimal employment of the FISCHERSCOPE X-RAY measuring instruments, not only in the laboratory but also in daily industrial use.

Scope of applications

From simple coating thickness measurements in the electroplating industry, such as zinc on iron, to part analyses, complex multi-coating applications, sophisticated precious metal analyses or trace analyses (RoHS), a single software program suffices for all measuring applications: WinFTM.

User-friendly

Whether in incoming goods inspection, quality control in manufacturing, or in the material testing laboratory in governmental institutions, the operative requirements met by WinFTM are as diverse as the range of uses to which the instruments are put. Easy and intuitive control of such complex instruments is the key to the broad acceptance enjoyed by the FISCHERSCOPE X-RAY series.



Video image with crosshairs

RoHS-standards

For this reason, FISCHER has designed the WinFTM Software such that no particular training is required for routine measurement operations. Based on the well-known Windows standard, its intuitive user interface and predefined, automated processes and command buttons make the job easy. All functions are quickly accessible and displayed only if they are actually needed, ensuring that the screen is always clearly arranged and uncluttered.

Solid physical foundation
WinFTM employs an algorithm based on fundamental parameters in order to determine composition of alloys, as well as thickness and composition of coatings, in one single measurement. Without requiring the use of standards (calibration), the unknown measurands are computed accurately from the signal spectrum.

Calibrating
Quality standards require that measuring equipment can be calibrated based on norms that are traceable to international or national calibration standards, thereby producing results that are traceable and comparable (to other methods). For this reason, each measurement application of the FISCHERSCOPE X-RAY instruments can be calibrated. The WinFTM Software stores and manages all calibration data, making it easy and convenient to document and substantiate the calibration.

Error calculation/Calculation of the measurement uncertainty
The WinFTM software provides comprehensive error calculation. The overall uncertainty of a measurement (or of the mean value from several measurements) is computed, taking into account the uncertainty of the standards, the counting statistics of the calibration measurements and the measurement itself. This measurement uncertainty ensures the required traceability of the measurement result.

Video image
WinFTM shows video of the sample from the same viewing direction as the primary beam. A superimposed cross-hair electronically accesses the respective image magnification depicts the position of the measurement spot in real size on the surface of the sample. The autofocus function allows easy, accurate and reproducible optical focusing.

DCM – Distance Controlled Measurement
To measure on geometrically irregular parts or indentations, FISCHERSCOPE X-RAY instruments are equipped with a special feature for distance-based measurement correction: the DCM Method. This function also allows for testing of complex surface shapes and for measurements in indentations, whereby WinFTM automatically factors the current measuring distance in when computing the measurement result for a specific area.

Automated Measurements
Recurring sequences can be easily automated by using predefined commands, which in turn can be activated via a user-defined command button. Even complex test plans with instructions for the operator, e.g. for quality control in manufacturing, can be integrated into a very simple operating procedure.

When using instruments with programmable XY-stage, measurements defined on one sample can be automated for repeatable measuring procedures.

The WinFTM software can recognise specific structures via image processing and track the measurement positions automatically. For specimens with shape tolerances, for example, this can ensure that measurements are always made at the correct location.

Measurement with DCM-method

Automated measurement

COATING THICKNESS

MATERIAL ANALYSIS

Substrate Material Recognition
For certain coating thickness measurements, WinFTM can automatically analyse the substrate material as well. This not only eliminates the need for normalisation when taking measurements on different materials, it also increases the reliability of the results because the coating thickness is correctly measured despite even slight fluctuations in substrate material composition.

Classes of Materials (COM)
Using the COM function, unknown samples can be assigned automatically to a predefined material class. These classes may be different kinds of materials, e.g. different alloys, specific coating thicknesses, or concentration ranges of a coating structure.

For example, this allows for the differentiation of gold alloys with high, medium or low gold content or with specific alloy elements. It should be noted that the specification necessary for defining the classes are contained therein directly, eliminating the time-consuming calibration of multiple material samples. The system can also be adapted or expanded to meet the particular needs of the customer.

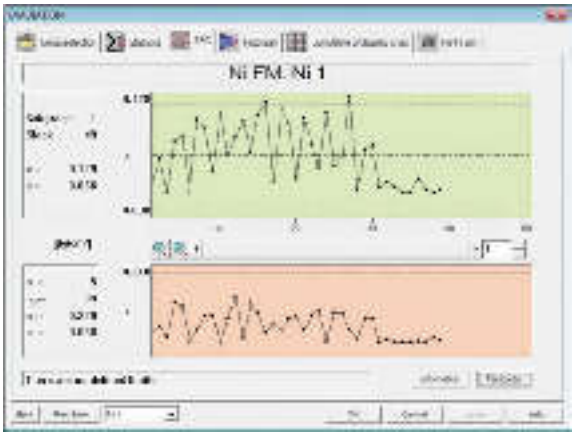
When measuring samples of unknown or diverse material compositions and coating thicknesses, WinFTM can automatically select the appropriate application to use for the measurement.

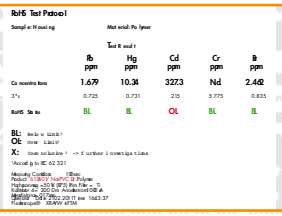
For example, in gold analysis, WinFTM first determines the type of alloy and then selects the appropriate measuring application required to determine the gold content with high accuracy.

Multiple Excitation
For each application, the excitation parameters "high voltage" and "primary filter" are set to produce the best possible results. For some applications, however, it may be necessary to work with different excitations in order to measure certain elements accurately. The WinFTM software enables the use of multiple excitations within a single measurement, so that all parameters are measured under the best possible conditions; the collected results are then presented in one combined evaluation.

Reliable
Nothing is worse than unwittingly conducting an incorrect measurement! For this reason, WinFTM automatically checks to see if the selected measuring application matches the sample being measured – and warns the operator in case of deviations. Background assistance monitors the instrument with respect to its basic parameters and thus ensure the highest degree of reliability.

Statistical Evaluation
From the individual measurement results, integrated statistics functions compute the mean value, the standard deviation and the coefficient of variation and display these values in a statistics window. The measurement results can be displayed individually, in a list, or as an SPC chart – and can also be documented.

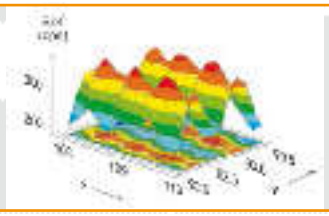



RoHS Test Protocol

	Pb ppm	Hg ppm	Cd ppm	Cr ppm	Br ppm
Concentrations	1.679	10.34	322.3	Nd	2.462
3*s	0.725	0.731	2.8	5.775	0.835
RoHS State	BL	BL	OL	BL	BL

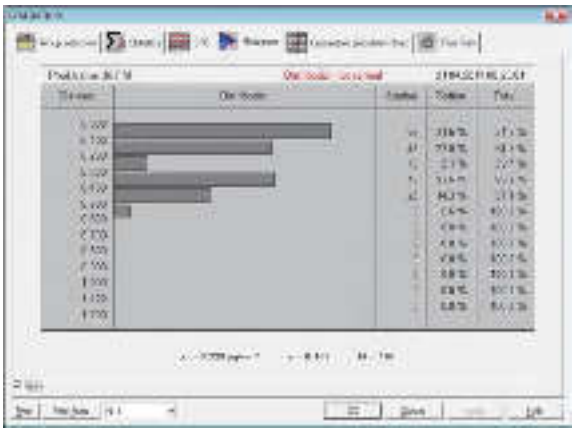
BL: below limit
OL: over limit

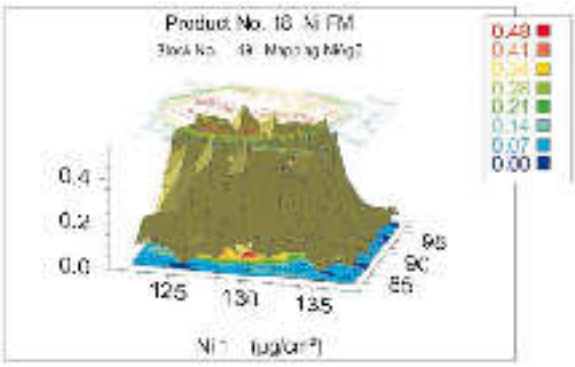
Measurement report



3D display of an element distribution

Furthermore, WinFTM presents the measurement data alternatively as a distribution (histogram, probability chart) or in a Statistical Process Chart (SPC). Capability indices C_p and C_{pk} are calculated for the specified tolerances.





Export Measurement Results and Print Forms

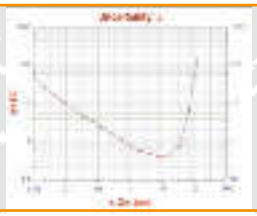
Single readings and block mean values, along with their measurement uncertainties, characteristic statistical values and any additional data relevant to the measurement, can be exported into files and evaluated using, for example, quality management systems. The integrated report generator produces individual result reports and customer-specific forms and templates. The content elements of the documentation can be specified freely, e.g. video image of the sample with measurement spots, the measurement results, characteristic statistical values, histogram, probability chart, spectrum, etc.

WinFTM Software Features

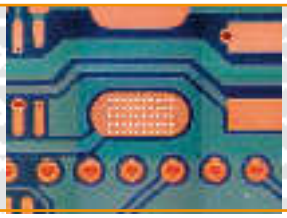
- Universal software
- Coating thickness measurement and analysis
- One single package with all functions
- User-friendly, intuitive operation
- Fundamental parameter method
- Sorting by class of materials
- Automated measurement sequences
- Adjustable measuring parameters (high voltage, filters and apertures)
- Multiple excitation
- Video image – with zoom, crosshairs and autofocus
- Substrate material recognition
- DCM – Distance Controlled Measurement
- Statistics functions
- Data export
- Report generator
- Documentation of calibration and settings
- Multiple interfaces and networking options

COATING THICKNESS

MATERIAL ANALYSIS

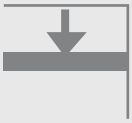


Calculation of measurement uncertainty



Programming of measuring points

X-RAY Instruments at a Glance

Direction of measurement	Product family	Characteristics – Application
 MEASUREMENT FROM BOTTOM TO TOP	XUL	A robust and inexpensive instrument for coating thickness measurements in the electroplating industry. It features a fixed aperture and one fixed filter as well as an X-ray tube with a slightly larger primary spot and is well suited for applications with measurement spot sizes starting at about 1 mm. Low-energy beam components are excited with lower effectiveness; however for standard applications measuring the thickness of typical electroplated coatings such as Cr, Ni, Cu, this poses little to no problem.
	XULM	Flexible instrument for measuring coating thickness with multiple uses. Both thin and thick coatings (e.g. 50 nm Au or 100 µm Sn) can be measured equally well through selectable high voltage filter combinations. The microfocus tube enables small measurement spot sizes at short measurement distances of just 100 µm. High count rates of a few kcps through proportional counter tube.
	XAN 310/315 XAN 220	Specialised for the cost-effective analysis of gold alloys. Only 1 fixed aperture and a fixed filter; thus particularly suited for precious metal analysis. XAN instruments are available with different detectors, making them optimmaly suited for customer requirements, from few elements to more complexe analysis with many elements.
	XAN 250	Analysis instrument that measures from bottom to top. Very flexible in its use. Fully enclosed measurement chamber allows also for large apertures and thus for high count rates that can be processed with the silicon drift detector. Excitation and radiation detection corresponds to the XDV-SDD. Ideal for the analysis of gold alloys and for trace analysis of harmful substances in plastics.
 MEASUREMENT FROM TOP TO BOTTOM	XDL	Robust instrument suited for coating thickness measurements, even at large measuring distances (DCM, stroke 0-80 mm). Features a fixed aperture and a fixed filter. Suitable for structure sizes starting at about 1 mm; comparable to the XUL. A programmable stage for automated measurements is available.
	XDLM	More universal than the XDL because equipped with a micro-focus tube, 4-x aperture changer and 3 primary filters. The measuring head corresponds to that of the XULM; thus suitable for smaller structures such as connector contacts or printed circuit boards. Larger measuring distances are possible as well (DCM, stroke 0-80 mm).
	XDAL	Similar to XDLM but with semiconductor detector. This expands the possibilities in element analyses and for measuring thin coatings – due to better signal/noise ratios. Because lower in intensity, less well suited for smaller structures.
	XDV-SDD	Premium model with universal application characteristics. Highest excitation flexibility, for both the size of the measurement spot and the spectral composition. With the silicon drift detector, even very high intensities > 100 kcps can be processed without a loss in energy resolution.
	XDV-µ	Measuring instrument optimised for micro-analysis. Depending on the X-ray optics, structures with a size of 100 µm or less can be analysed. Very high intensities and thus good precision. Even for thin coatings, measurement uncertainty < 1 nm possible. Suitable only for plane or nearly plane samples.
	XUV	Universal premium instrument with comprehensive measurement capabilities. Comparable to the XDV-SDD but additionally outfitted with a measurement chamber that can be evacuated, making it possible to analyse light elements beginning at Z=11 (Na). Precise, motor-driven XYZ-stage and video camera for exact sample positioning and for measuring small sections.
 PROCESS	X-RAY 4000	For continuous measurement of coatings on foils, strips and punched strips in ongoing production. Measuring head may be positioned at right angles to the transport direction of the specimen. Easy handling and quick start-up.
	X-RAY 5000	Flange measuring head for continuous measurements in production lines. For coatings with metallic elements on strips, foils or glass panels. Measurements can be carried out in vacuum or in air. Water-cooled version also available.

[1] The features listed here serve only to characterise the product families.
Changes and technical advances are possible at any time and are listed in the current data sheets.

Technical Features[1]

Detector	Tube	Primary filter	Number of apertures/size (mm)	C-slot
PC	Standard	1	1 (Ø 0.3)	yes
PC	Micro-focus	3	4 (0.05*0.05 – Ø 0.3)	yes
PC (XAN 310) PIN (XAN 315) SDD (XAN 220)	Standard (XAN 310/315) Micro-focus (XAN 220)	1	1 (Ø 0.3 XAN 310) 1 (Ø 1 XAN 220/315)	no
SDD	Micro-focus	6	4 (Ø 0.2 – Ø 2)	no
PC	Standard	1	1 (Ø 0.3)	yes
PC	Micro-focus	3	4 (0.05*0.05 – Ø 0.3)	yes
PIN	Micro-focus	3	4 (Ø 0.1 – Ø 0.6)	yes
SDD	Micro-focus	6	4 (Ø 0.1 – Ø 3)	no
SDD	Micro-focus	4	Poly-capillary	yes
SDD	Micro-focus	6	4 (Ø 0.1 – Ø 3)	no

Instrument accessories (apertures, filters, cooling) available according to measuring application.
Data interfaces for integration with quality management or control systems.

PC: Proportional counter tube PIN: Silicon PIN detector SDD: Silicon drift detector

FISCHERSCOPE® X-RAY XUL®/XULM®

MEASUREMENT FROM BOTTOM TO TOP

With the FISCHERSCOPE X-RAY XUL and XULM series, the X-ray source and the detector are located below the measurement chamber, allowing for fast and easy positioning of the samples. Furthermore, the viewing window facilitates positioning, and large controls on the instrument front simplify handling, which is especially helpful when measuring large quantities of parts in daily production.

Despite their compact size, these instruments feature a high-volume measurement chamber, so that even big objects can be measured. An opening in the housing (C-slot) allows for measurements on large, flat samples such as printed circuit boards that might otherwise not fit into the measurement space.

The sample is placed directly on the metal support or for even higher orientation precision, on the optionally available manual XY-stage.

The XUL and XULM instruments are both equipped with proportional counter tube detectors; however, they differ in their X-ray tubes. The robust and cost-effective XUL is furnished with one aperture and one fixed filter. The standard built-in X-ray tube has a larger primary beam spot; therefore, the smallest useful aperture is 0.3 mm. Because of beam divergence, only measurement spots of about 0.7 mm – 1 mm can be resolved.

Measurement on PCBs: Au/Ni/Cu/PCB

Gold jewellery

The XULM is used for smaller structures. It is furnished with a micro-focus tube that also allows for small measurement spots down to about 100 µm, while the proportional counter tube detector still allows for relatively high count rates. Very good repeatability precision can be achieved even at short measuring times. Additionally, the XULM instruments feature automatically interchangeable apertures and multi-filters to flexibly create optimum excitation conditions for various measuring applications.

Examples from practical applications

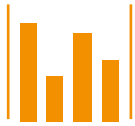
The XULM instruments are very well suited for measurements on fragile parts such as connectors, contacts or wires, as well as for measurements of coatings on printed circuit boards such as Au, Ni and Cu. Even thin gold coatings just 80 nm thick can be measured with a measurement spot of Ø 0.25 mm, achieving a repeatability precision of only 2.5 nm at 20 sec.

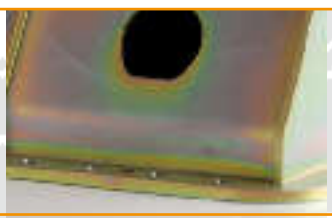
Characteristics

- X-ray tube with W-anode and glass window or micro-focus X-ray tube with W-anode and beryllium window. Maximum operating conditions: 50 kV, 50 W
- Proportional counter tube as X-ray detector
- Aperture: fixed or 4-x automatically exchangeable, 0.05 x 0.05 mm to Ø 0.3 mm
- Primary filter: fixed or 3-x automatically exchangeable
- Adjustable measuring distance 0 – 27.5 mm
- Fixed sample support or manual XY-stage
- Video camera for optical observation of the measurement location along the axis of the primary X-ray beam. Crosshairs with calibrated scale (ruler) and display of the measurement spot
- Design-approved, fully protected instrument compliant with the German X-ray ordinance § 4 Para. 3

Typical fields of application

- Measurement of coatings such as Au/Ni/Cu/PCB or Sn/Cu/PCB in the PC Board industry
- Coatings on connectors and contacts in the electronics industry
- Decorative coatings Cr/Ni/Cu/ABS
- Electroplated coatings such as Zn/Fe, ZnNi/Fe as corrosion protection on mass-produced parts (screws and nuts)
- Jewellery and watch industry
- Determination of the metal content of electroplating baths
- Especially for easy handling of large and/or flexible PCBs an extended sample support is available





Corrosion protection: Zn/Fe

Automotive: Cr/Ni/Cu/ABS

FISCHERSCOPE® X-RAY XAN®

MEASUREMENT FROM BOTTOM TO TOP

In their various configurations, the instruments of the FISCHERSCOPE X-RAY XAN family cover a very wide range of applications. Their particular strength lies in quick and precise materials analysis and user-friendly handling, for e.g. the analysis of precious metal and gold alloys. The instruments are also used in the analysis of thin coatings in the electronics and PC board industries.

All models have in common the geometrical arrangement of their hardware components. X-ray source and detector are located below the measurement chamber. The measurement is carried out from bottom to top.

This allows for fast and easy positioning of the samples. The instruments of the XAN family are available in several versions that differ with regard to X-ray tubes, detectors, number of apertures and filters. Therefore, the XAN family offers optimised solutions for various applications and accuracy requirements while delivering excellent cost-effectiveness.

The assortment of XAN instruments also includes models with both hardware and software specially designed to meet the unique requirements of the jewellery industry and the gold trade.

Determination of the silver content

Alloys: CuNiZn

Examples from practical applications

Instruments with different types of detectors are used for the analysis of gold alloys. For example, the XAN 500, which is equipped with an inexpensive proportional counter tube detector, is ideal for analysing simple gold alloys with only a few elements, such as yellow gold alloys with Au, Ag and Cu. However, if alloys with many elements or overlapping fluorescence peaks are to be measured, then semiconductor detectors are better suited, as in the XAN 315 or XAN 220. With their significantly better resolution, they also enable the separation of, for example, gold and palladium, which is critical in the analysis of dental alloys and fused precious metal alloys.

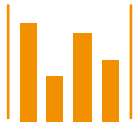
For laboratories and testing institutes, the XAN 250 offers a silicon drift detector (SDD), an exchangeable six position filter and four different apertures for accommodating a wide variety of applications. With this instrument, the repeatability precision for Au is below 0.5‰, and accuracies compared to cupellation can be achieved.

Characteristics

- X-ray tube with W-anode and glass window or micro-focus X-ray tube with W-anode and beryllium window. Maximum operating conditions: 50 kV, 50W
- Proportional counter tube, silicon PIN diode or Silicon drift detector as X-ray detector
- Aperture: fixed or 4-x automatically exchangeable, Ø 0.2 mm to Ø 2 mm
- Primary filter: fixed, 3-x exchangeable or 6-x automatically exchangeable
- Fixed sample support
- Video camera for optical observation of the measurement location along the axis of the primary X-ray beam. Crosshairs with calibrated scale (ruler) and display of the measurement spot
- Design-approved, fully protected instrument compliant with the German X-ray ordinance § 4 Para. 3

Typical fields of application

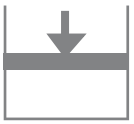
- Gold and precious metal analysis in the jewellery and watch industries
- Measurement of thin coatings of only a few nanometres, such as Au and Pd on printed circuit boards and electronics components
- Trace analysis (e.g. harmful substances in electronic components (RoHS) or tools)
- Analysis of light elements such as Al, Si, P with the XAN 250
- General materials analysis and coating thickness measurement in laboratories, testing institutions and universities



RoHS: Hazardous substances in plastics

Determination of the gold content

FISCHERSCOPE® X-RAY XDL®/XDLM®



MEASUREMENT FROM TOP TO BOTTOM

The FISCHERSCOPE X-RAY XDL and XDLM series are closely related to the XUL and XULM series. Both use the same detectors, beam shaping filter combinations. Thus, the XDL instruments are also outfitted with a standard X-ray tube and a fixed aperture that are very well suited for measurements on larger parts.

With the XDLM models, the X-ray source is a microfocus tube that allows for measurements on small structures and close to the excitation of the low-energy components. Additionally, the XDLM instruments feature automatically interchangeable apertures and filters to flexibly create the optimum excitation conditions for various measuring applications.

Both instrument models are equipped with a proportional counter tube detector. Even with small measurement spots, sufficiently high count rates can be obtained due to the large detector area, ensuring good repeatability precision.

In contrast to the XUL and XULM instruments, the XDL and XDLM series instruments measure from top to bottom. They are designed as user-friendly desktop units with a modular structure, which means that they can be furnished with a simple support, various XY-stages and Z-axes to accommodate various requirements.

Electrolyte solution analysis: Cu, Ni, Au (g/l)

Measuring PCBs: Au/Ni/Cu/PCB

In the version with a programmable XY-stage, the XDL series can be used for automated series testing. Surfaces can be easily scanned – and thus examined for homogeneity. For simple and quick sample positioning, the XY-stage travels automatically into the loading position when the hood is opened (pop-out function) and a laser pointer marks the measurement spot. For large, flat samples such as PC Boards, the housing has openings on the side (C-slot). Because of the large, easily accessible measurement chamber, the instruments are suited not only for measurements on flat, bare objects but also for larger specimens with complex shapes (sample heights up to 140 mm). For instruments with a Z-axis, the measuring distance can be selected freely within 0 – 80 mm. Making measurements in indentations or on geometrically uneven objects possible (DCM method).

Examples from practical applications

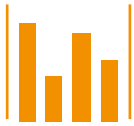
The XDLM measurement system is frequently used to measure coatings such as Au/Ni, Au/PdNi/Ni, Ag/Ni or Sn/Ni on various substrate materials (e.g. Cu or Fe alloys) on connectors and contacts. Often, the functional areas are small structures such as tips or peaks, for which either very small apertures or apertures fitted to the shape of the specimen must be used, in order to keep the influence of geometry to a minimum. For example, when performing measurements on oblong structures, slot apertures are used for maximum intensity.

Characteristics

- X-ray tube with W-anode and glass window or micro-focus X-ray tube with W-anode and beryllium window. Maximum operating conditions: 50 kV, 50W
- Proportional counter tube as X-ray detector
- Aperture: fixed or 4-x automatically exchangeable, 0.05 x 0.05 mm to Ø 0.3 mm
- Primary filter: fixed or 3-x automatically exchangeable
- Adjustable measuring distance 0 – 80 mm
- Fixed sample support, manual XY-stage
- Video camera for optical observation of the measurement location along the axis of the primary X-ray beam. Crosshairs with calibrated scale (ruler) and display of the measurement spot
- Design-approved, fully protected instrument compliant with the German X-ray ordinance § 4 Para. 3

Typical fields of application

- Measurements of mass-produced electroplated parts
- Corrosion protection and decorative coatings such as chrome on nickel/copper
- Bath analysis in the electroplating industry
- Measurement of e.g. thin gold, palladium and nickel coatings in the PC Board industry
- Measurement of coated connectors and contacts
- Measurement of functional coatings in the electronics and semiconductor industries
- Especially for measuring large and/or flexible PCBs optimised models with extended sample support are available



Corrosion protection: Zn/Fe

Connectors: Au/Ni/CuSn6

Showerhead: Cr/Ni/Cu/ABS

FISCHERSCOPE® X-RAY XDAL®

MEASUREMENT FROM TOP TO BOTTOM

This design of the FISCHERSCOPE X-RAY XDAL measurement system corresponds to the XDLM. The difference is in the type of detector. With the XDAL, a Peltier-cooled silicon PIN detector is used with an energy resolution that is significantly better than that of the proportional counter tube used in the XDLM. This instrument is, therefore, suited for general materials analysis, trace analysis and for measurement of thin coatings.

The X-ray source is a micro-focus tube that can resolve small target areas. However, due to the relatively small active detector area (as compared to the proportional counter tube), the XDAL has only limited suitability for very small structures or measurement spots because only low intensities are measured. Similar to the XDLM, apertures and filters can be changed automatically in order to create the optimum excitation conditions for different measuring applications.

The FISCHERSCOPE X-RAY XDAL has a large measurement chamber which accommodates specimens with complex geometries. The motor-driven, adjustable Z-axis allows for sample heights of up to 140 mm. For large, flat samples such as PC Boards, the housing has openings on the side (C-slot).

The measuring system is equipped with a fast, programmable XY-stage, so surfaces can be examined easily in the mapping mode. Also, serial measurements on components, e.g. leadframes, or the measurement of multiple and varied components can be quickly programmed and executed automatically.

High reliability: Pb (>3%) in electronic components

PCB assemblies: Lead test

Because the XY-stage travels automatically to the loading position when the hood is opened (position function), quick positioning of the sample is simple. A laser pointer shows the measuring position on the specimen.

Examples from practical applications

The FISCHERSCOPE X-RAY XDAL is used to determine Pb in tin-lead solder coatings. In this application, the thickness of the SnPb coating must be determined correctly in order to analyse the concentration of Pb. For "high reliability" applications in the aeronautics and space industry, the alloy Pb content must be at least 5% to avoid the formation of whiskers.

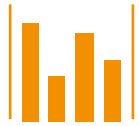
On the other hand, for electronics products in daily use, the RoHS standard applies, which restricts the Pb content of the solder coating to a maximum of 1000 ppm. As long as the detection limit for Pb in solder coatings with the XDAL depends on the thickness, it is usually sufficiently low that both requirements are easily met by the XDAL.

Characteristics

- Micro-focus X-ray tube with W-anode and beryllium window. Maximum operating conditions: 50 kV, 50W
- Peltier-cooled silicon PIN diode as X-ray detector
- Aperture: 4-x automatically exchangeable, Ø 0.1 mm to Ø 0.6 mm
- Primary filter: 3-x automatically exchangeable
- Adjustable measuring distance 0 – 80 mm
- Programmable XY-stage
- Video camera for optical observation of the measurement location along the axis of the primary X-ray beam. Crosshairs with calibrated scale (ruler) and display of the measurement spot
- Design-approved, fully protected instrument compliant with the German X-ray ordinance § 4 Para. 3

Typical fields of application

- Materials analysis of coatings and alloys (also thin coatings and low concentrations) Incoming goods inspection, manufacturing monitoring
- Research and development
- Electronics industry
- Connectors and contacts
- Gold, jewellery and watch industries
- Measurement of thin Au and Pd coatings of only a few nanometres in printed circuit board manufacturing
- Trace analysis
- Determination of lead (Pb) for "high reliability" applications
- Analysis of hard material coatings



HSS-drill: TiN/Fe

Cutter: TiN/Fe

FISCHERSCOPE® X-RAY XDV®-SDD

MEASUREMENT FROM TOP TO BOTTOM

The FISCHERSCOPE X-RAY XDV-SDD features a silicon drift detector with a large sensitive area and good energy resolution. When combined with large apertures, very high count rates can be realised, producing excellent repeatability precision and very low detection limits. The XDV-SDD is particularly well suited for measuring the thinnest of coatings or trace analysis. The improved sensitivity for X-radiation with low energy also expands the range of measurable elements down to lower atomic numbers, enabling, for example, the reliable measurement of phosphorous or aluminium in air.

In order to create ideal excitation conditions for every measurement, the XDV-SDD features exchangeable apertures and primary filters.

With its large and easily accessible measurement chamber, the XDV-SDD can accommodate flat, bare objects as well as large specimens with complex shapes. Series of measurements of coating thickness and element distribution are made simple with the fast, programmable XY-stage.

User-friendly operation, a wide-opening hood and control elements located on the front of the device facilitate the day-to-day use of this instrument.

Hazardous substances in metals: Pb, Cd in Al-alloy

Toys: determination of Pb, Cd, Hg

The precise definition of the measurement location is simplified by a high-resolution, high magnification video camera, which accurately displays the measurement position during operation. A laser pointer acting as a positioning aid further facilitates the quick orientation of the samples.

The performance capabilities and universal design make the XDV-SDD ideal for research and development, process qualifying, and laboratories. It is also indispensible in quality assurance and in production monitoring, due to its robust design and user-friendliness.

Examples from practical applications

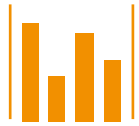
Legal regulations strictly limit the concentration of various harmful substances, for example in electronics, toys or packaging. The XDV-SDD makes it possible to quickly and easily monitor compliance with these limits. For example, the especially critical chemical elements Pb, Hg and Cd can be measured with detection limits of just a few ppm in plastics.

Characteristics

- Micro-focus X-ray tube with W-anode and beryllium window. Maximum operating conditions: 50 kV, 50W
- Peltier-cooled silicon drift detector as the X-ray detector
- Aperture: 4-x exchangeable, Ø 0.1 mm to Ø 3 mm
- Primary filter: 6-x exchangeable
- Programmable XY-stage with pop-out function
- Video camera for optical monitoring of the measurement location along the axis of the primary X-ray beam. Crosshairs with calibrated scale (ruler) and display of the measurement spot
- Design-approved, fully protected instrument compliant with the German X-ray ordinance § 4 Para. 3

Typical fields of application

- Inspection of very thin coatings, e.g. in the electronics and semiconductor industries
- Trace analysis, e.g. detection of harmful substances according to RoHS, toy standards, packaging standards
- Gold and precious metal analysis with highest precision
- Photovoltaic industry
- Measurement of thickness and composition of NiP-layers



NiP/Fe: P-concentration and coating thickness

NiP/Fe: P-concentration and coating thickness

FISCHERSCOPE® X-RAY XDV-µ®

MEASUREMENT FROM TOP TO BOTTOM

The FISCHERSCOPE X-RAY XDV-µ measurement systems are equipped with a polycapillary X-ray optics for focusing the X-radiation. This enables both the resolution of very small measurement spots and high excitation intensity. The instruments' large-area silicon drift detectors make them particularly effective for measuring very thin coatings, as well as for trace analysis on small structures or components.

In order to select the excitation conditions for every measurement, the XDV-µ systems are supplied with four exchangeable primary filters.

With their large and easily accessible measurement chambers, the XDV-µ instruments are well-suited for measurements on bulky objects. For large test samples such as PC Boards, the housing has openings on the side (C-slot). Serial measurements of coating thickness and element distribution are made easy with the fast, programmable XY-stage.

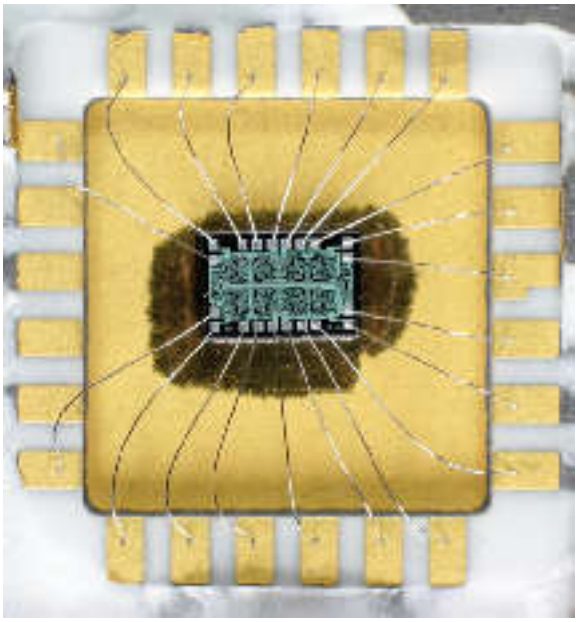
Leadframe: Au/Pd/Ni/CuFe

Measuring PCBs: Au/Ni/Cu/PCB

Wires Sn/Cu

User-friendly operation, a videoscope hood with a large viewing window and control elements located on the front of the device facilitate the day-to-day use of these instruments.

Precise positioning of the sample is ensured by a high-resolution video optics with three magnification levels, meaning that even the thinnest of wires or very small contact points on semiconductors can be displayed razor-sharp, with the measurement spot appearing exactly at the image position. A laser pointer acting as a positioning aid further facilitates orientation of the samples.



Their performance capabilities and specialisation on the smallest structures make the XDV-µ instruments ideal for research and development, process qualifying, and for laboratories. They are also indispensible in quality assurance, as well as in production monitoring.

Examples from practical applications

A typical coating system for contact points on PC Boards is Au/Pd/Ni/Cu/PCB, where the structures to be measured are often smaller than 100 µm. Au and Pd coatings typically range in thickness between 10 and 100 nm. With the XDV-µ, thin gold or palladium coatings can be measured with repeatability precisions of ~0.1 nm or ~0.5 nm, respectively, on measurement spots with 20 µm FWHM.

Characteristics

- Micro-focus X-ray tube with W-anode and beryllium window, optional Mo-anode. Maximum operating conditions: 50 kV, 50W
- Peltier-cooled silicon drift detector as the X-ray detector
- Poly-capillary X-ray optics, measurement spot with about 10-40 µm FWHM, also halofree optics available
- Primary filter: 4-x exchangeable
- Programmable XY-stage with pop-out function
- Video camera for optical monitoring of the measurement location. Crosshairs with calibrated scale (ruler) and display of the measurement spot

Typical fields of application

- Measurement of coating systems on PC Boards, leadframes and wafers
- Measurement of coating systems on small components and thin wires
- Materials analysis on small structures and small components
- Especially for measuring large and/or flexible PCBs optimised models with extended sample support are available
- For better handling of wafer a waferchuck is obtainable

SMD-component: Lead test

Wafer: Au/Pd/Ni/Cu/Si-Wafer

FISCHERSCOPE® X-RAY XUV®

MEASUREMENT FROM TOP TO BOTTOM

The FISCHERSCOPE X-RAY XUV is equipped with a large measurement chamber that can be evacuated. With its large-area silicon drift detector, the XUV can detect fluorescence radiation with low energy down to about 1 keV, specifically enabling measurement of the elements Na and Mg as well as the L-radiation of Zn, Cu and Ni. Due to the high count rates possible when using large apertures, very small repeatability precision values and low detection limits can be achieved, making the XUV suitable for measuring the thinnest of coatings, as well as for trace analysis.

Optimal measuring conditions can be created for every measurement using the exchangeable apertures and primary filters. The measurement position is shown in the video image during the measurement. With its spacious and easily accessible measurement chamber and the programmable XYZ-stage, this instrument accommodates flat, plane objects as well as specimens with complex shapes. Serial measurements of coating thickness or element distributions are straightforward and easy. A laser pointer acting as a positioning aid further facilitates the quick orientation of the samples.

Soil specimen, ashes, minerals

Gemstone: Matrix Al_2O_3, SiO_2

Due to its universal design and the expanded measurement capabilities provided by the vacuum chamber, the FISCHERSCOPE X-RAY XUV measurement system is the ideal instrument not only for research and development but also for process qualifying and laboratory applications.

Examples from practical applications

Type, origin and authenticity are essential features for assessing the value of a precious stone, and analysis of the stone's matrix is crucial for their determination. As a rule, this is based on Al or Si oxide with accompanying elements such as Mg or Na. In addition, trace elements such as Cr, Fe or Ga are important. The XUV allows for the analysis of the entire spectrum of necessary elements.

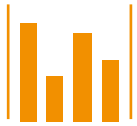
Thin Al and Si or Al oxide and Si oxide coatings have become increasingly important in various areas of application. Here, the measurement of coating thickness under vacuum provides significant improvements. Using the XUV, repeatability precisions of only a few nm can be achieved for these coatings.

Characteristics

- Micro-focus X-ray tube with Rh anode and beryllium window, optional W- or Mo-anode. Maximum operating conditions: 50 kV, 50W
- Peltier-cooled silicon drift detector as the X-ray detector
- Aperture: 4-x exchangeable, Ø 0.1 mm to Ø 3 mm
- Primary filter: 6-x exchangeable
- Programmable XYZ-stage
- Video camera for optical observation of the measurement location along the axis of the primary X-ray beam. Crosshairs with calibrated scale (ruler) and display of the measurement spot
- Measurement in vacuum, in atmosphere or with He purge

Typical fields of application

- Measurement of light elements
- Measurement of thin coatings and trace analysis
- General materials analysis and forensics
- Non-destructive gemstone analysis
- Photovoltaic industry



Wafer: Al/Si-Wafer

Gemstones: trace elements Cr, Fe, Ti, Ga,...

FISCHERSCOPE® X-RAY 4000

PROCESS

With the FISCHERSCOPE X-RAY 4000 Inline measurement system, FISCHER has created a product for continuous measurements in running production lines, whose rugged design specifically meets the rough demands of industrial environments.

The X-RAY 4000 measurement systems can be customised for various purposes: detector options include proportional counter tube, silicon PIN and silicon drift detector; the X-ray beam can be oriented from bottom to top, from top to bottom, or horizontally; and, with a second measuring head, simultaneous measurement of the front and back of an object is possible.

Two axis for measurements can also be specified perpendicular to the direction of the specimen movement. The measuring head can be very accurately positioned along this axis. Three versions with different travel path lengths are available. Two of these versions also provide for enclosure cooling of the measurement system, making them capable of examining hot surfaces.

Sensor contacts: Au/Ni/CuFe

Electroplated strip: Au/Ni/CuSn6

Due to the orientation of the built-in camera's optics along the X-ray beam, which correctly presents the measurement spot's position and size, it is possible to target the relevant measuring points precisely, similar to with bench-top units. And since the travel path of the measuring head runs perpendicular to that of the sample conveyor, it is also possible to inspect multiple points on a given object. By selecting different filters and apertures, the instrument can be quickly adapted to measure several different coatings on the same specimen.

As a true in-line measurement system, the FISCHERSCOPE X-RAY 4000 is designed specifically for user-friendliness and minimal set-up times. For example, converting from one production line to another is simple due to the easily adjustable conveyor guides. Calibration is also automated and therefore quickly carried out.

Various data interfaces allow for easy integration of the instrument into quality management systems or controls. The production process can also be monitored directly at the measurement location, alerting operators immediately when control limits are violated, for example.

Examples from practical applications

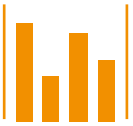
Stamped parts are often partially gold-coated. Here the thickness of the gold layer should ideally be inspected during the production process. Doing so can verify a minimum thickness, eliminating the waste of valuable raw materials through coatings that are too thick. The metrological difference between stamped and full strip is compensated by the WinFTM software.

Characteristics

- X-ray tube with W-anode and glass window or micro-focus X-ray tube with W-anode and beryllium window. Maximum operating conditions: 50 kV, 50W
- Proportional counter tube, Peltier-cooled Silicon PIN diode or silicon drift detector as X-ray detector
- Aperture: 2-x exchangeable, Ø 0.3 mm and 4 mm x 0.12 mm
- Primary filter: fixed or 3-x exchangeable
- Measuring distance 30 mm
- Travel: 230 mm in the standard version (optionally expandable to 620 or 1000 mm)
- Video camera for optical observation of the measurement location along the axis of the primary X-ray beam. Crosshairs with calibrated scale (ruler) and display of the measurement spot in the still image

Typical fields of application

- Strip electroplating, e.g. contacts, stamped components
- Measurement on hot-galvanised strips
- Photovoltaic industry
- Metal coatings on foils and strips
- Electronics industry, suppliers
- Process monitoring



Connectors: Au/Ni/CuSn6

FISCHERSCOPE® X-RAY 5000

PROCESS

The FISCHERSCOPE X-RAY 5000 series is specifically designed as a flange measuring head for integration into a production line. It is ideally suited for continuous, non-destructive inline analyses of alloys and the measurement of thin coatings on large-area products directly in an on-going production process. In contrast to the X-RAY 4000 series, the X-RAY 5000 does without changers for filter and aperture and without a camera system. Because these are often unnecessary for objects with large surface area.

The X-RAY 5000 can be customised for the purpose at hand: X-ray source, primary filter and semiconductor detector can be adapted optimally to suit the intended application.

The measurements can be carried out in air or in vacuum. As an option, the flange can also be supplied in a water-cooled design, which makes performing measurements even on very hot substrate materials (surface temperatures up to 500°C) unproblematic.

CIGS: CuInGaSe/Mo/glass

Depending on the design, measuring distances between 60 and 150 mm can be selected. Under certain circumstances, distance variations of up to one centimetre, for example caused by wavy specimens, may be compensated for during the measurement using the WinFTM software.

Calibration is quickly and easily completed on a workpiece master directly in the production process. Extensive calibration of the measurement library – as with the bench-top instruments – is possible but not necessary. The repeatability precision of the X-RAY 5000 instrument is excellent due to its large detector area, state-of-the-art semiconductor detector electronics and digital pulse processor. The instrument's outstanding long-term stability also drastically reduces the need for re-calibration, saving time and resources.

The FISCHERSCOPE X-RAY 5000 measuring head has a very compact design and can be integrated directly into production lines using a standardised flange. The entire mechanical design is focused on maximum robustness and serviceability. For example, the instrument can be serviced while operating in a production line under vacuum, without having to break the vacuum.

To integrate the X-RAY 5000 measurement system into a superordinate process control system, open interfaces according to industry standards, e.g. OPC, are available.

Examples from practical applications

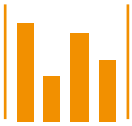
In the solar industry, for example, the FISCHERSCOPE X-RAY 5000 determines the thickness and composition of CIGS, CIS, or CdTe coatings on different substrate materials such as glass, metal or plastic.

Characteristics

- X-ray tube with W-anode and glass window or micro-focus X-ray tube with W-anode and beryllium window, optional Rh or Mo-anode. Maximum operating conditions: 50 kV, 50W
- Peltier-cooled silicon PIN diode or Silicon drift detector as X-ray detector
- Aperture: fixed Ø 1 mm, Ø 2 mm, Ø 4 mm or Ø 8 mm (with SDD also Ø 11 mm)
- Primary filter: fixed
- Measuring distance: 60 – 100 mm or 100 – 150 mm

Typical fields of application

- Photovoltaics (CIGS, CIS, CdTe)
- Analysis of thin coatings on metal strip, metal foils and plastic films
- Continuous production
- Process monitoring of sputter and electroplating production lines
- Large-area measurement

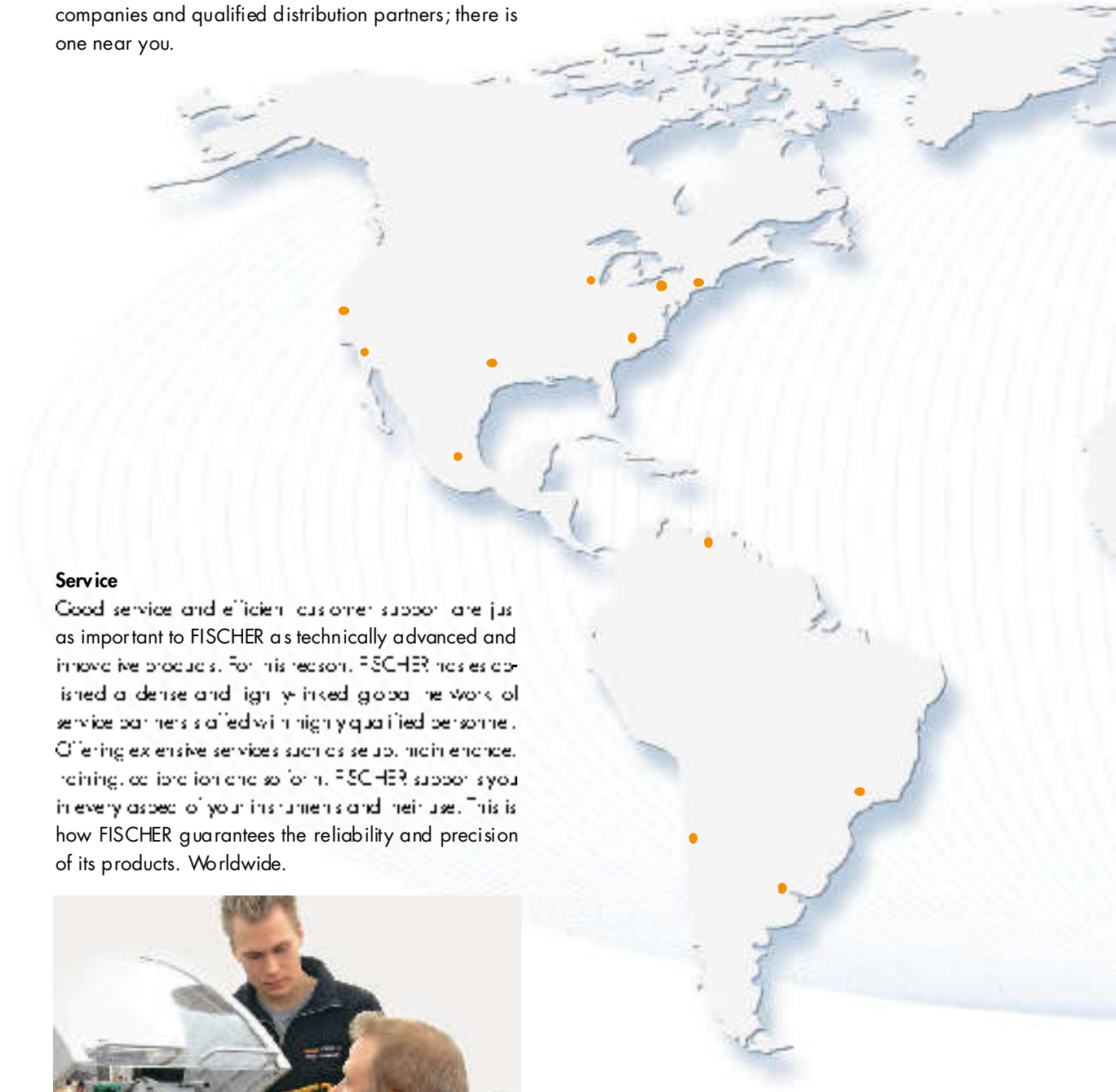


CIGS: CuInGaSe/Mo/foil

FISCHER worldwide

Knowing what their customers need and want is a must for anyone trying to succeed in today's globalised markets. Because we at FISCHER think of ourselves as partners to our customers, we attach great importance to providing them excellent service and working in close cooperation with them. This is why the Helmut Fischer Group maintains its worldwide presence through own companies and qualified distribution partners; there is one near you.

In keeping with our high standards of quality and customer satisfaction, all members of the Helmut Fischer Group are certified according to DIN EN ISO 9000.



SERVICE

Service

Good service and efficient customer support are just as important to FISCHER as technically advanced and innovative products. For this reason, FISCHER has established a dense and tightly linked global network of service partners staffed with highly qualified personnel. Offering extensive services such as calibration, maintenance, training, calibration and so forth, FISCHER supports you in every aspect of your instruments and their use. This is how FISCHER guarantees the reliability and precision of its products. Worldwide.

Application Laboratories

More and more demanding applications require highly qualified application advice. FISCHER addresses this need through its strategically located Application Laboratories around the world (Germany, Switzerland, China, USA, India, Japan and Singapore).

Training and Seminars

Because we want you to derive maximum benefit from our products, FISCHER's specialists are happy to share their practical know-how: starting with seminars and training sessions on the technical basics, through the optimal use of the instruments, to expert symposia on special topics.

FISCHER worldwide

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