C142-E030E

SHIMADZU
Excellence in Science

Energy Dispersive X-ray Fluorescence Spectrometer

EDX Series EDX-720/800HS

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The implementation of new environmental regulations, such as RoHS and ELV in the EU, has resulted in an increased demand for instruments that can perform trace, rapid analysis of a wide range of samples. With an even greater level of sensitivity and expedition, the EDX Series meets this demand, enabling both trace and rapid analysis that goes beyond the limits of screening analysis.

X-ray Fluorescence Spectrometers

An EDX fluorescence spectrometer irradiates a sample with X-rays, and then measures the energy of the generated fluorescent X-rays to determine the type and amount of elements comprising the sample. This nondestructive analysis technique allows measurement of a wide variety of sample types (solids, powders, liquids, thin films, etc).

EDX Series instruments are used in a variety of fields.

1 **Electrical and Electronic Materials**
Assessment of regulated substances used in electrical and electronic parts in accordance with Global environmental regulations
Thin-film analysis and defect analysis for semiconductors, disks and liquid crystals

2 **Chemical Industry**
Analysis of organic and inorganic materials and products, catalysts, pigments, paints, rubbers and plastics

3 **Petroleum and Petrochemicals**
Analysis of nickel (Ni), vanadium (V), and sulfur (S) in heavy oils Analysis of dopants and contaminant elements in lubricating oil

4 **Building and Construction Materials**
Analysis of ceramics, cements, glass, bricks and clays

5 **Medical Supplies**
Analysis of materials and products and analysis of catalysts during synthesis
Analysis of sulfur (S), chlorine (Cl) and bromine (Br)

6 **Agriculture and Food Products**
Analysis of soils, fertilizers, foods and food-related products

7 **Iron, Steel and Nonferrous Metals**
Analysis of composition and impurities in raw materials, alloys, solders and precious metals

8 **Machinery and Automobiles**
Assessment of regulated substances used in automobile parts in accordance with ELV compositional analysis and coating-thickness measurement of machine parts

9 **Environment**
Analysis of soil, effluent, ashes and filters

10 **Other Applications**
Analysis of archaeological samples and precious stones

Features

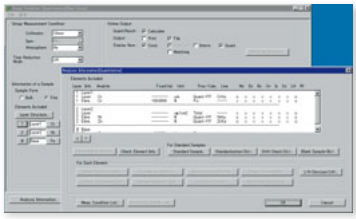
Large Sample Chamber with Automatic Opening/Closing Door

Equipped with an automatic opening/closing door, the large sample chamber can accommodate samples up to 300 mm wide and 150 mm high. Also, operation in combination with the optional sample turrets (for continuous measurement) allows fully automatic measurement at the touch of a button. (Patent granted)

Large sample chamber allows samples to be analyzed without having to cut up the sample

Standard-less Quantitative Analysis Software Is Suitable for Various Applications - from Thin Films to Organic Substances

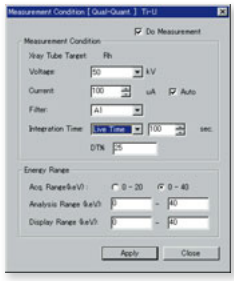
The software includes FP (fundamental parameter) methods for quantitative analysis as standard. These include the Bulk FP method, which allows the analysis of samples such as oxides, metals, and resins, and the Thin-Film FP method, which enables the thickness measurement and compositional analysis of coatings and thin films.



Thin-Film FP is provided as a standard feature for measuring coating thickness

Equipped with Five Types of Filters for High-Sensitivity Analysis

This model is equipped with five types of filters for reducing and eliminating background, characteristic lines, and other forms of scattered radiation. These filters greatly improve the detection sensitivity for lead (Pb), mercury (Hg), cadmium (Cd) and others.



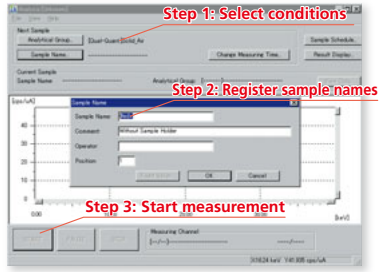
High-sensitivity and standard-less analysis is possible using a primary filter

Switching Calibration Curve Function Recognizes Sample Type Differences and Selects Appropriate Calibration Curves Automatically

The optimum calibration curve for the sample is selected automatically from pre-registered calibration curves.
For example, the calibration curve with polymer resin samples is automatically selected, according to whether the samples are judged to contain chlorine (Cl).

Simple Operations Start Fully Automatic Measurement – Even Any Analyst Can Perform Simple, Accurate Measurement

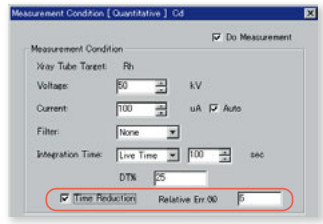
There is no need to set complicated procedures before sample measurement.
No specialized knowledge, experience or expertise is required.



Measurement can start after only 3 operational steps.

Time-Reduction Function Sets Measurement Time Automatically According to Target Precision Level

Measurement time is determined automatically according to the target precision level set.
Measurement stops when measurement precision reaches the set level.



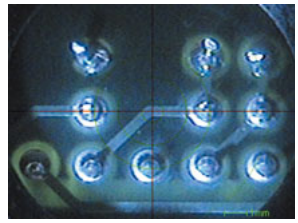
When the target precision level is entered, the system determines the required measurement time.

No Time-Consuming Pretreatment! Analysis in Air, Helium, or Vacuums Possible!

Measurement in helium or vacuum atmosphere is possible, allowing analysis of light elements whose X-ray emissions are heavily absorbed by air. Solid samples can be analyzed in vacuum atmosphere, and powders and liquids can be analyzed in helium atmosphere. (Optional function)

Sample Observation Camera (Option)

A CCD camera can be installed in the main unit and used to observe the sample position. This is useful for checking analysis positioning.

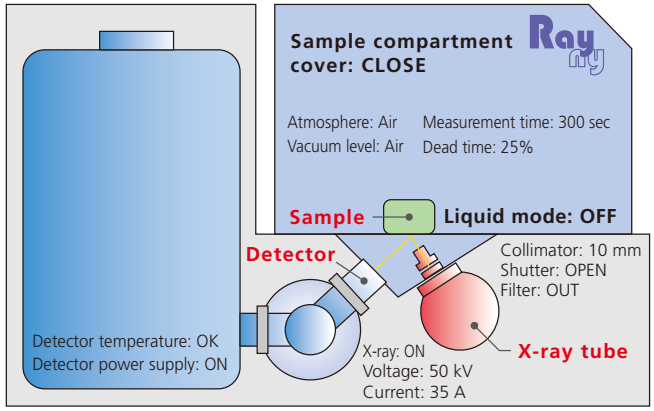


Defect analysis is simple using four types of collimators and the sample observation unit

Excellent Performance and High Operability

Principle and Features

With X-ray fluorescence spectrometry, a sample is irradiated with X-rays emitted by an X-ray tube and the resulting characteristic X-rays generated in the sample (fluorescent X-rays) are detected. In particular, X-ray fluorescence spectrometers that use semiconductor detectors are called "energy dispersive". Advantages of these spectrometers include the ability to perform simultaneous measurement of many different elements, a compact design, and the distance between the sample and the detector can be small because there are no driving mechanical parts. In addition, using this system, attenuation of fluorescent X-rays is small and measurement is possible even in air. Furthermore, this system does not require time-consuming pretreatment and a wide variety of samples can be measured.



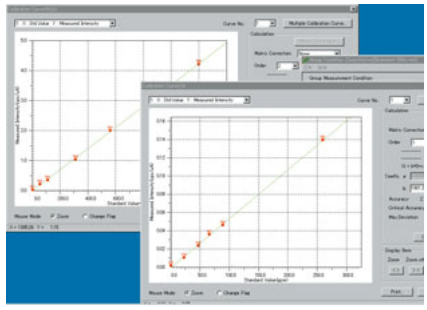
* The figures given here are for example purposes only.

Various Methods Enable Powerful, Flexible Quantitative Analysis

1. Calibration-Curve Method

Quantitative Analysis with High Accuracy

With this method, standard samples are measured, and a calibration curve is created as a relationship between the concentration and the X-ray fluorescence intensity of each element.
The concentration of the unknown sample is quantitated by using this calibration curve. This is well-known as empirical method.
With this method, it is necessary to prepare standard samples of each different matrix material and create calibration curves for each element; however, this method provides highly accurate analysis.

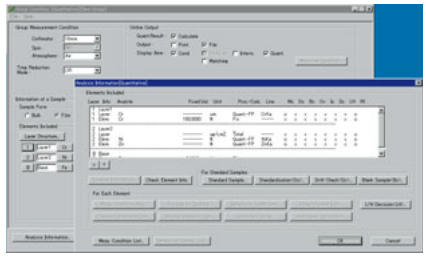


Calibration-Curve Setting Window

2. FP Method

Perform Bulk Analysis and Analyze Thin Films, Organic Materials and etc. without Standard Samples!

With the FP method, the X-ray intensity is obtained and quantitative analysis is performed using theoretical calculation. This method is very effective for quantitative analysis of unknown samples for which standard samples are not provided. Shimadzu EDX Series is equipped with Shimadzu's high-performance FP software, which was developed based on our many years of experience with wavelength-dispersive spectrometers. This software includes the Bulk FP method, which can be used to analyze samples such as oxides, metals, and resins, and the Thin-Film FP method, which can be used for film-thickness and compositional analysis of coatings and thin films without standard samples.



FP Method Setting Window

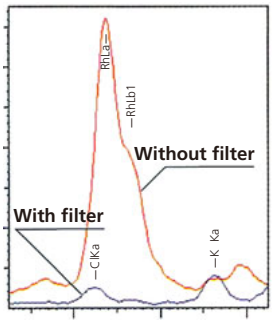
Wide Variety of Samples Supported

Trace Analysis with Automatic Change among 5 Filters

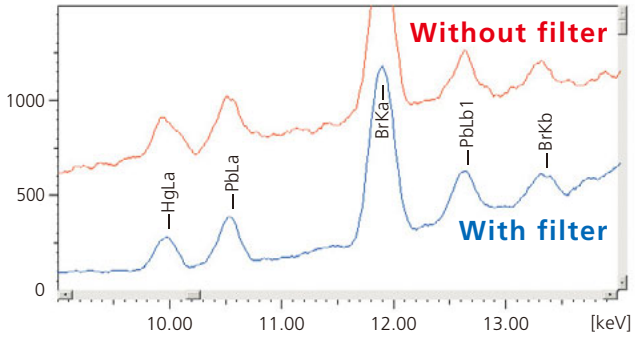
In trace-element analysis, a scattered X-ray, such as the continuous X-ray from the X-ray tube, causes a large background, and it is difficult to detect target peaks. In the case of chlorine (Cl), a characteristic X-ray from the X-ray tube interferes and overlaps with a target peak. In such a cases, a primary X-ray filter that cuts the unnecessary X-ray is an effective tool to reduce the background, eliminate interference peaks, and consequently improve the detection sensitivity. Normally, four or five types of filters are required to cover the entire element range.

Filter	Representative measurement elements
#1	Cl
#2	Cr
#3	*1:Hg, Pb, Br, Bi *2:Hg, Pb, Br, Bi (high sensitivity type)
#4	*1:Rh-Cd/*2:Cd (high sensitivity type)
#5	Cd

*1: EDX-800HS
*2: EDX-720



Trace element: Chlorine
(removal of characteristic lines)



Trace element: Lead (reduces background)

Nonstandard Quantitative Analysis

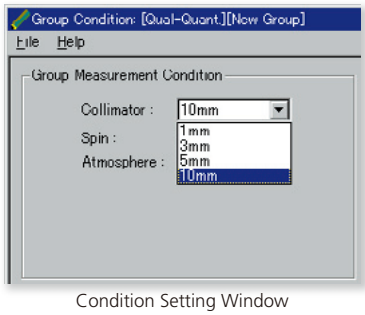
Shimadzu's original FP software can calculate the quantitation without standard samples even when the filter is used because this software considers X-ray absorption by the filter theoretically.

With instruments that don't have such a function, it is necessary, when using a filter, to measure standard samples and recreate the calibration curve.

Functions for Handling a Variety of Sample Forms

Setting of Analysis Region Using Collimator and Setting of Measurement Atmosphere (Option)

When a sample is small, a collimator can improve the S/N ratio by irradiating the sample only, and therefore eliminating unnecessary X-rays. The irradiation diameter can be switched between 1, 3, 5, and 10mm. Furthermore, the FP method can be used at any collimator diameter, as the FP method sensitivity coefficient is converted automatically according to the irradiation diameter. Combination with a CCD camera is recommended (see below). Additionally, measurement in a helium or vacuum atmosphere is possible in order to analyze analysis the light elements whose sensitivity is lower when measured in air atmosphere. (Option)



Condition Setting Window

Setting Measurement Position Using Sample Observation Kit (Option)

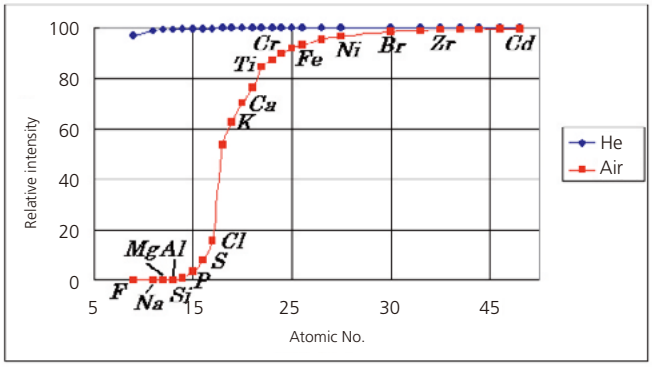
A CCD camera makes it easy to find and set the analysis positions in measurements of foreign matter or samples made up of multiple parts.

CCD Camera Image of Electronic Part

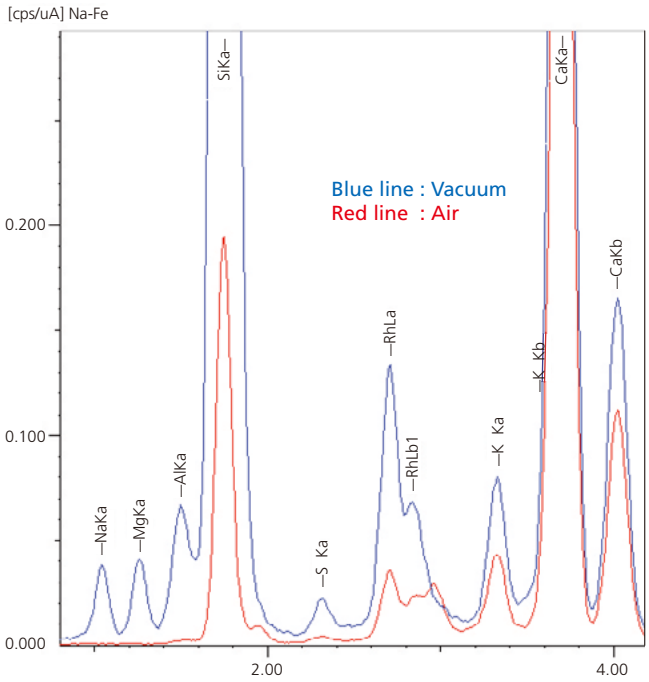
Changing the Measurement Atmosphere Enables High-Sensitivity Measurement of Light Elements

Vacuum Unit (Option) / He Purge Unit (Option)

Since the energy of fluorescent X-rays generated from light elements is weak, energy is absorbed if air is present between the sample and detector, which may worsen detection sensitivity. Setting the measurement chamber to a vacuum atmosphere is effective in increasing sensitivity when measuring light elements. He purging is useful in the analysis of light elements contained in samples that, for example, generate liquids or gases and that cannot be set to a vacuum atmospheric state.



Relative Intensities of Air and He After Purging (with vacuum taken as 100)



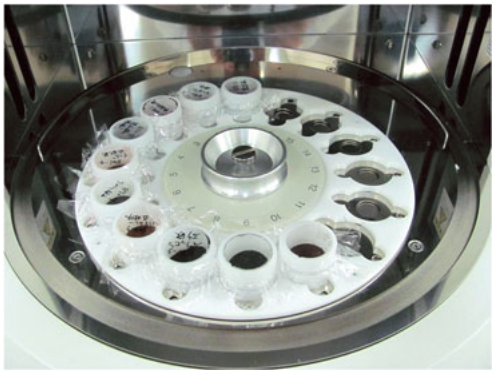
Comparison of Vacuum and Air Atmosphere Profiles (sample: water glass)

Continuous Measurement Results in Improved Throughput

Range of Turrets (Option)

Adding on a turret enables automatic continuous measurement. This is particularly effective in improving throughput when measuring in a vacuum or He atmosphere.
Continuous measurement using a combination of different analysis conditions is also possible. Furthermore, X-ray emission can be automatically set to OFF or to a standby state after continuous measurement is finished.

In addition to two types of 16-sample turrets (for solids and for liquids), which are ideal for measuring samples in sample containers, two other types are available – an 8-sample turret that accommodates large samples up to 52 mm in diameter and an 8-sample turret with spinner that is useful for analyzing non-uniform samples.



Example of Using 16-Sample Turret (for Solids)

Example of Using 8-Sample Turret

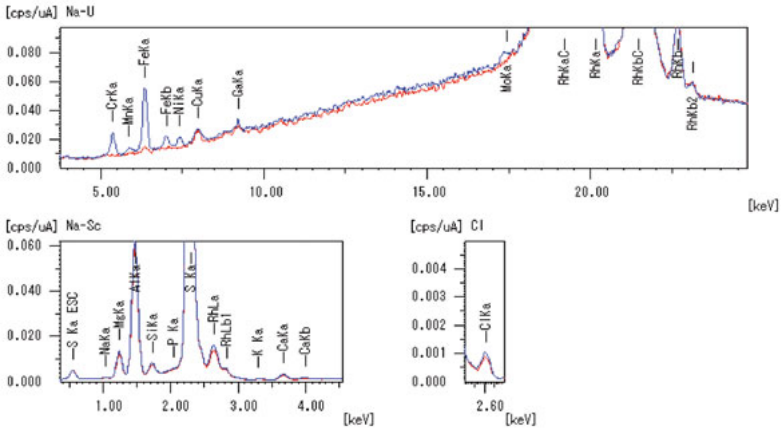
Extensive Applications in a Wide Range of Fields

Analysis of Foreign Matter

Analysis of Foreign Matter on Tablets

Fluorescent X-ray analysis is effective in the analysis of foreign matter adhering to or contained in food, drugs, and other products since it allows elements to be analyzed non-destructively. Micro-contaminants can also be easily analyzed by using a CCD camera and collimator.
We analyzed foreign matter on a tablet. Since the sample was smaller than the instrument's minimum irradiation diameter (1 mm), a location that contained the foreign matter and one that did not (i.e. blank) were measured, and the two profiles were overlapped and subjected to subtraction processing to assess the sample.

External Appearance of Sample
Blue: Contains foreign matter
Red: No foreign matter (blank)



Overlapping of Profiles of Location Containing Foreign Matter (Blue) and Blank (Red)

Analysis Target	Analysis Result		Standard Deviation	Processing	Analysis Line	Intensity
Fe	61.699	%	0.637	Quantitation-FP	FeKa	0.391
Cr	16.658	%	0.293	Quantitation-FP	CrKa	0.135
Ni	11.621	%	0.341	Quantitation-FP	NiKa	0.048
Mn	5.981	%	0.179	Quantitation-FP	MnKa	0.046
Mo	4.040	%	0.089	Quantitation-FP	MoKa	0.086

* This analysis sample was prepared at Shimadzu by attaching foreign matter, especially for assessment.

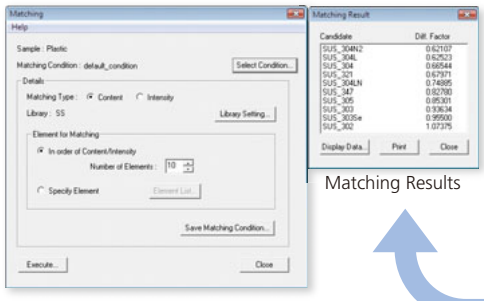
Results of Quantitative Analysis After Profile Subtraction (Blue-Red)

Flexible Functions for Accommodating a Variety of Sample Forms

Matching Function

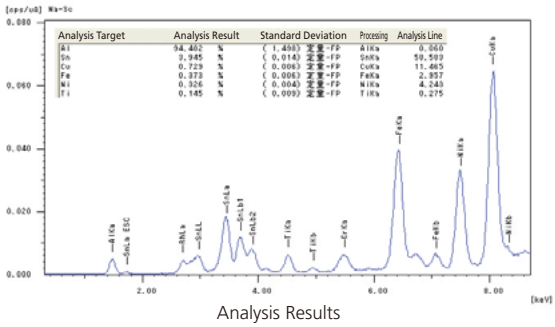
"Matching" is a function for comparing the analysis results of a certain sample with existing data from a library and displaying the result in order starting with the highest degree of match.

There are two types of libraries, one for content data and the other intensity data. Samples can be registered using existing data from each of these libraries. Values can be entered manually for content data.



Matching Conditions

Matching Results

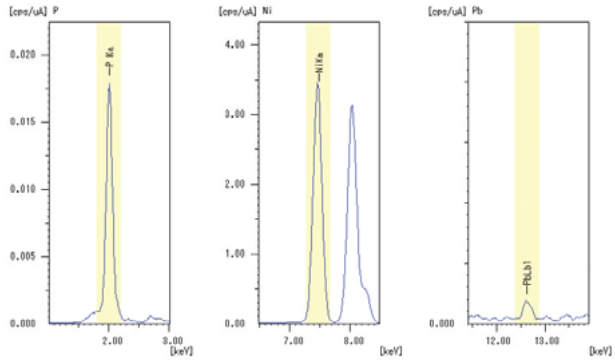


Analysis Results

Thin-Film Measurement

Measurement of Film Thickness of Electroless Ni-P Plating and Its Composition Ratio

The thickness and composition of not only single-layer but also multilayer films can be obtained by the thin-film FP method. The amount of deposition can also be measured.
This method demonstrates its effectiveness also in the measurement, for example, of Pb in plating.



Peak Profiles of P, Ni, and Pb

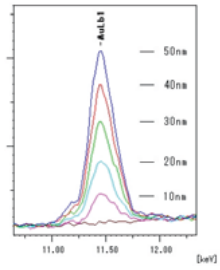
Layer	Information	Analysis Target	Analysis Result		(Standard Deviation)
1		Layer1			
1		Layer Layer1	5.632	um	(------)
1	Component	Ni	90.599	%	(0.052)
1	Component	Pb	296.655	ppm	(34.983)
1	Component	P	9.371	%	(0.037)
B		Base			
B	Component	Cu	100.000	%	(------)

Quantitative Analysis Result

* With the thin-film FP method, the lamination layer order including the base and the content element information must be entered.

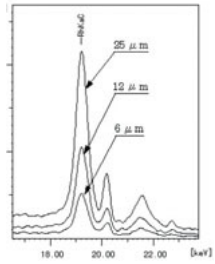
Measurement of Au Vapor-Deposited Film

This is an example of measurement of a glass sample vapor-deposited with thin Au film.
Heavy element thin films can be measured from the sub-nanometer (several Å) order.



Example of Thickness Measurement of Organic Film Using Scattered X-Rays

The thickness of even organic films that do not contain inorganic compounds can be measured using scattered X-rays. The figure on the right shows overlapping of the scattered X-ray profiles of polyester films of different thicknesses.



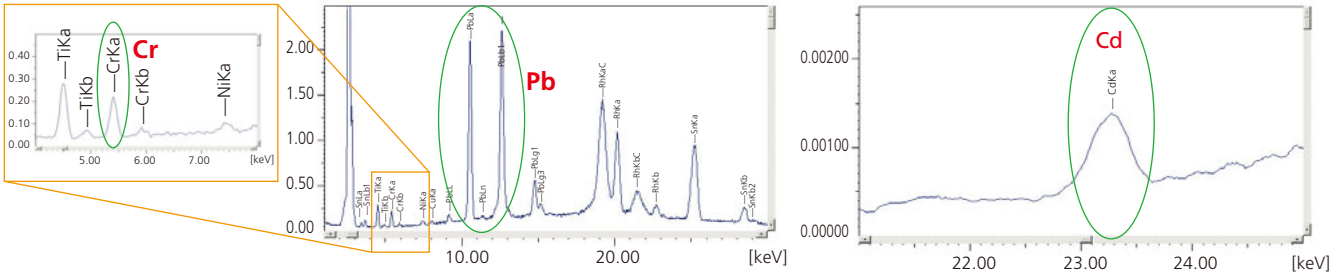
Examples of Measurement of Various Film Thicknesses

A variety of other film thicknesses can be measured.

Sample	Film (Lamination) Makeup	Quantitative Result
Plated Steel Plate	Amount of deposited film ? mg/m² — Film composition Cr 100% Amount of deposited film ? g/m² — Film composition Zn 100% Substrate composition Fe 100%	Cr layer 75.4 mg/m² Zn layer 31.6 g/m²
Film Formation on Silicon Wafer	Film thickness ? nm — Film composition Fe ?%, Ni ?% Substrate composition Si 100%	Film thickness 111 nm Fe 18.8%, Ni 81.2% (C.V 0.2%, 0.05%)
Anti-Static Film on Resin Film Peel Coating Film	Amount of deposited film ? μg/cm² — Film composition Si compound* Resin film composition $C_{10}H_8O_4$ (PET) 100%	Si compound 5.5 μg/cm² (C.V 0.8%) *Set the actual chemical formula since there are a variety of compounds.
Paper Composition	Film weight 10.5 mg/cm² — Component?/composition?	SiO_2 1.16%, MgO 0.54% Other: $C_6H_{10}O_5$ 97.65% (balance)

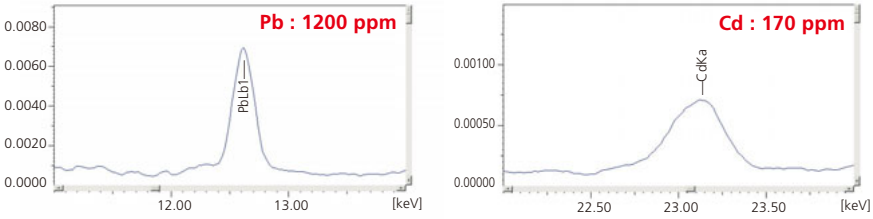
Analysis of RoHS and ELV-regulated Hazardous Elements

Measurement of Polymer Resin Samples



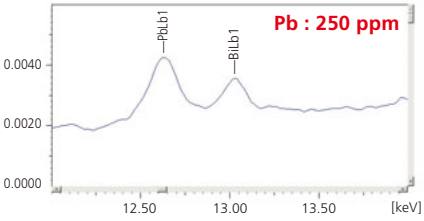
Analysis of Hazardous Substances in Resin Materials Used in Power-Supply Adapter Casings, Wire-Coating Materials, and Electronic-Device Casings

Measurement of Metal Samples



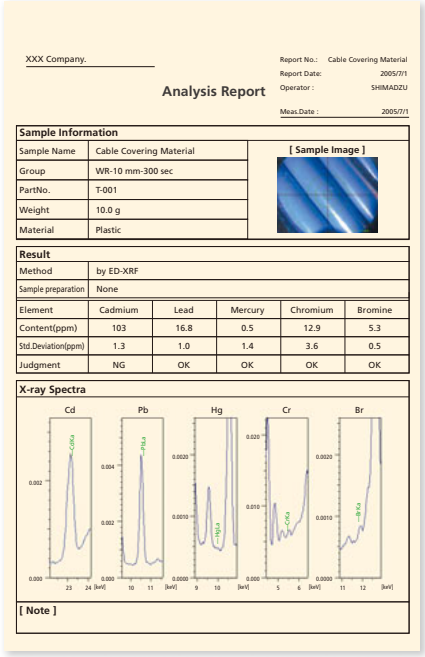
Analysis Examples for Lead and Cadmium in Brass

Measurement of Lead-Free Solder Samples



Analysis Example for Lead in Lead-Free Solder Sample

Report Generator Function



XXX Company.

Analysis Report

Report No.: Cable Covering Material
Report Date: 2005/7/1
Operator : SHIMADZU
Meas.Date : 2005/7/1

Sample Information

Sample Name	Cable Covering Material
Group	WR-10 mm-300 sec
PartNo.	T-001
Weight	10.0 g
Material	Plastic

[Sample Image]

Result

Method	by ED-XRF
Sample preparation	None

Element	Cadmium	Lead	Mercury	Chromium	Bromine
Content(ppm)	103	16.8	0.5	12.9	5.3
Std.Deviation(ppm)	1.3	1.0	1.4	3.6	0.5
Judgment	NG	OK	OK	OK	OK

X-ray Spectra

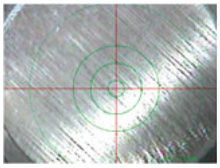
Cd Pb Hg Cr Br

[Note]

Other Analysis Examples

Control Analysis of Metal Materials

The EDX can be used for judging metal scrap and for checking product types. Also, it can be made good use of in control analysis of samples subjected to pretreatment such as grinding.
The table below summarizes example analysis values for elements contained in cast iron. The table shows that although carbon cannot be detected, the coefficient of variation of other elements is about several percent and that the values demonstrate sufficient performance for product management and acceptance inspections at secondary user sites.



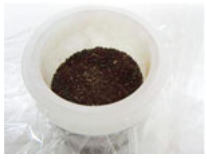
Sample Image

	Si	Mn	P	S	Cu	Ni	Cr	Mo
Degree of Accuracy (%)	0.023	0.019	0.0048	0.0046	0.0048	0.0075	0.0051	0.0060
Quantitative Value (%)	2.53	0.40	0.050	0.086	0.086	0.069	0.051	0.093
Reproducibility (%)	0.02	0.010	0.007	0.002	0.004	0.005	0.004	0.002
Coefficient of Variation (%)	0.78	2.4	14	2.2	4.5	7.3	8.1	2.3

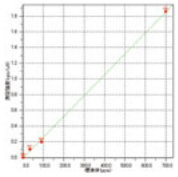
Result of Repeated Measurement of Cast Iron Sample

Quantitative Analysis of Elements Contained in Black Tea Leaves

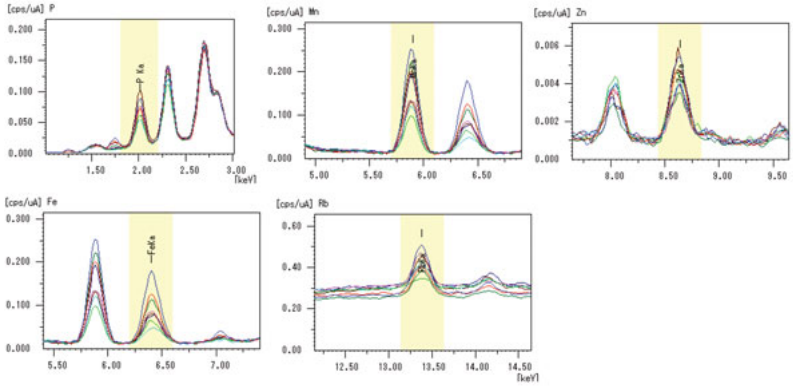
Leaves of black tea made in India (4 types), Ceylon (5 types), and China (3 types) were crushed in a mortar, poured into a sample container coated with polypropylene film, and analyzed by the calibration curve method.
Differences, in particular, in the content of phosphor (P), manganese (Mn), zinc (Zn), iron (Fe), and rubidium (Rb) appeared according to the country of origin. It can be seen that the EDX is also useful in discerning the country of origin of agricultural products.



Sample Container



Calibration Curve of Mn



Overlapped Profiles of P, Mn, Zn, Fe, and Rb

	Sample Name	P	S	K	Ca	Mn	Fe	Cu	Zn	Rb	Sr
1	4300india-assam	2799.0	2350.1	19092.2	4503.8	540.8	60.4	12.4	27.1	863.9	13.7
2	4303india-assam	2434.4	2203.7	19635.4	5440.8	634.0	222.5	8.0	21.1	657.0	10.8
3	4304india-assam	3128.7	2353.6	19348.2	5591.7	899.6	100.3	9.0	21.4	827.0	11.3
4	4305india-assam	2191.5	2207.4	19397.8	5547.4	428.9	111.3	10.1	20.3	680.7	13.4
5	4501ceylon-dimbula	1853.2	2156.9	18837.0	5286.2	325.1	41.5	12.5	22.9	605.0	15.0
6	4502ceylon-dimbula	1975.3	1807.4	16173.0	5542.1	263.9	68.1	13.7	26.6	150.2	12.9
7	4520ceylon-uva	2027.7	2099.5	17872.7	4999.0	529.8	77.1	11.8	21.6	473.6	20.0
8	4530ceylon-kandy	2576.7	2326.3	18135.7	5129.2	397.5	101.2	12.2	31.5	489.3	18.8
9	4540ceylon-ruhuna	2699.2	2427.0	18372.5	3827.7	384.8	86.5	12.0	19.9	856.9	9.5
10	4701china-anhui	3802.5	2555.6	17849.0	4240.6	818.5	223.4	16.7	41.4	977.7	14.0
11	4702china-anhui	3693.5	2511.6	18023.0	4413.2	1009.7	257.3	12.6	36.2	749.7	16.8
13	4750china-yunnan	3041.6	2427.0	19761.1	5765.7	723.7	362.6	10.1	32.3	1295.5	19.2

Quantitative Analysis Results of Black Tea Leaves

	P	Mn	Fe	Zn	Rb
India Average Value	2638.4	625.9	123.6	22.5	757.2
Ceylon Average Value	2226.4	380.2	74.9	24.5	515.0
China Average Value	3246.9	782.2	287.4	34.6	915.8
Overall Average Value	2741.9	563.7	149.9	27.3	721.0

Average Values of Elements Having a Large Difference by Country of Origin

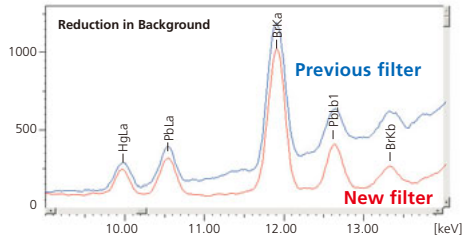
EDX-720/800HS Features

Improved Hardware Enables Twice the Sensitivity in Analysis of Hazardous Elements such as Lead and Cadmium

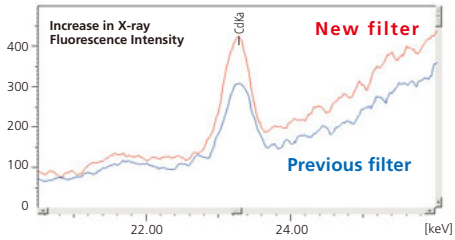
EDX-720

New Filters Improve Sensitivity in Analysis of Hazardous Elements

The S/N ratio is improved by adopting two types of new filters that efficiently cut the continuous X-rays component from the X-ray tube. It is possible to perform the trace analysis with high sensitivity by reducing the background.



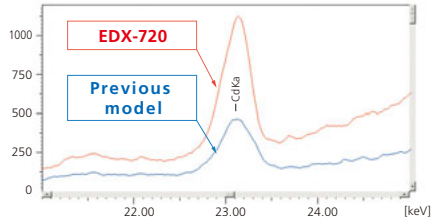
Comparison for Standard Sample of
PVC Resin Containing 100-ppm Lead



Comparison for Standard Sample of
PVC Resin Containing 100-ppm Cadmium

Detector Count Rate Increased through Adoption of High-Count-Rate Circuit

The counting system used in the EDX-720 has been modified to process at an even higher count region than previous system to measure with higher precision.
Particularly in the analysis of resin samples, which generate large numbers of scattered X-rays, and in metal samples, which generate a large amount of fluorescent X-rays from the main component, it has been difficult to get information about trace elements because almost all counted signals are for scattered or fluorescent X-rays from the base material. The count rate attained with the EDX-720 is more than twice that of previous models and detection sensitivity is significantly higher. It is possible to reduce the analysis time significantly because the same level of precision can be attained in half the time required with previous models.



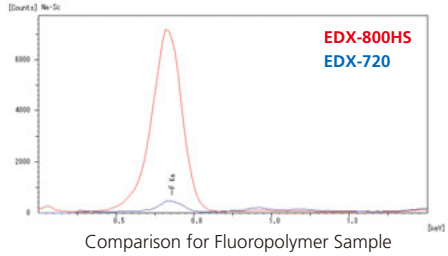
Comparison using Standard PVC Resin Sample
Containing 100-ppm Cadmium

Maximizing Detectability of Light Elements Provides High-Sensitivity Analysis

EDX-800HS

Special Detector Window Material Reduces Absorption of Light Elements and Provides High-Sensitivity Measurement

Analysis of light elements must be measured in helium or vacuum atmospheres. However, even in these kinds of atmospheres, particularly with organic component elements such as oxygen (O) and fluorine (F), the detector window itself can act like an absorbing material and adversely affect the detection efficiency.
With the EDX-800HS, an ultrathin film consisting of a special material is used for the detector window to perform high-sensitivity analysis of elements lighter than sodium.



Comparison for Fluoropolymer Sample

Specifications

Main Specifications

Measurement principle	X-ray fluorescence spectrometry
Measurement method	Energy dispersive
Applicable sample type	Solid, liquid, or powder
Measurement range	$_{11}$Na to $_{92}$U (EDX-720) $_{6}$C to $_{92}$U (EDX-800HS)
Sample size	300 mm (dia.) × 150 mm (H) max.

X-ray Generator	
X-ray tube	Rh target
Tube voltage	5 to 50 kV
Tube current	1 to 1,000 µA
Cooling method	Air cooling (with fan)
Exposure area	10 mm dia. (standard) (Automatic switching between 4 settings: 1, 3, 5, and 10 mm dia.)*
Primary filter	Automatic switching between 5 types

Detector	
Type	Si (Li) semiconductor detector
LN_2 supply	Only during measurement
LN_2 Dewar capacity	3 L
LN_2 consumption	Approx. 1 L/day

Sample Chamber	
Atmosphere	Air, vacuum*, helium*
Sample exchange*	8/16-sample turret 8-sample turret with spinner Precision stage
Sample observation*	CCD camera

Vacuum Unit* (for high-sensitivity analysis of light elements) It is necessary for measurement of elements lighter than S (Sulfur)	
Evacuation	Oil rotary vacuum pump, directly connected
Vacuum monitor	Pirani gauge
Atmospheric-pressure monitor	With pressure sensor

Data Processing Unit (To be procured separately)	
Main unit	IBM PC/AT compatible
Memory	More than 256 MB
HDD	More than 20 GB
FDD	3.5-inch × 1
Printer	Color inkjet printer
CD	CD-ROM drive
OS	Windows XP / Windows 7

Software	
Qualitative analysis	Measurement/analysis software
Quantitative analysis	Calibration-curve method, matrix correction, FP method, Thin-Film FP method, Background FP method.
Matching software (intensity/content)	
Utilities	Automatic correction functions (energy correction, FWHM (full-width half-maximum) correction)
System-status monitoring function	
Analysis-result tabulation function	

(Items with * mark are optional.)

Installation Requirements

Temperature	10°C to 30°C
Relative humidity	40% to 70%

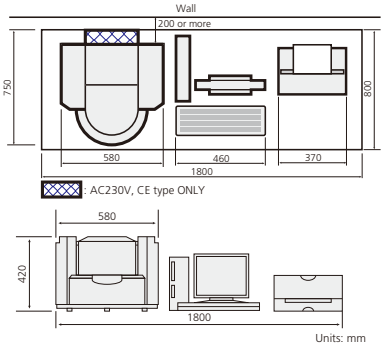
EDX-720/800HS (AC100V)

Power requirements : AC100V10%, 15 A, 50/60 Hz
Dimensions of the main body : 580(W) × 650(D) × 420(H) mm
(23(W) × 26(D) × 17(H) inches)
Main body weight : Approx. 80 kg

EDX-720/800HS CE type (AC230V)

Power requirements : AC220 V, 230 V, 240 A10%, 1000 VA, 50/60 Hz
Dimensions of the main body : 580(W) × 750(D) × 420(H) mm
(23(W) × 30(D) × 17(H) inches)
Main body weight : Approx. 100 kg

Footprint

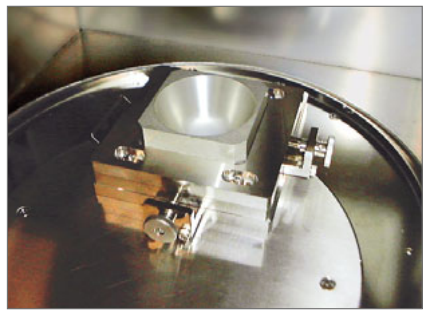


Sample Pretreatment for X-ray Fluorescence Spectrometry

Sample format	Pretreatment	Pretreatment equipment
Powder sample	No pretreatment (put in sample cell)	————
	Pressing	Vibration mill, briquette machine
	Melting; making glass bead sample	Automatic bead fusion furnace
Liquid sample	No pretreatment (put in sample cell)	————
	Dropping on paper filter and drying	————
Solid sample	No pretreatment (flat part put on stage)	————
	Surface polishing, cutting	Sample polisher, lathe
Food or biological sample	No pretreatment (put in sample cell)	————
	Mashed into paste using blender mill (put in sample cell)	Blender mill

A Wide Variety of Optional Accessories

Precision Stage P/N 212-22925



This stage is to set a region of interest on the sample to the irradiation area automatically, when collimator and CCD options are equipped. This is useful especially for smaller area like 1 mm. A large knob and XY slide mechanism move the sample smoothly and make sample positioning easy.
The sample holder can be replaced, and the stage has a central opening of up to 70 × 70 mm.

Stroke : 10 mm
Feed : 1 mm per revolution
Inner diameter of standard holder : 31 mm (can be used with the attached sample cell)

16-Sample Turret (for Solid Samples) P/N 212-22665-91

This turret is used for the sequential analysis of solid samples with diameters less than 32 mm. It is particularly effective for analysis in helium or vacuum atmospheres.

8-Sample Turret P/N 212-22665-93

This turret is used for the sequential analysis of larger samples less than 52 mm dia.

16-Sample Turret (for Liquid Samples) P/N 212-22665-92

This turret is used for the sequential analysis of up to 16 liquid or powder samples contained in sample cells.

* A turret drive unit is required with each of the above turrets.

8-Sample Turret with Spinner P/N 212-22345

A turret with spinner used to acquire averaged information of heterogeneous samples like minerals, foods, soil by spinning samples. To be used with solid or small sample holders.

Small-Sample Cover** P/N 212-23860-91

This cover helps shorten the evacuation time when analyzing a small sample sequentially. (Patent granted)
Sample size: 62 mm (dia.) × 120 mm (H) max.

Sample Cells

3571 31 mm Open-End X-Cell

P/N 219-85000-55 (100 pcs/set)
(Outer diameter: 31.6 mm; Volume: 10 mL)
This polyethylene sample cell is used for liquid and powder samples. It is used with Mylar or polypropylene film.

3577 Micro X-Cell

P/N 219-85000-54 (100 pcs/set)
(Outer diameter: 31.6 mm; Volume: 0.5 mL)
The cell is used for trace samples. In order to reduce the scattered radiation emitted from the sample cell, it is recommended that a collimator is used with this cell.

3529 31 mm X-Cell

P/N 219-85000-52 (100 pcs/set)
(Outer diameter: 32 mm; Volume: 8 mL)

3561 31 mm Universal X-Cell

P/N 219-85000-53 (100 pcs/set)
(Outer diameter: 31.6 mm; Volume: 8 mL)

Mylar Film for Sample Cell

P/N 202-86501-56 (500 sheets/set)

Polypropylene Film for Sample Cell

P/N 219-82019-05 (73-mm wide, 92-m long)
This film is effective for the trace analysis of light elements in vacuum and helium atmospheres.

Sample Observation Camera**

P/N 212-22750-95

The camera displays an image of the sample to check the analysis position. Images can be stored in files.

Vacuum Unit

with RP : P/N 212-22460
without RP : P/N 212-22460-01
(RP : oil rotary vacuum pump)

This unit is used for the high-sensitivity analysis of light elements. Samples must not contain water or oil, and powder samples must be pressed before analysis. When analyzing a large number of samples, this unit should be used together with a sample turret.

Automatic Collimator**

P/N 212-22320

Collimator with aperture exchange mechanism in 4 steps of either 1, 3, 5, or 10mm dia.
The energy dispersive type features less attenuation of sensitivity for a small area than the wavelength dispersive type.

Helium Purge Unit

without He gas Cylinder : P/N 212-22495-01

Used in direct analysis of a liquid sample. By replacing air with a He atmosphere, X-ray absorption is reduced and sensitivity for light elements is improved. In addition, it is effective for eliminating Ar peaks.

Hand-Operated Press **P/N 044-33101-01**

The Hand-operated Press is used to press powder samples into a molding ring using hydraulic pressure. The pressure value can be read directly from the meter. This press is used together with disc-shaped compression plates for holding the sample.

Press size	200 × 150 mm
Stroke	150 mm
Weight capacity of plate	0 to 15 tonnes
Compression plates	Upper and lower compression plates (P/N 210-15024)
Molding ring	Polyvinyl chloride (P/N 212-21654-05, 100 pcs/set) 22 (I.D.) × 3.5 (height) mm Aluminum (P/N 202-82397-05) 24 (I.D.) × 5 (height) mm

Compression-plate heads

P/N	Product name	Remarks
212-22685-91	Turret Drive Unit**	Drives 8/16-sample turrets. Used together with a turret.
212-22354	Solid Sample Holder for Spinner	A sample holder for the analysis of a sample less than 52 mm dia.
212-22357	Small Sample Holder for Spinner	A sample holder for the analysis of a sample less than 11 mm dia.
212-22656-01	Sample Fixing Jig, 40-mm dia. (for 8-sample turret)	Use to fix position displacement during turret rotation.
212-22656-02	Sample Fixing Jig, 30-mm dia. (for 8-sample turret)	
212-22656-03	Sample Fixing Jig, 20-mm dia. (for 8-sample turret)	
212-22656-04	Sample Fixing Jig, 20-mm dia. (for 16-sample turret)	
212-25276-91	X-ray Pilot Lamp	Indicates X-ray exposure.

Note : Items with ** mark are options to be installed at Shimadzu. (Factory option)

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