C142-E050

SHIMADZU
Excellence in Science

Energy Dispersive X-ray Fluorescence Spectrometer

ALTRACE

ALTRACE™

ENERGY DISPERSIVE X-RAY FLUORESCENCE SPECTROMETER

Pushing the Boundaries of Detection

Detect trace elements with ease.

A combination of optical system design and Shimadzu's proprietary high-speed signal processing technology allows ALTRACE to reach new heights in terms of sensitivity.

Unparalleled Sensitivity

- Implement batch elemental analysis from the ppm to percent levels.
- Screen from sub ppm to percent levels.
- Convenient analysis of liquid and powder samples.

Escape from Complicated Pretreatment

- No need for complicated chemical pretreatment before analysis.
- Direct and simple screening, and also precise.
- Lower cost and easier operation compared to methods that incorporate pretreatment.

High Throughput and Efficiency

- Automatic consecutive analyses of up to 48 samples
- User-friendly drawer style tray
- Support for interrupted analysis during measurements

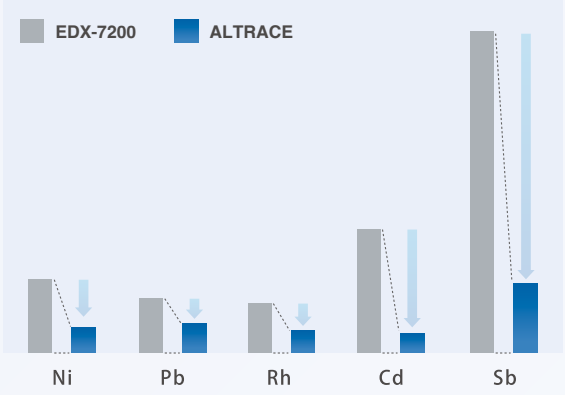

SHIMADZU
1
2
SHUTTER OPEN
X-RAYS ON
ERROR
ALTRACE

Unparalleled Sensitivity

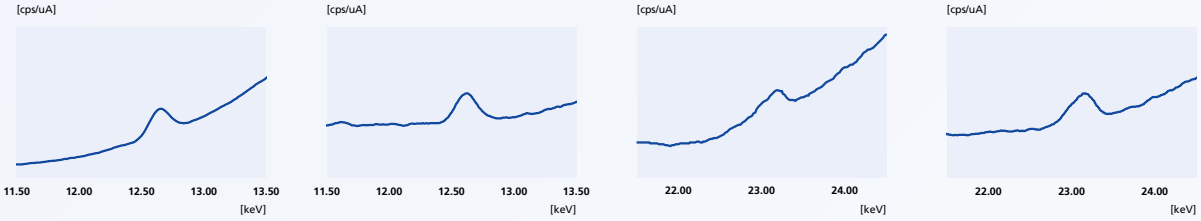
With Shimadzu's combination of optical system design and proprietary high-speed signal processing, ALTRACE reaches the highest detection sensitivity compared to Shimadzu's general-purpose systems (EDX-7200).

Unparalleled Sensitivity that Goes Beyond Typical Measurement Needs

The combination of optical system that optimally arranges high-power X-ray tube and high-sensitivity detector, and high-speed signal processing has achieved high detection efficiency.
In the analysis of aqueous solution samples, the detection limit for all elements have been improved compared to the conventional equipment (EDX-7200).
It can be used effectively for the analysis of low concentration samples and the automatic analysis of multiple samples requiring shorter measurement time.



Comparison of detection limit between conventional equipment (EDX-7200) and ALTRACE



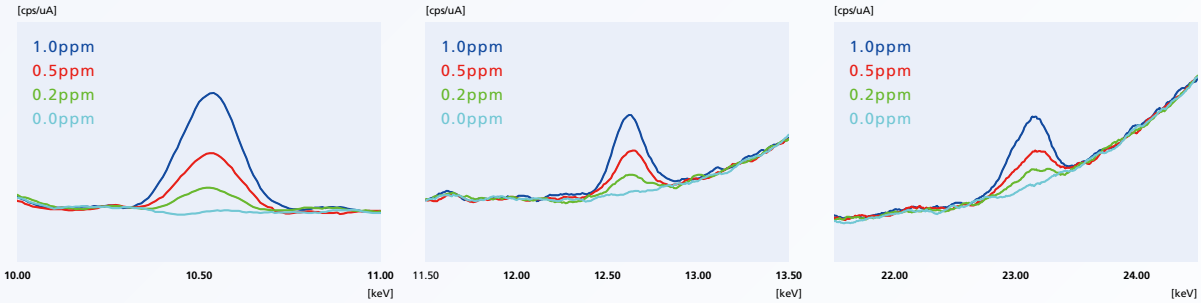
EDX-7200
(600 seconds measurement time)
Pb 5ppm

ALTRACE
(600 seconds measurement time)
Pb 1ppm

EDX-7200
(600 seconds measurement time)
Cd 5ppm

ALTRACE
(600 seconds measurement time)
Cd 1ppm

Implements batch element analysis across a wide range from the sub ppm level to the % level



Aqueous As Solution
(600 seconds measurement time)

Aqueous Pb solution
(600 seconds measurement time)

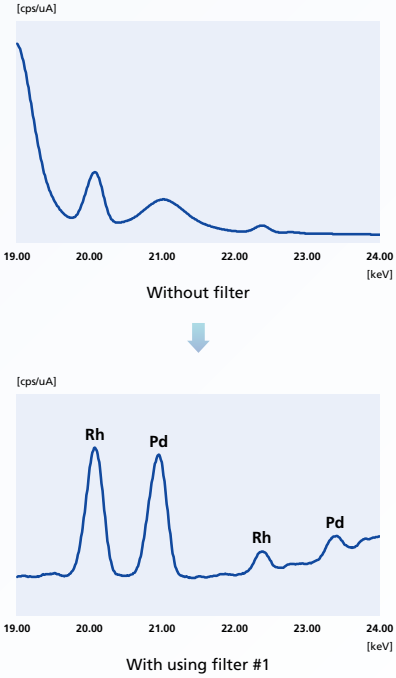
Aqueous Cd solution
(600 seconds measurement time)

Automatic Filter Exchange Improves Sensitivity

Background removal is facilitated by a primary X-ray filter, thereby improving S/N ratio. For trace-level analysis, where background is not negligible, filters are particularly advantageous. ALTRACE is equipped with 6 primary filters (8 types, including open and attenuator), which can be exchanged autonomously by the software.

	Effective Energy (keV)	Example of Applicable Elements
Filter #1	14 to 38	Mo,Rh,Pd,Ag,Cd,Sn,Sb
Filter #2	2 to 4	S,Cl
Filter #3	5 to 10	Cr,Mn,Fe,Co,Ni
Filter #4	9 to 10	Hg
Filter #5	9 to 14	As,Br,Zr,Hg,Pb,Bi
Filter #6	4 to 5	Ti,V

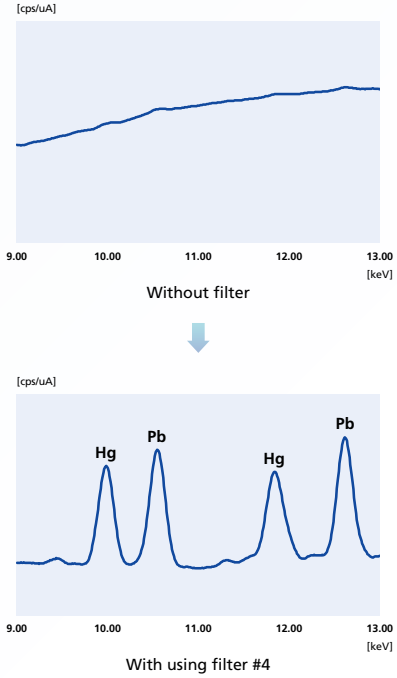
Aqueous Rh and Pd solution



Without filter

With using filter #1

Aqueous Hg and Pb solution



Without filter

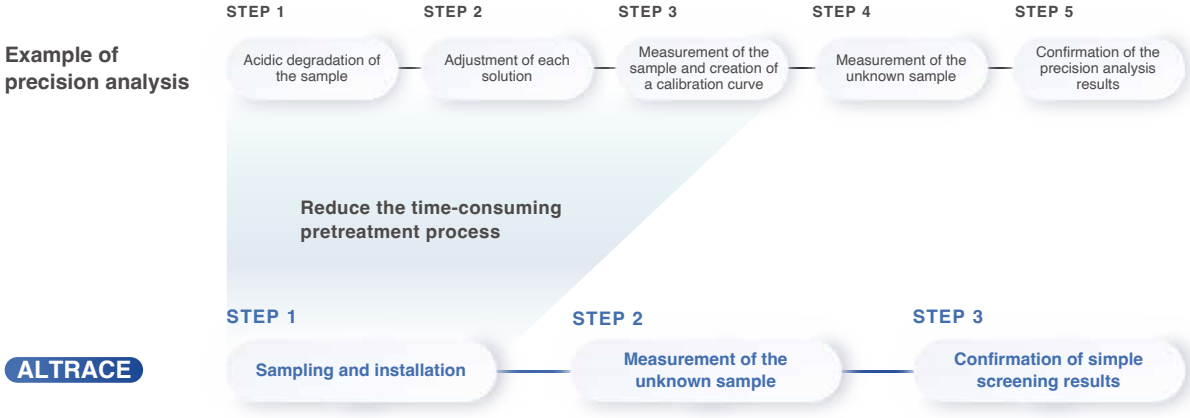
With using filter #4

Escape from Complicated Pretreatment

Liquids and powders can be directly measured by simply placing them as is in the sample cell. EDX is a non-destructive technique; therefore, the same sample can be measured for both simple screening and precision analysis. To date, previous EDX systems could not measure concentrations on the order of 0.1 ppm. With ALTRACE, this level is now detectable. It is now possible to obtain sub-ppm level detection, without the need for chemical pretreatment.

Simple Screening in Combination with Precision Analysis

When performing quantitative analysis by specifying elements, once a calibration curve is created, there is no need to recreate the calibration curve for each measurement. In addition, ALTRACE is suitable for simple screening analysis, since qualitative and quantitative analysis using the fundamental-parameter (FP) method can be performed without specifying elements.



Solids, Powders and Liquids Can Be Measured As Is

With ALTRACE, samples are placed into a dedicated sample cell. The sample is supported by a transparent X-ray film that is suitable for the sample.

Powdered Samples and Pellet Samples

Powder and pellet samples are placed in the sample cell and supported with polypropylene film.

Liquid Samples (Water Soluble and Oleaginous)

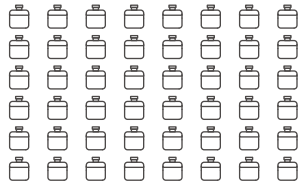
Aqueous solutions are poured into the sample cell and supported on a polypropylene film. Other liquids, such as organic solvents, can be measured by using an appropriate film.

Powder | Pellet | Aqueous solution | Organic solvent

High Throughput and Efficiency

Automatic Consecutive Analyses of Up to 48 Samples

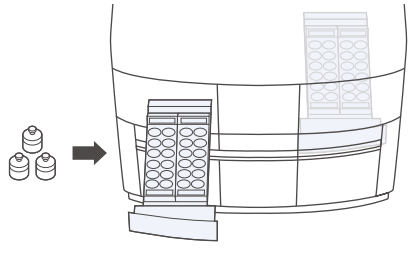
710mm wide main body is equipped with a multi-sample changer.
The tray drawer system allows for safe sample replacement without having to access the inside of the instrument.



48
samples

Analysis can be Paused and Reassigned, Increasing Flexibility

During analysis, ALTRACE can be paused, and new samples can be added and the analysis schedule adjusted accordingly. As such, there is no need to wait for analysis to be completed to start sample preparation.



Ability to Measure a Diverse Array of Matrices Makes ALTRACE Suitable for a Variety of Applications

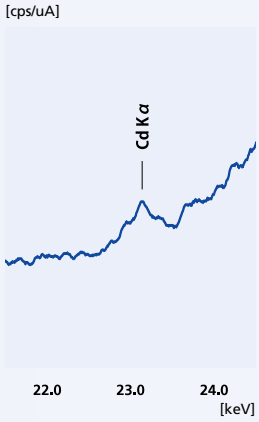
Food Products Field

Cacao powder, rice, powdered milk, etc

Calibration Curve Method

Cadmium, arsenic, lead, and mercury are highly regulated in food products due to their inherent toxicity. A maximum allowable value of less than 1 ppm is specified. ALTRACE can detect these levels, and as low as 0.1 mg/kg, in food products.

Analysis Results for Standard Sample NMIJ7502-a



Profile of CdK α

n	Cd
1	0.508
2	0.599
3	0.597
4	0.474
5	0.557
6	0.549
7	0.469
8	0.502
9	0.574
10	0.485
Mean	0.532
Standard deviation	0.050
Standard value	0.548
Coefficient variation	9.40

NMIJ CRM 7502-a
Results of 10 replicates [mg/kg]
(300 seconds measurement time)

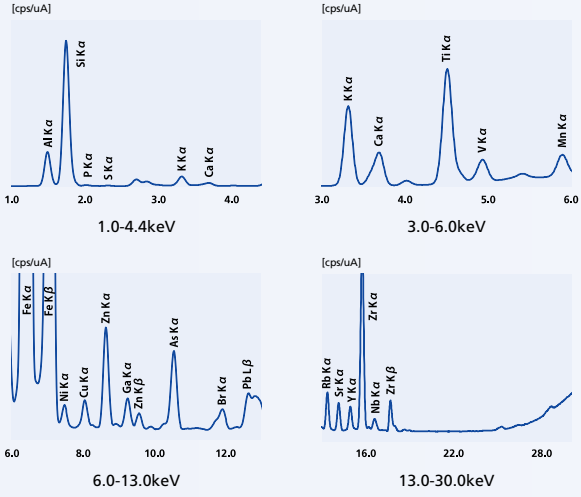
Chemical Products and Soil

Raw materials for chemical products (liquids and powders)

FP Qualitative and Quantitative Analysis

Energy dispersive X-ray fluorescence spectrometers are used in fields related to the environment. Powdered and granular samples can be placed in a sample cell and analyzed as is, without dissolving them. Soil contains a variety of elements. After performing a qualitative analysis of such elements, a quantitative analysis is performed using the FP method.

Analysis Results for Soil Samples



Target Elements	Analytis Results
SiO_2	59.793 %
Al_2O_3	22.177 %
Fe_2O_3	8.074 %
K_2O	1.472 %
TiO_2	0.832 %
MgO	0.715 %
CaO	0.417 %
P_2O_5	0.268 %
SO_3	0.079 %
MnO	0.063 %
V_2O_5	0.051 %
ZrO_2	0.030 %
Cr_2O_3	0.026 %

Target Elements	Analytis Results
ZnO	0.015 %
Rb_2O	0.008 %
CuO	0.005 %
SrO	0.005 %
As_2O_3	0.003 %
NiO	0.003 %
Ga_2O_3	0.003 %
Y_2O_3	0.003 %
PbO	0.002 %
NbO	0.001 %
I	0.001 %
Br	0.001 %

Results of the quantitative analysis

Consumables and Options

Polyester Film

500pcs/set

202-86501-59

For supporting samples. Polyester is recommended for organic solutions, e.g. oils.

Polypropylene Film

500pcs/set

212-14030-91

Film for supporting samples. Polypropylene is suggested for liquid powder, and pellet samples.

Sample Cell Body

100 pcs/set, I.D. 25mm, volume 10mL

212-14043-01

Polypropylene

Sample Cell Ring

100 pcs/set

212-14043-03

For fastening the sample film.

Sample Cell Lid (for Air)

100pcs/set

212-14043-02

Lid of sample cell Dedicated part for auto-sampler

Sample Cell Lid (for Vacuum)

100 pcs/set

212-14043-04

Lid of sample cell for use in vacuum

Sample Plate (for Air)

212-13834-91

Additional sample plates (for air).
Four sample plates (for air) are included as standard with the instrument.

Sample Plate (for Vacuum)

212-13834-92

Additional sample plates (for vacuum).
Four sample plates (for vacuum) are included with the vacuum measurement unit.

Contamination-Proof Cup

10 pcs/set

212-14114-41

Protects the detector and X-ray tube from contamination.

Vacuum Measurement Unit

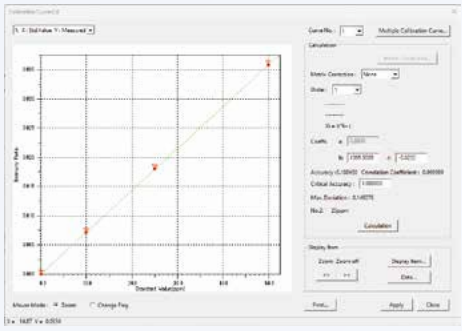
212-14200-41 (for 100V)
212-14200-42 (for 220-240V)

For high-sensitivity measurement of light elements. Space behind the unit will have to be available for rotary pump and vacuum control switch box.

Analysis Functions

Calibration Curve Method

In the calibration curve method, standard samples are measured, and the relationship between standard concentration and X-ray intensity is manifested in a curve. The curve can be used to quantify samples of unknown concentration.
Standard samples should be composed of a similar matrix as the unknown. In addition, a curve must be made for each target element. Calibration curve methods can provide high accuracy and quantitative data. Correction methods, such as absorption/excitation correction, overlapping correction, and other methods, are supported.

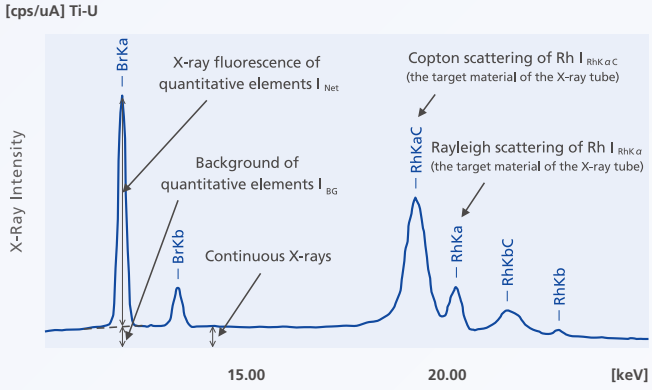


FP Method

The FP method determines the elemental composition using a theoretical intensity calculation. Useful for quantitative methods where it is difficult to procure standards. For samples where the main components are C, H, and O, a balance (residue) setting is required, which can be determined by the user beforehand or theoretically using the shape of the scattered X-ray profile.

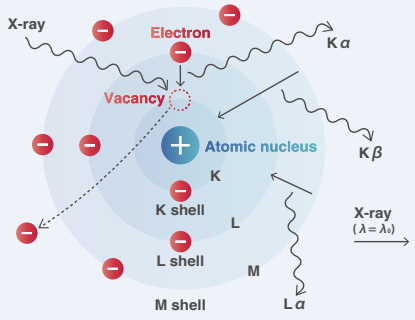
Background FP Method

The background FP method uses the intensity of scattered X-rays (background) to further correct for matrix effects.



Principle Behind the Production of X-Ray Fluorescence

When a sample is irradiated by X-rays, characteristic secondary X-rays are emitted by atoms within the sample. These secondary X-rays are referred to as fluorescent X-rays. Each element has its own unique set of characteristic X-rays with their own energy and wavelength. As such, an energy dispersive X-ray spectrometer can be used to do both qualitative and quantitative analysis by measuring the intensity of X-rays at a given energy.

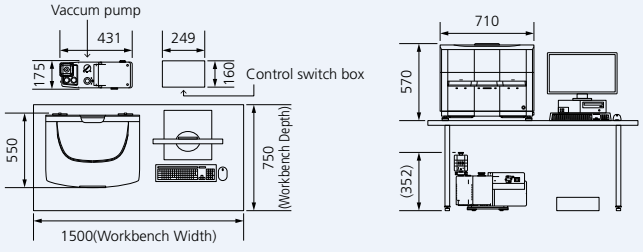


Main Specifications

Measurement Specifications	**Measurement principle**	X-ray fluorescence spectrometry
	Measurement method	Energy dispersive
	Target samples	Solids, liquids, powders
	Measuring range	Na to U
	Sample cell size	Dia. 25 × 20 mm
X-Ray Generator	**X-ray tube**	Rh target (100 W)
	Voltage	5 to 65 kV
	Current	4000 μA max.
	Cooling method	Air-cooled (with fan)
	Analysis region	Dia. 18mm
	Primary filters	Automatic exchange of 6 types (8 types when including open and the attenuator)
	Leakage dose rate	0.5 μSv/h max.
Detector	**Type**	Silicon drift detector (SDD)
	Liquid nitrogen	Not required (electronic cooling)
Measurement Chamber	**Measurement atmosphere**	Air, vacuum
	Sample replacement	48-sample autosampler
	Protective function	Contamination-proof cup
	Sample rotation function	Sample spinner included
Data Processor	**CPU**	Intel® Core™ i5-13500 or above
	Memory	16 GB min.
	SSD	500 GB min.
	Optics	Super Multi Driver
	PC OS	Windows® 11 Pro
Software	**Qualitative analysis**	Measurement/analysis software
	Quantitative analysis	Calibration curve method, matrix correction, FP method, thin-film FP method, background FP method
	Utilities	Automatic calibration function (energy calibration and intensity check)
	Others	Instrument status monitoring function, analysis results tabulation function
Installation	**Temperature**	12 to 30 °C (temperature fluctuation rate 2 °C/hour max., temperature fluctuation range: ±5 °C max.)
	Relative humidity	40 to 70 % (No condensation)
	Power supply	100 to 240 V ± 10 %, 50/60 Hz, 300 VA*
	Dimensions	W710 × D550 × H570 mm
	Weight of main unit	Approx. 110 kg

* Options are not included.

Installation Example Units: mm



The vacuum measurement unit (optional) consists of a rotary pump and a control switch box.
Make sure that the rear and sides of the ALTRACE unit are at least 800 mm away from walls and other devices that are difficult to move.

Shimadzu Corporation
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