



EDX 800

User manual

Drawell International Technology Limited
Chongqing Drawell Instrument Co., Ltd.
Shanghai Drawell Scientific Instrument Co.,Ltd.

Add: Suite 2705, Building No.12,Shiyou Road No.1,Yuzhong,Chongqing

Homepage:www.drawell.com.cn

Tel:0086-023-63268643

Email:sales05@drawell.com.cn

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Foreword

1. What is XRF?

X-ray fluorescence (XRF) is the emission of characteristic "secondary" (or fluorescent) X-rays from a material that has been excited by bombarding with high-energy X-rays or gamma rays. The phenomenon is widely used for elemental analysis and chemical analysis, particularly in the investigation of metals, glass, ceramics and building materials, and for research in geochemistry, forensic science and archaeology.

A typical X-ray Fluorescence Spectrometer is composed of excitation source (X-ray tube) and detection system. When materials are exposed to the radiation (the 1st X-ray) from X-ray tube, excitation of their component elements may take place and the material emits radiation (the 2nd X-ray), which has energy characteristic or wavelength characteristic of the atoms present; the energy and the quantity of the 2nd X-ray will be measured by detection system. Then, the instrument software will convert the information acquired by detection system into the category and the content of the component elements in sample.

Theoretically, each element in element periodic table can be measured with XRF principle, while effective measurable elements range from Na11 to U92.

2. Physical principle of XRF

X-radiation (composed of X-rays) is a form of electromagnetic radiation. X-rays have a wavelength in the range of 0.01 to 10 nanometers, characteristics of which are defined by energy (unit: keV) and wavelength (unit: nm)

When a primary X-ray excitation source from an X-ray tube or a radioactive source strikes a sample, the X-ray can either be absorbed by the atom or scattered through the material. The process in which an X-ray is absorbed by the atom by transferring all of its energy to an innermost electron is called the "photoelectric effect." During this process, if the primary X-ray had sufficient energy, electrons are ejected from the inner shells, creating vacancies. These vacancies present an unstable condition for the atom. As the atom returns to its stable condition, electrons from the outer shells are transferred to the inner shells and in the process give off a characteristic X-ray whose energy is the difference between the two binding energies of the corresponding shells. Because each element has a unique set of energy levels, each element produces X-rays at a unique set of energies, allowing one to non-destructively measure the elemental composition of a sample. The process of emissions of characteristic X-rays is called "X-ray Fluorescence," or XRF.

X-ray Wavelength

According to Moseley's Law, wavelength of XRF λ is related to element atomic number Z:

$$\lambda = K (Z - S)^{-2}$$

K and S are invariables.

X-ray Energy

According to Quantum theory, X-ray can be regarded as particle flux composed by quantum or photon:

$$E = h\nu = hc/\lambda$$

E: Energy of photon in X-ray, unit: keV

h: Planck constant

v: light wave frequency

C: velocity of light

Therefore, XRF qualitative analysis is based on element category acquired by testing XRF wavelength or energy; in addition, intensity of XRF and element content is related, thus, quantitative analysis of element can be conducted.

3. Application and analysis of XRF

a) X-ray can be used in element analysis which is a new analytical technology. XRF analytical technology has been widely applied in metallurgy, geology, nonferrous metal, building materials, commodity inspection, environment and hygiene, etc.

b) Intensity of characteristic X-ray of each element is affected by sample element content as well energy and intensity of excitation source.

c) Basic principle of XRF analysis: element content information can be acquired by measuring the intensity of characteristic X-ray of each element.

4. XRF and other methods

Advantages:

a) Fast analysis: analysis time is related to analysis precision, 2-5 minutes.

b) XRF spectrum isn't affected by the chemical constitution of samples and is barely affected by powder, solid or liquid, crystalloid or non crystalloid. Wavelength changes can be observed in high-resolution precision test (gas sealed in container can also be analyzed). This effect is more obvious, especially in super-soft X-ray range. Wavelength changes can be used in chemical potential test.

c) Non-destructive analysis: neither changes to chemical condition nor sample emission can be caused during test; same sample can be tested for several times with good reproducibility.

d) XRF analysis is a physical analytical method which can be used in analysis of group of elements with similar chemical properties.

e) High analytical precision

f) Easy to prepare samples, all solid, powder and liquid samples can be analyzed.

Disadvantages:

a) Difficult for absolute analysis, thus standard sample is needed for quantitative analysis.

b) Lower accuracy towards light elements.

c) Easily influenced by element interference and overlapping peaks.

5. XRF Spectrometer

Different elements have different energy and wavelength of characteristic X-rays, thus by measuring the energy or the wavelength of X-rays; you can find which element it is and conduct qualitative analysis. The intensity of X-rays emitted from samples after excitation, which have the characteristic of the element presented in samples, is related to element content

in samples. Based on which, quantitative analysis of element can be conducted by measuring its intensity.

XRF Spectrometer has two models:

WD-XRF (Wavelength Dispersive XRF) and ED-XRF (Energy Dispersive XRF)

Chapter 1 General Description

1.1 Introduction

1.1.1 Features

This instrument can be applied for professional noble metal detection with intelligent detection software, both of which, therefore, will make the instrument play the best performance.

1.1.2 Parameters

- Measurement elements: Au, Ag, Pt, Pd, Cu
- Sample types: solid, liquid, powder
- Measurement time: 60-100s
- Operating temperature: 15-30°C
- Relative humidity: $\leq 70\%$
- Power supply: 110/220V

1.1.3 Applications

- Detection of noble metals such as gold, platinum, silver, etc and content determination of a variety of jewelry
- Thickness measurement upon metal coating and content determination of electroplating solution and coatings
- Mainly for the processing industry of noble metals and jewelry
- Bank, jewelry sales and testing institution
- Electroplating industry

1.1.4 Configurations

- Single sample chamber
- Movable sample platform
- Gas-sealed counter
- Amplifier circuit
- High/low voltage power supply
- X-ray tube
- Computer and inkjet printer

1.2 Unpacking

Unpack the instrument and you will find: instrument, standard sample, hanging board and black bag.

挂板(一)

分析原理



元素成份分析仪
电镀层厚度测试仪
Rohs指令的有害元素的测试

X荧光分析仪的优势:

- 准确: 可以测出化学组成
- 快捷: 分析一个样品中的几十个元素, 只需几分钟
- 无损: 对被分析的样品可以无任何物理和化学破坏



挂板(二)

元素周期表
PERIODIC TABLE OF ELEMENTS



配件包



电源线



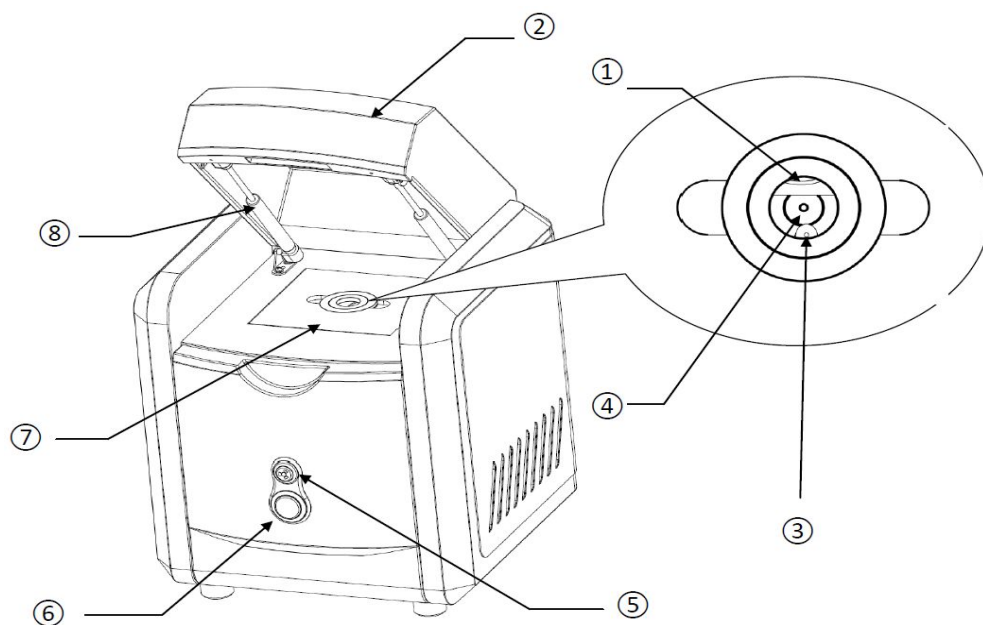
USB延长线

Chapter 2 Instrument Specification

1. Size: 430(L)×380(W)×355(H)mm
2. Weight: 34kg
3. X-ray source:
 - X-ray tube: W target (Rh target and Ag target are optional)
 - Voltage of X-ray tube: 0-50KV, adjustable
 - Current of X-ray tube: 0-1mA, adjustable
 - Refrigeration of X-ray tube: closed style air cooling
4. Collimating system: Φ 1.5mm for standard allocation (optional upon requests)
5. X-ray detection system: proportional counter
6. Sample observation system:
 - Sample illumination: LEC lamp, inferior vertical irradiation
 - Sample observation: CCD high definition camera
7. Angle between bare tube rays and horizontal direction: 45 degree
8. Size of sample chamber: 306(W) x 260(H) x 78(D) mm
9. Safety protection: when the lid of the instrument is not fully closed, the high pressure won't work then.
10. Data acquisition: 2048 ways of subdividing data acquisition
11. Power supply: voltage input: AC220V/110V±10%, ≤3A, 50/60HZ

Chapter 3 Appearance Introduction

3.1 Appearance Introduction



① Surface light source(for observing the sample)

② Cover

③ Collimator

④ Detector

The measurement window of detector is made of beryllium membrane and fragile. It can be easily damaged by an external force. And the results of any operation on this window are regarded as man-made sabotage and Drawell is not responsible for it.

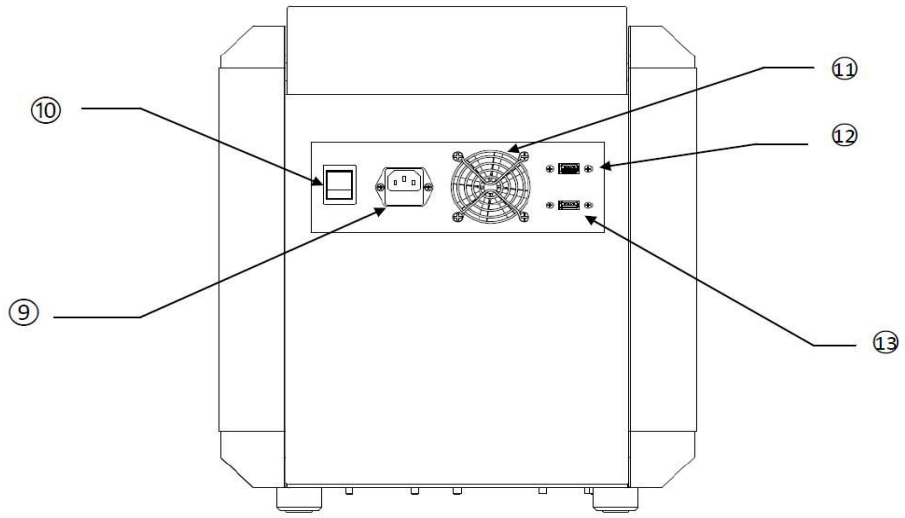
⑤ High voltage indicator

The indicator goes on when the machine is working.

⑥ Power indicator

⑦ Sample bench

⑧ Telescopic strut



- ⑨ Power interface
- ⑩ Power switch
- ⑪ Fan
It radiates heat
- ⑫ USB1
- ⑬ USB2

Chapter 4 Installation and Connection

4.1 Installation Environmental Requirements

1. Such equipment as air conditioning, computer and printer should be installed in the room.
2. The room should be free of water source, heat source, strong EMI, flammable substances, dust and direct sunlight.
3. An on-line AC purification regulated power supply is recommended to be equipped. But for regions with unstable voltage and frequent power cuts, it is required.

4.2 Connections

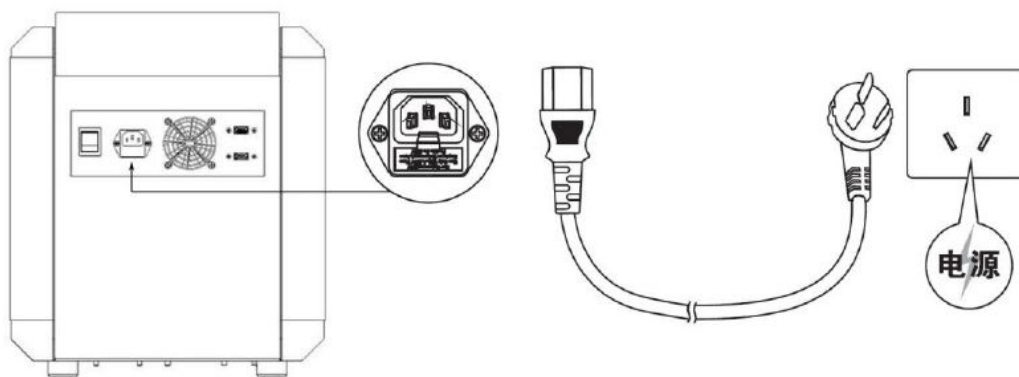
The system mainly consists of main instrument, host computer, color monitor, keyboard and printer.

The computer is the installation core with only one line connected respectively to keyboard, printer, display and the main instrument. The connecting line of the host computer is placed on its back panel. Attach each line and lock screws as needed.

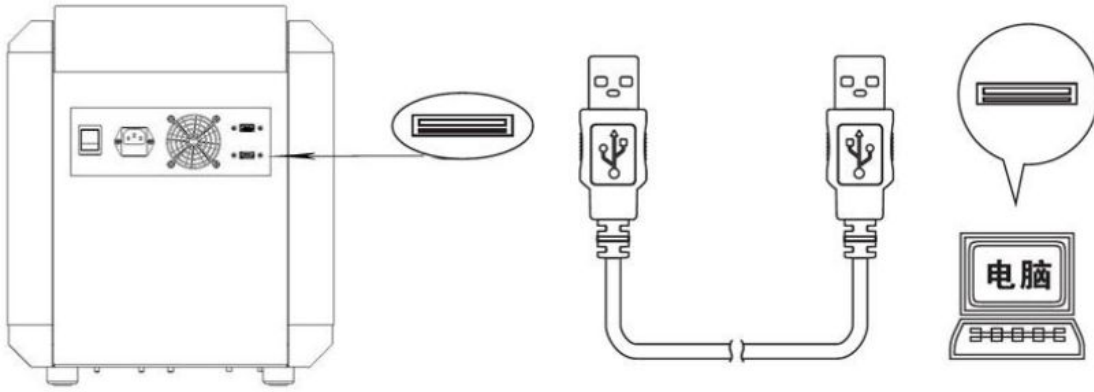
AC purification regulated power supply is recommended to avoid damage from unstable power supply.

Generally, the instrument drifts as the temperature changes, affecting the measurement results. Although there are correction methods in the software to eliminate the affection, it is strongly recommended to equip air conditioning.

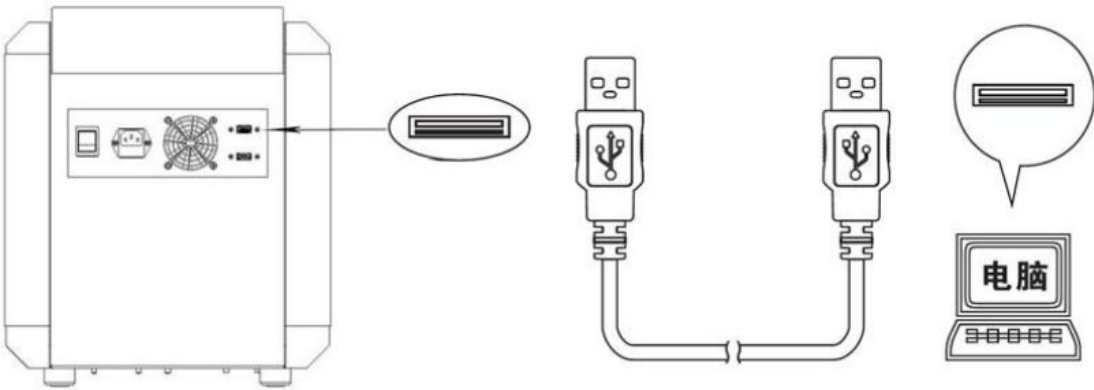
1. Connect one end of power cord to the instrument and the other to the power wiring panel.



2. Connect one end of USB1 to the instrument, and the other to the computer host.



3. Connect one end of USB 2 to the instrument, and the other to the computer host.



Chapter 5 Operations

5.1 Operation Cautions

1. The instrument can be put in 0-50°C (32~122°F) of the ambient environment and operated in 15-30°C, with both allowance humidity between 0~60%(non-condensation). Both the ambient temperature and humidity should keep constant during operations.
2. The three-pin plug should be applied to connect to a grounded socket.
3. As a precision instrument, regulated power supply with high precision is recommended to be equipped. Uninterrupted power supply (UPS) should be equipped for computers in case of data loss.
4. The instrument should be separated from electromagnetic fields when in use.
5. Direct contact with liquids is prohibited in case of short circuit. If liquids fall into the instrument, please turn off the instrument immediately and ask technicians for an overhaul before reuse.
6. Do not let liquids or any foreign bodies fall into the instrument. If they contact with electrical components inside the instrument, short circuit may occur and therefore fire disaster or electric shock accidents may be resulted in.
7. Do no dirty or scrape calibration standard films, Otherwise reading errors may be resulted.
8. No mechanical or chemical methods is allowed to be applied to eliminate dirties on the calibration standard films. If necessary, you can use towel to erase dirties gently.
9. Do not try to disassemble or refit the instrument without permission. Any treatments made by non professionals will damage the instrument.
10. If there is smoking or any abnormal noise, please turn off the main power switch, pull out power cord and then telephone the local authorized Drawell distributor for aids.
If you go
on operating the instrument in this case, fire disaster or electric shock accident may be resulted. Besides, articles should be avoided to put near the instrument so that you can pull out the power cord whenever needed.
11. For safety reasons, be careful that do not touch the down button when you take out or put samples.
12. For safety reasons, do not put any articles within the covering range of chamber cover to promise the vacuum degree of sample chambers.
13. For safety reasons, please turn off all switches of the instrument for long-term layout (such as night). Besides, necessary attached protection measures are needed. When the instrument will not be used for a period, turn off the main power supply and pull out the power cord, cover it with dustproof cover and place in a dry and well ventilated safe place.

5.2 Switch On

First check the connections between the power supply, the computer and the instrument. Make sure everything is all right before switching on the system. Here is the correct switch-on procedure:

1. Switch on the main power supply.
2. Turn on the X-ray instrument.
3. Turn on the printer.
4. Turn on the computer.

Chapter 6 Care and Maintenance

XRF analyzers are precise instruments which require close attention to both the usage and maintenance. The suggestions we put forward as follows will help users well comply with the guarantee clause and extend the service life of the instrument.

1. The instrument should be operated and kept by special person who shall be responsible for it. All other people should not touch, operate or remove the instrument without permission.
2. AC purification regulated power supply should be equipped to promise the stability of power supply.
3. Do not try to disassemble the instrument. Any treatments upon the instrument by non professionals will damage precise components of the instrument.
4. Pay special attention to avoid knocking and damages to the surface or internal components during the usage, storage and transportation of the instrument.
5. The instrument in the measurement should avoid interferences such as the one from Motor, vibration, electric welding, electromagnetic and high pressure.
6. The instrument should keep dry for minerals in rainwater, wet gas and liquids which will corrode the precise components.
7. Do not position the instrument in dusty and dirty places which will pollute the optical system and therefore result in the inaccurate measuring results.
8. Do not position or operate the instrument in places with too high temperature, otherwise the service life of the electric components shall be reduced and the battery shall be damaged.
9. Do not position or operate the instrument in places with too low temperature, otherwise moisture may be formed when the temperature rises (to the normal temperature), therefore damage the circuit board.
10. Do not clean or wipe the instrument with corrosive chemicals and heavy detergents. Please wipe the dust on instruments away with soft cloth. If there is dirty spot, gently wipe it away with alcohol cotton balls.
11. When the instrument won't be used for a period, well cover it with dustproof cover and position it in dry and well ventilated places.
12. Pay attention on the following tips during operations:
 - A. When switching on the power supply, keep gentle and slow. Do not treat it with excessive force in case of damage upon the keyboard.
 - B. When positioning samples into sample chambers, pay attention to the sample cleanness to keep dusts from falling inside which will pollute the X-ray tube and detector window, resulting in inaccurate results or damages upon the detector.
 - C. Frequent cleaning with alcohol cotton balls upon sample lids is required.
13. 30 min preheating is required for the instrument before starting up. Perform the initialization and then normal detection can be performed after taking the above precessions.
14. When measuring different types of samples, corresponding options should be selected from the program field to promise the best measuring results.

15. For long-term normal operation, periodical testing upon each parameter is required with relative adjustment.

Notes:

Please contact the nearest Drawell office or authorized service center immediately if the instrument or fittings cannot work normally.

Chapter 7 Troubleshooting

1. The power light is dark with the power on.

Recommended solutions:

- (1) Check whether the power cord is connected correctly or not and the power socket is on or not;
- (2) Check the fuse in the power socket is blown or not. If blown, replace the fuse or power socket.

2. Vacuum pumping cannot be realized or vacuum degree cannot achieve its normal value.

Recommended solutions:

- (1) Check whether the power switch of vacuum pump is on or not, the pipelines in instrument are connected correctly or not and the wing nuts on clamp has been tightened or not;
- (2) Check whether the sample lids of the instrument have been fully closed or not. If not, lift sample lids to make sure there is no foreign body on O-ring. And then lower the sample lids.

3. USB cannot be recognized.

- (1) Poor contact of USB: pull out the USB line and reinsert it to promise full contact of USB ports. Turn off power switch and then reopen it;
- (2) The USB drivers are not installed correctly. Reinstall the drivers in correct methods;
- (3) Static electricity of the host computer makes USB devices non-identified: pull out all connecting lines of peripheral in host computers (including host power cord, display data line, mouse, keyboard, etc). Continue switching the host computer for 3-5 times. For each switch, you should press the button for more than 1 second with intervals of 1-2 seconds for each switch.

4. The video window of samples shows nothing.

- (1) Check whether the sample is positioned in the right place or not;
- (2) Check whether the USB line is connected correctly or not;
- (3) Check whether the camera driver is installed or not;
- (4) The collimator and filters deviate from the designated location;
- (5) Check whether the motor code is consistent with the fitting list.

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