

EDX Pocket III Handheld X-ray Fluorescence Spectrometer

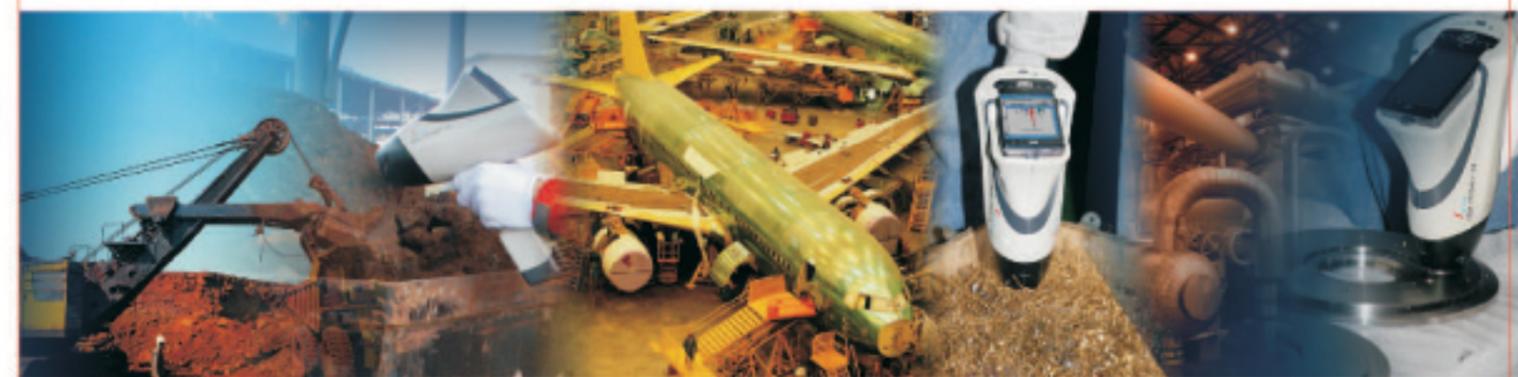
- Alloy Analyzer
- Rapid Minerals Analyzer
- Rapid RoHS Tester



Handheld High-performance On-site Analyzer



Skyray Instrument Inc.
50 Braintree Hill Park, Suite 201,
Braintree, MA USA 02184
Tel: 617.202.3879 Fax: 781.519.4766
Website: www.skyrayinstrument.com



Precision Instruments SKYRAY Elaborates



Company Profile

Skyray has built a strong reputation and has gained over 80% of the market share in XRF technology within the past 5 years alone. Skyray Instrument has stepped up to a level of highly reputable equipment, with some of the largest manufacturing companies entrusting us with supplying them with our analytical equipment, Skyray has built a strong ever lasting reputation globally.

Skyray Instrument has recently joined the North American Market and wants to bring these low-cost, precise analytical equipment to the North American Consumer and Manufacturing market. The company possesses a first class expert management team, a strong Research Development Team, unparalleled technology with over 50 patents and a reputable service team. Skyray Instrument is the most trustworthy friend of the users as it implements rigid quality control on its products, pursues technological innovation ceaselessly and offers technical support promptly. Skyray Products command a good market both at home and abroad. Skyray representatives can be found in more than 50 countries world-wide including in regions such as Russia, Germany, Italy, Austria, Spain, Switzerland, Korea and Singapore and many more. There are over 100 offices and service stations all over the world.

Skyray Instrument, as an industry technology leader, is constantly exploring the pinnacle of analytical field and providing customers with more advanced products and more satisfied services, meanwhile, providing more perfect solutions for electronics, electric appliances, jewelry, toys, food, construction materials, metallurgy, minerals, plastics, petroleum, chemistry, medicine and other industries.

An introduction to EDX Pocket III

EDX Pocket III is a Handheld X-ray Fluorescence Spectrometer specifically developed for on-site analysis by Skyray. They include RoHS Analyzers, Alloy Analyzers, Scrap Metals Recycling Analyzers, Mineral Analyzers, Precious Metals Analyzers and Soil Analyzers. They are the smallest, rapidest, most functional and most accurate XRF analyzers available on the market. They can be used widely in fields such as alloy analysis, minerals analysis, geographic analysis, precious metals analysis, scrap metals recycling analysis, RoHS testing and soil analysis. Moreover, it can also be used to perform Positive Material Identification (PMI) and verification.



Years of brewing and **development**

Persistent efforts in **quality pursuit**

Optimized integration of **high-end configurations**

EDX-Pocket III is always outstanding!

- Its streamlined design brings us powerful visual impact
- Its magnificent colors exhibits unique charm
- Its exquisite kernel displays beauty of science and technology
- Its prudent gunlock design provides secure "firewall" at the fullest
- Its portability shows us great concern to humanity

*Rapid Accurate Non-destructive
Intuitive Lightweight Easy-to-use Safe*

Main characteristics of EDX Pocket III

- * The instrument is small, light and portable, providing rapid and non-destructive on-site analysis of the samples.
- * Figurative interface, flexible software operation, intuitive spectrum display and definite results.
- * Several working curves are provided in the software, which can even be edited and renewed by the users upon test requirements.
- * Optional GPS helps locate the tested sample when mining or surveying mines in the field.
- * SD card with super large capacity is available. There is no limit of data storage.
- * Attractive design and comfortable feel when held in hand.
- * The carrying case has high strength and high sealing capacity, drop and shock proof as well.
- * Faster analysis and better accuracy, delivering lab-quality results.
- * Wide range of measurable elements: Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Zr, Nb, Mo, Sn, Hf, Ta, W, Re, Pb, Bi, Se, Sb, Pb, Au and Hg.
- * Broad application fields: RoHS testing, alloy analysis, geographic analysis, minerals analysis, precious metals analysis, heavy metals analysis in soils, and scrap metals recycling analysis.

As a heritage of Skyray art of instrument manufacturing, EDX Pocket III Handheld X-ray Fluorescence Spectrometer is rapid, accurate, non-destructive, portable, safe and reliable.

- ※ Rapid and accurate on-site analysis, giving a test in tens of seconds and saving time and money significantly .
- ※ Field based direct surface measurement can be done without sample preparation. Any sample type, including soil, rock, dirt, dreg, solid particles, liquid sediments, etc can be tested.
- ※ It has maximized flexibility with choice of analysis modes, ensuring good test results.
- ※ It can withstand all kinds of harsh environment in temperature between -20°C and 50°C. It is ideal for dusty, humid, and high-temperature conditions over long periods.
- ※ The instrument is easy and comfortable to use. High visualized. Brief training is needed.

An introduction to EDX Pocket III specifications

<i>Working principle</i>	XRF analysis exploiting X-ray Fluorescence Spectrometry
<i>Measurable elements</i>	S-U
<i>Detector</i>	advanced thermoelectric cooling Si-PIN semiconductor X-ray detector with high performance and high energy resolution
<i>Excitation source</i>	mini 40kV/50μA X-ray tube, Ag/W anode target
<i>Data display</i>	high definition and high resolution PDA (Personal Digital Assistant), Windows CE operating system, Bluetooth communication, personal data handling and e-mail sending.
<i>Data storage</i>	Large capacity SD card and SD card reader enable the data to store on PC and print out
<i>Power supply</i>	operating time of two fully-charged Lithium batteries is no less than 8 hours
<i>Weight</i>	1.4 kilos(without battery)
<i>Overall size</i>	260×325×125mm (L×H×W)
<i>Ambient environment</i>	temperature-20°C~+40°C
<i>Safety feature</i>	both PDA and software operations are protected by passwords. Unauthorized people are not allowed to operate.
<i>Standard accessories</i>	shock, pressure & water-proof carrying case with padlocks, 110v/220v general-purpose charger, large capacity SD memory card, SD card reader, two 4000mAh Lithium batteries, Lithium battery charger, PDA accessories, lab test stand (optional), etc.

EDX Pocket III Application fields

An Introduction to Alloy Analysis

EDX Pocket III Handheld X-ray Fluorescence Spectrometer can analyze all kinds of high and low alloy steel, stainless steel, tool steel, Chrome-Molybdenum Steel, Nickel alloy, Cobalt alloy, Nickel-Cobalt heat-resistant alloy, Titanium alloy, Copper alloy, Bronze, Zinc alloy and Tungsten alloy; it can also identify Grades of light Aluminum and Magnesium alloys through measuring other alloy elements.

Steels are alloys in which Iron is mixed with Carbon (major elements) and other elements such as Silicon, Manganese, Sulfur and Phosphor. Other elements are added to produce the chemical specifications for the desired steel grade. By determining the concentration of these elements, we know the properties and types of steels.

◆ Chromium—Chromium is added to increase abrasion resistance, hardness and most of all corrosion resistance. Steel with chromium above 13% is regarded as stainless steel.

◆ Manganese—Manganese is a very important alloying element in steel, which helps to produce texture and strengthen toughness and abrasion resistance. In the heat treatment and press process, it de-oxidizes the inner side of the liquid steel. Manganese is often seen in steels used to make scissors (except A-2, L-6 and CPM420V).

◆ Molybdenum—Molybdenum is a carbonization agent, which is used to prevent embrittlement of certain steels. It keeps the strength of the steel at higher temperature. Molybdenum is seen in many types of steel, e.g. the air-hardening steel (e.g. A-2, ATS-34). Air-hardening steel contains 1% or more Molybdenum. Mo's function is to cause the steel to harden in the air.

◆ Nickel—Nickel is used to improve strength, corrosion resistance and ductility of the steels. It is often seen in L-6\AUS-6 and AUS-8.

◆ Silicon—Like Manganese, Silicon improves the strength of the steel. Further, it keeps the strength of steel during the production process.

◆ Vanadium—Vanadium is added to improve the abrasion resistance and the ductility of the steels. Vanadium appears in many types of steel, such as M-2, Vascowear, CPM T440V and 420VA. The biggest difference between BG-42 and ATS-34 is that the former contains Vanadium.

Applied to:

- High-temperature and high-pressure industries: steel melting, boiler, pipeline and vessel manufacturing
- Industries such as non-ferrous metals, space and aviation, weaponry and shipbuilding

Material identification and quality assurance of high-temperature and high-pressure industries such as steel melting and boiler.



An Introduction to Alloy Analysis

EDX Pocket III Application fields



Alloy composition identification and quality assurance of high-tech industries such as shipbuilding and space and aviation industries

Alloy Grade Library and Measurable Standard Elements :

Extensive Alloy Grade Libraries: standard libraries of countries such as China (GB), USA (AISI, UNS, ASTM), Japan (JIS), France (NF), Russia (TOCT), Sweden (SS14), Britain (BS) and Germany (DIN). EDX Pocket III allows easy editing of grade libraries. The measurable standard elements include 26 elements Al, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Se, Zr, Nb, Mo, Pd, Cd, In, Sb, Hf, Ta, Pt, Pb, Ag, Sn, Bi and Au.

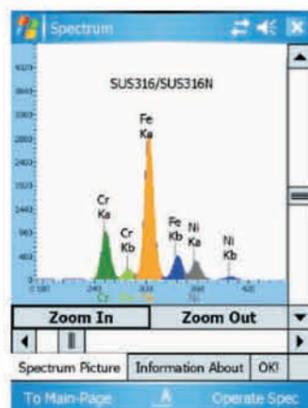


Compliance and safety tests of spare parts in power and power station industries

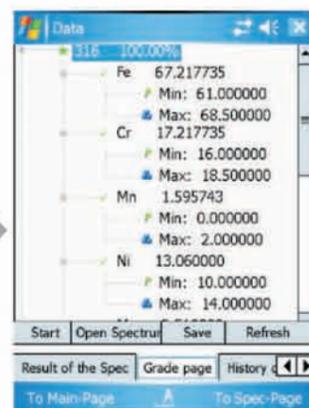


EDX Pocket III Test Example and Analysis

As for finished products such as stainless steel, the users are more concerned about the concentration of Cr, Mn, Ni, Mo and Ti, for their varying concentrations may result in different uses of the steels. These alloying elements can be measured in the air.



▲ Spectrum of grade analysis



▲ Grade analysis display

Corresponding grades

SUS316J1/SUS316J11

The main compositions of the stainless steel are Fe, Cr, Ni, Mo and Mn.

The test sample is a national standard, with grade name 316. The measurement time is 30s and test environment is standard. The following are the measured results:

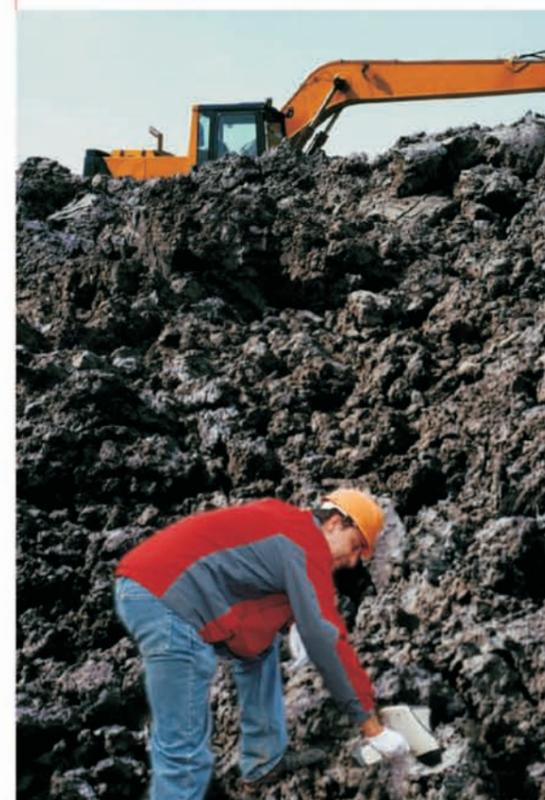
Element	316 Range of the content	Standard value	Tested value
Cr	16%~18%	17.07	17.22
Mn	0~2%	1.14	0.79
Fe	66%~72%	65.57	65.6
Ni	10%~14%	12.1	12.08
Cu	0~0.8%	0.073	0.054
Mo	2%~3%	2.92	2.92
Ti	0~0.05%	0.032	0.045
V	0~0.055	0.036	0.053
Co	0~0.1%	0.081	0.074
Al	0.00	0.00	0.05
Zn	0.00	0.00	0.00
Se	0.00	0.00	0.00
Zr	0.00	0.00	0.00
Nb	0.00	0.00	0.00
Pd	0.00	0.00	0.00
Ag	0.00	0.00	0.00
Cd	0.00	0.00	0.00
In	0.00	0.00	0.00
Sn	0.00	0.00	0.00
Sb	0.00	0.00	0.00
Hf	0.00	0.00	0.00
Ta	0.00	0.00	0.00
Pt	0.00	0.00	0.00
Au	0.00	0.00	0.00
Pb	0.00	0.00	0.00
Bi	0.00	0.00	0.00

▲ A test report of stainless steel

EDX Pocket III Application fields

An Introduction to Minerals Analysis

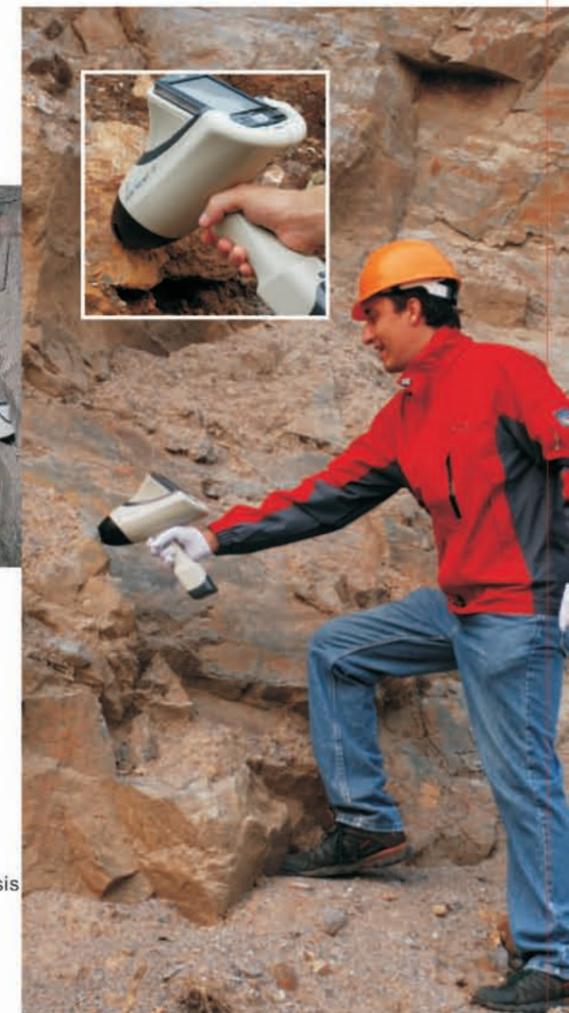
EDX Pocket III Handheld X-ray Fluorescence Spectrometer features rapid identification of mineral categories, auto qualitative and quantitative analysis of multi elements, different test options, free and unlimited adding of test modes and in-built intensity correction mode correcting deviation caused by different geometric shapes or uneven structural density. It is widely used in geography, metallurgy, rare earth, petroleum, environment monitoring, non-ferrous metals, food, agriculture, research institutes, colleges and mining enterprises.



▲ Ore tail analysis



▲ Crude ore and ore concentrates analysis



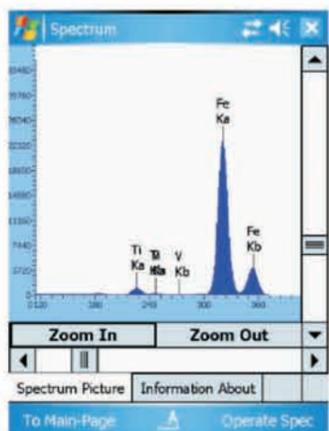
▲ In-field minerals exploration and survey

Applied to:

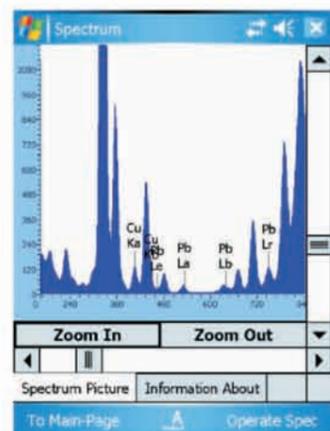
- Mineral exploration and survey
- In-situ inspection of rocks, soil, sediments and ores
- Drawing of atlas of mineral resources
- Analysis of crude ore, ore concentrates and tails in washing process
- Determination of grade of ores during the purchase of crude ores and ore concentrate
- In-field measurement of archeology

EDX Pocket III Test Example and Analysis

An Introduction to Minerals Analysis



▲ Vanadium-Iron sample GBW07224



▲ Sediment sample GBW07318

Element	Intensity	Content
Cr	5.11	0.0243
Fe	355.955	11.9
Ni	9.909124	0.0087
Cu	9.690593	0.0011
Zn	48.669674	0.0165
Ba	8.81	0.076
Pb	5.78	0.0066
V	4.805	0.019
Zr	27.215	0.0524
As	1.505	0.001029

▲ Measurement results

The major compositions of the ores are Fe, Ba, Zr, and Ca.



● There is a wide range of samples in the geographic and mineral industries: rocks, soil, sediment, ores, etc. They have complicated compositions and require rapid and accurate qualitative and quantitative analysis on the site or in the field. Besides, if tests are to be carried out before large-scale production, they must produce results as quickly as possible. Therefore, two features are ascribed to this industry: sample complexity and measurement rapidness.

EDX Pocket III Application fields

An Introduction to Scrap Metals Recycling and Utilization

Scrap metals recycling is an indispensable aspect of circular economy, which has positive influence on environment protection and resources economization. Nowadays, nations around the world are propelling the cause of scrap metals recycling, waste electronic products reuse and circular economy transformation of steel and non-ferrous industries. China is currently making experiments on circular economy in key industries, areas, industrial parks, and cities.

Skyray EDX Pocket III Handheld X-ray Fluorescence Spectrometer is designed for on-site measurement and rapid sorting of volume scrap metals. It allows the scrap dealers to make rapid and reliable judgment on the raw material deals. As a powerful weapon used for metal identification in scrap and regeneration metals recycling, it has contributed significantly to the development of renewable material industry.



▲ Overstock steels recycling in warehouses

Applied to:

- **Scrap metals recycling:** Rare metals: gilt, silver plating, silver point, Hg, Mo, Ni and W; Non-ferrous metals: Cu, Al, stainless steel, lead soldering tin, tin dross, zinc, etc
- **Waste electric appliances recycling:** household appliances such as air-conditioner, refrigerator, washing machine, TV and refrigerator
- **Waste commercial units recycling:** central air conditioning system, refrigeration equipment, electric wire and cable, battery cell, electric motor, machine tool, elevator, jack box, transformer and boiler

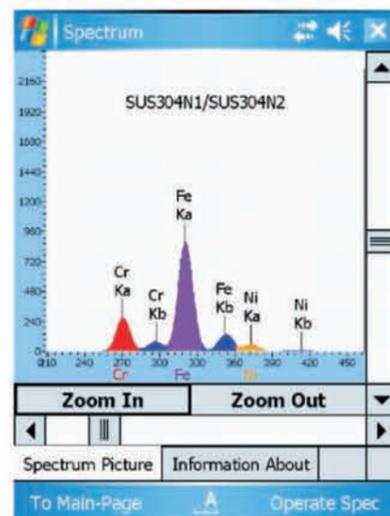


▲ Test of cutting scraps or shavings

▲ Sorting of metals in salvage station

EDX Pocket III Test Example and Analysis

An Introduction to Scrap Metals Recycling and Utilization



▲Spectral analysis

Element	Intensity	Content
Cr	193.05	19.513111
Fe	654.203495	70.939709
Mn	22.601495	2.076465
Ni	58.2	7.460715
Cu	3.155911	ND
Mo	23.277595	ND

▲Measurement Results

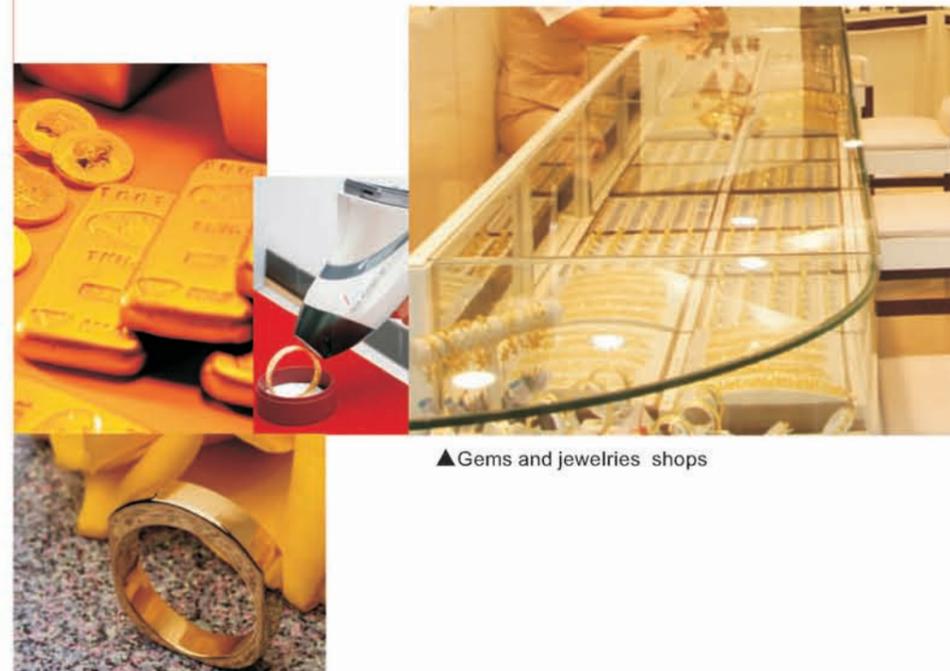
The major compositions of the scrap metals are Fe, Cr, Ni and Mn.

EDX Pocket III Application fields

An Introduction to Precious Metals Analysis

Precious metals refer to the eight metal elements Au, Ag and Ru, Rh, Pd, Os, Ir, Pt in Pt family. Most of these metals have beautiful colors. They are normally un-reactive as they have strong resistance to chemicals. They are usually made into jewelries or souvenirs. They also have wide industrial application.

Skyray EDX Pocket III Handheld X-ray Fluorescence Spectrometer can test grades and purity of the precious metals, identify grades of gemstones and conduct routine physical, compositional and structural analysis of jewelries.



▲Gems and jewelries shops



▲Test institutes of precious metals jewelries

Applied to:

- Measure concentration of precious metals Au, Pt, Ag and other jewelries
- Precious metals and jewelries processing industries
- Jewelry shops and test institutes
- Banks and electro plating industry



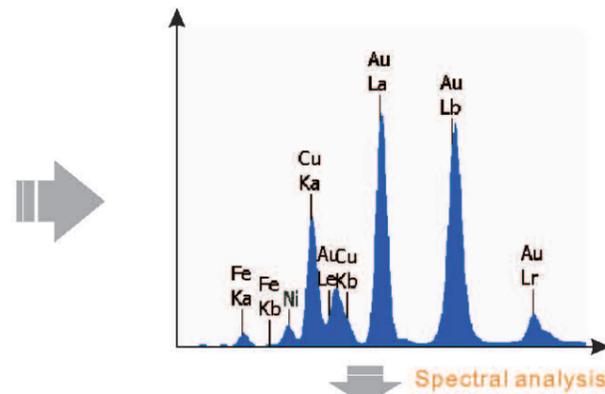
EDX Pocket III Test Example and Analysis

An Introduction to Precious Metals Analysis

EDX Pocket III tests precious metal fineness for gold, silver, platinum, palladium, etc in accordance with National Standard GB 1887 Jewelry--Fineness of Precious Metal Alloys and Designation and GB/T 18043 Precious Metals Jewellery Content Non-destructive Test Method X-ray Fluorescence Spectrometry.



▲Jewelry test example



Element	Intensity	Content
Au	0.484258	74.492227
Cu	0.196015	15.420389
Ni	0.122583	6.225294
Fe	0.090834	1.902314
Zn	0.080972	1.535448
Ag	0.012456	0.316642

The major constituents of this jewelry are: Au, Zn, Ni, Ag and Cu; the Au content is 74.495%

Corresponding Jewelry Type

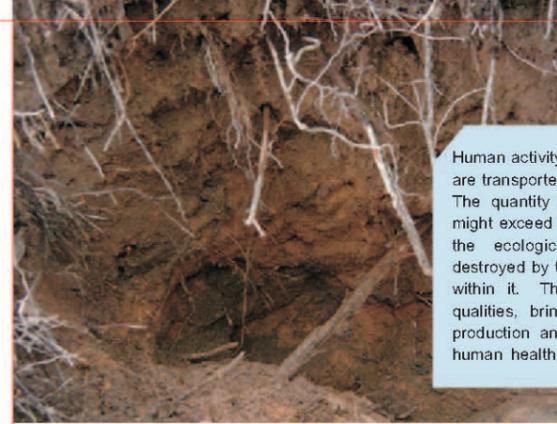
18k gold

Name of the precious metals jewelry	Types of jewelry	Content of metal elements	Type identifier
Au jewelry	18k gold	Au≥750‰	18K, G18K, G750, Au750
	Pure gold	Au≥990‰	Pure gold, G990, Au990
	Gold999	Au≥999‰	Gold999, G999, Au999
Ag jewelry	Ag jewelry	Ag≥925‰	S925, Ag925
	925 silver	Ag≥990‰	S990, Ag990
Pt jewelry	Pt900	Pt≥900‰	Pt900
	Pt950	Pt≥950‰	Pt950
	Pt990	Pt≥990‰	Pt990
Pd jewelry	Pd950	Pd≥950‰	Pd950
	Pd990	Pd≥990‰	Pd990

▲Precious metals jewelries currently sold on the market

Name of the imitation jewelries	Remarks
Gold filled	gold-filled jewelry is usually composed of a layer of thin gold leaf bonded to base metals such as brass, silver, zinc and nickel. Some gold-filled pieces have the look and feel of the gold. Jewelries of this kind are usually stamped with 34kf or 18kf.
Gold plating	gold plating is to deposit a thin layer of gold with thickness of about 10 micrometer onto the surface of another base metal, most often copper, silver, zinc, nickel or their alloys, by electrolyzing means. Jewelries of this kind are usually stamped with 18KGP and 24KG.
Pinchbeck	pinchbeck is a gold imitation material made by brass, most often plated with gold on the surface.
Rare-earth gold	rare-earth gold does not contain gold. It is an alloy composed of copper, nickel and a small amount of rare earth elements.
Ti gold	Ti gold is also an imitation jewelry and is seldom seen on the market. The base metal is usually coated with Ti to form a new substance TiN.

▲Imitation jewelries currently sold on the market



▲soil cutaway view

Human activity will produce different wastes, which are transported to the soils through different ways. The quantity and generation speed of the wastes might exceed the purifying ability of the soils. Then the ecological balance of the soils may be destroyed by the dominant accumulation of wastes within it. Therefore, soils lose functions and qualities, bringing a harmful effect on the growth, production and quality of the crops and that on human health, existence and development.

EDX Pocket III Application fields

An introduction to heavy metals in soils

Soils may be polluted by liquid and solid wastes from cities and industries dealing with heavy metals. The surface soil full of high intensity heavy metals, driven by wind or water forces, may continue to pollute the air, the surface water, the underground water and the ecological system, which altogether pose a great threat to human life and health. This is especially true when the pollutants are Hg, Cd, Pb, As, Cu, Zn, Ni, Co and V. Hg is usually found in waste water released by some plants. They will continue to exit in the soils for a very long time. Pb is usually found in car exhausts and steel melting industry. They are most often discovered in the soils on both sides of the roads. Arsenic is usually found in pesticide, antiseptic, rodenticide, weed killer and vulcanization ores exploration, separation and melting industry.

As a powerful weapon to keep soils safe, EDX Pocket III Handheld X-ray Fluorescence Spectrometer is widely used to provide multi-elemental analysis of all types of soils. It can also be used in archeology. The samples can be solids, dust, powder, scraps, slurry filtered substances and membranes.



▲On-site analysis of suspicious polluted area



▲Area identification of landfills

Applied to:

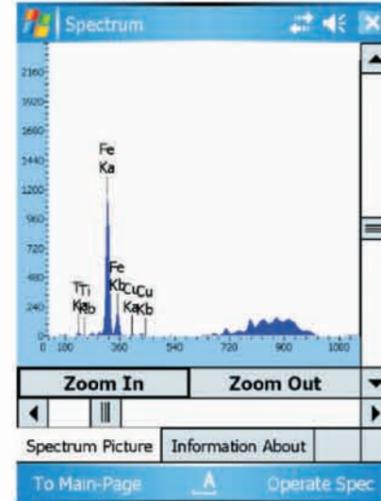
- Pre-sorting of contaminated soil before landfill
- Protection of water resource
- Environment protection institutes
- Archeology and soil research



▲Evaluation of soil ecological balance influenced by industrial liquid wastes

EDX Pocket III Test Example and Analysis

An Introduction to Precious Metals Analysis



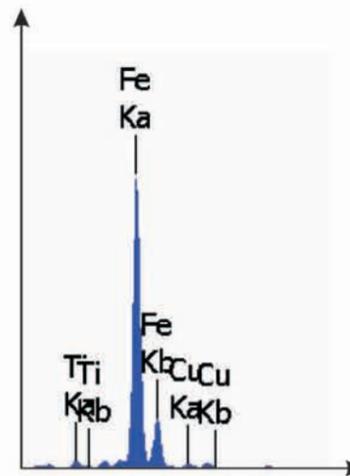
▲ Spectrum of soil test



Element	Intensity	Content
Ca	0.011259	0.528252
Ti	0.028632	0.918795
V	0.005475	0.017697
Cr	0.040963	0.082305
Mn	0.048252	0.033808
Co	0	0
Fe	1.68686	6.339775
Ni	0.021085	0.001014
Cu	0.030997	0.011775
Zn	0.03379	0.017276
Br	0.00825	0
Zr	0.103853	0.105714

▲ Results of soil test

Heavy metals contained in the soils are Fe, Ti, Ca, Zr, Cr, and Mn.



▲ Heavy metals spectrum in soils

EDX Pocket III Application fields

An Introduction to RoHS/Non-halogen Testing of Electric and Electronic Appliances and Toys

RoHS directive is also called green directive, which covers a wide range of products: electronic, electric, medical, communication, toys, and safety protection equipments. They include not only the whole machine products, but also the related spare parts, raw materials and packing materials.

RoHS directive restricts the amount of Pb, Hg, Cr⁶⁺, PBB and PBDE contained in the related products to be less than 0.1%(1000ppm) and Cd 0.01%(100ppm). These restriction values are the legislative basis for determining whether the products comply with the directive or not.

According to Non-halogen Standard of International Electrotechnical Commission (IEC 61249-2-21), the maximum amount of Br element in the related products is restricted to 0.09% (900ppm), Cl to 0.09% (900ppm) and Br+Cl to 0.15% (1500ppm).

Skyray instrument has been engaged in the research, production and sales of X-ray fluorescence spectrometers since its establishment. Our **EDX Pocket Series Handheld X-ray Fluorescence Spectrometers** have received warm repercussion from the manufacturers of electric and electronic products for RoHS testing. After the enforcement of EU Toy Directive, they have become a powerful weapon of toy safety testing.

Applied to:

- Production of electric components and parts
- Third party evaluation of electric spare parts and raw material suppliers
- Testing and verification of packing material
- Testing and identification of hazardous elements in batteries
- Testing of toys, stationeries, children goods and gifts

Precision parts: accurate positioning, interference eliminated.



Non-destructive test of precious goods: with no damage to the objects.



▲ Toy safety testing

Large-sized articles: tested without barrier or limitation.



EDX Pocket III Application fields

Testing standard of substances restricted by RoHS Directive

Hazardous substances	Standards (mg/kg)
Cd	100
Pb	1000
Hg	1000
Cr⁶⁺	1000
PBBs	1000
PBDEs	1000

Non-halogen Standard

Hazardous substances	Standards (mg/kg)
Br	900
Cl	900
Br+Cl	1500

Restricted substances and their typical uses

Pb	
Solders	
Paints	Pigments and driers
Glass materials	Pb is allowed in fluorescent lamp
Ceramic materials	Pb is allowed in certain electronic ceramic materials
Iron, aluminum & copper materials	A certain amount of Pb is allowed
Plastics	PVC stabilizer and pigments
Batteries	Pb is allowed in acidic batteries for vehicles

Cd	
Plastics	Stabilizer and pigments
Solders	Seldom used
Ceramics	Seldom used
Connectors	Relays and switches
Batteries	Cd is allowed in Ni-Cd batteries
Semiconductors	Optical sensors and solar cell panels

Hg	
Batteries	Prohibited (see battery directive)
Connectors	Relays and sensitive switches
Fluorescent lamps	A certain amount of Hg is allowed

Cr ⁶⁺	
Passivation layers	Commonly used for naked metal surfaces to enhance adhesion of plating layers
Anti-corrosive plating layers	Painting and plating layers
Chrome plating layers	Plating layer of chromium metal is not under control
Plasticizer	Commonly used to plastics plating process but not final products

PBBs & PBDEs	
Plastics	Brominated flame retardants

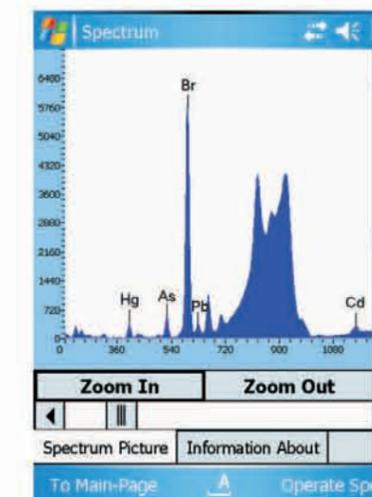
What are RoHS and WEEE Directives?

The European Union has adopted Directive 2002/95/EC on the restriction of certain hazardous substances (RoHS) and Directive 2002/95/EC on waste electrical and electronic equipment (WEEE) with their publication in the Official Journal of the European Union on February 13, 2003, which stipulates that the producer responsibility principle of WEEE comes into effect on August 13, 2005, and six hazardous substances are restricted to use in new electrical and electronic equipments put on market from July 1, 2006.



An Introduction to RoHS/Non-halogen Testing of Electric and Electronic Appliances and Toys

EDX Pocket III Test Example and Analysis



▲ Spectrum of toy test



Element	Intensity	Content
Br	494.715	808
Cd	14.295	140.8
Hg	24.4	25.3
Pb	13.905	107.6
As	34.62	30.9

▲ Results of toy test

Cd in this toy is RoHS incompliant:
Content of Cd is 140.8ppm > 100ppm
CBr in this toy is Non-halogen compliant:
Content of Br is 808ppm < 1500ppm

