NEX QC SERIES

Elemental analysis by X-ray fluorescence

Low cost EDXRF elemental analyzers

Rigaku

Applied Rigaku Technologies, Inc.

NEX QC delivers superior performance in a rugged package

Energy dispersive X-ray fluorescence (EDXRF) is a routinely used analytical technique for the qualitative and quantitative determination of major and minor atomic elements in a wide variety of sample types. The heart of its versatility stems from the ability to provide rapid, non-destructive, multi-element analyses — from low parts-per-million (ppm) levels to high weight percent (wt%) concentrations — for elements from sodium ($_{11}$Na) through uranium ($_{92}$U).

The versatile Rigaku NEX QC series of EDXRF spectrometers delivers routine elemental measurements across a diverse range of matrices — from homogeneous liquids of any viscosity to solids, thin films, alloys, slurries, powders and pastes.

Elemental analysis in the field, plant or lab

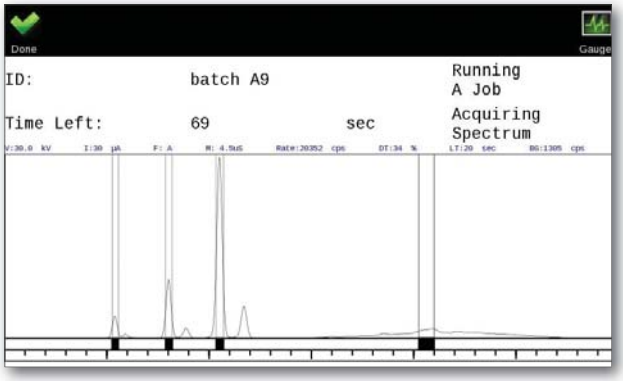
Especially designed and engineered for heavy industrial use, whether on the plant floor or in remote field environments, the superior analytical power, flexibility and ease-of-use of the NEX QC series add to its broad appeal for an ever expanding range of applications, including exploration, research, RoHS inspection, and education, as well as industrial and production monitoring applications. Whether the need is basic quality control (QC) or its more sophisticated variants — such as analytical quality control (AQC), quality assurance (QA) or statistical process control like Six Sigma — the NEX QC series is the reliable choice for routine elemental analysis.

Next generation low cost EDXRF elemental analyzer

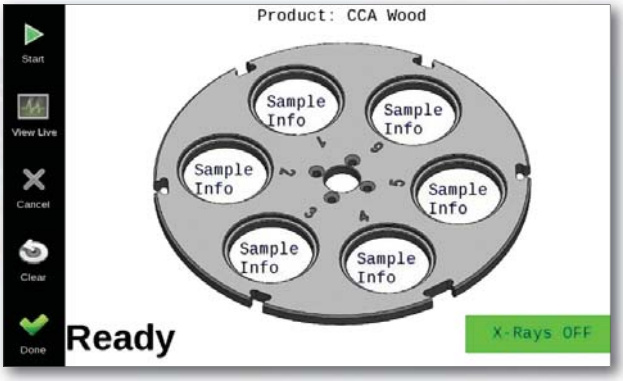
Intuitive software with touchscreen interface

Availability of hardened high-resolution touchscreen displays has allowed Rigaku to redefine the user interface experience for the 21st century. Membrane keyboards and primitive displays are now a thing of the past. Operating the NEX QC series of elemental analyzers is a familiar experience, with finger selectable icons guiding users through routine analysis operations. Touchscreen interface technology lowers the cost of ownership because it simplifies operator training and reduces the potential for operator error.

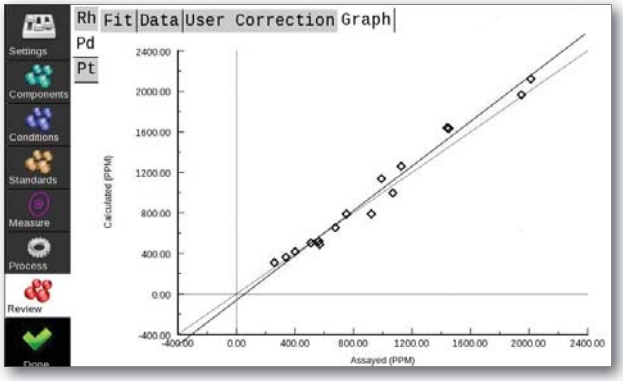
Touchscreen style top level menu allows the operator to select the desired analysis with the touch of an icon



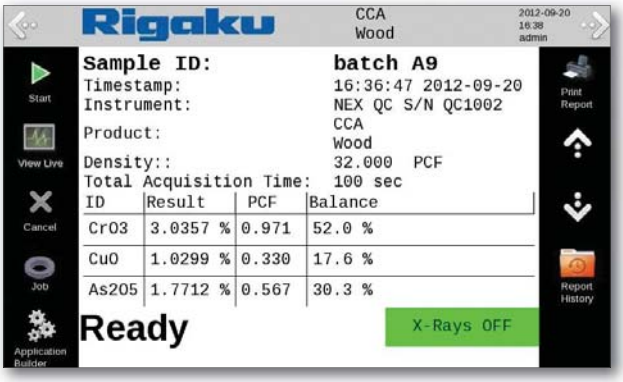
Live spectrum acquisition with the NEX QC showing Cr, Cu and As peaks from a treated lumber sample



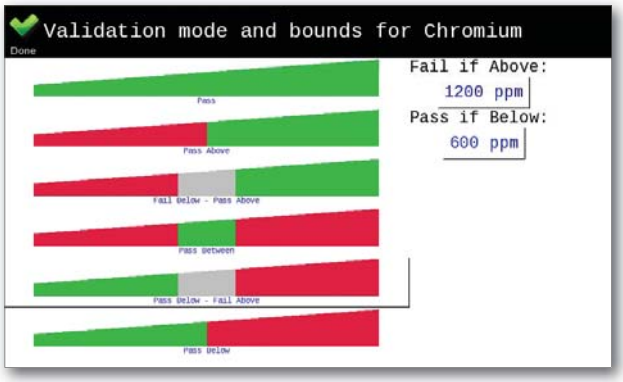
Next, enter the sample identification for each sample tray position and touch the "start" icon



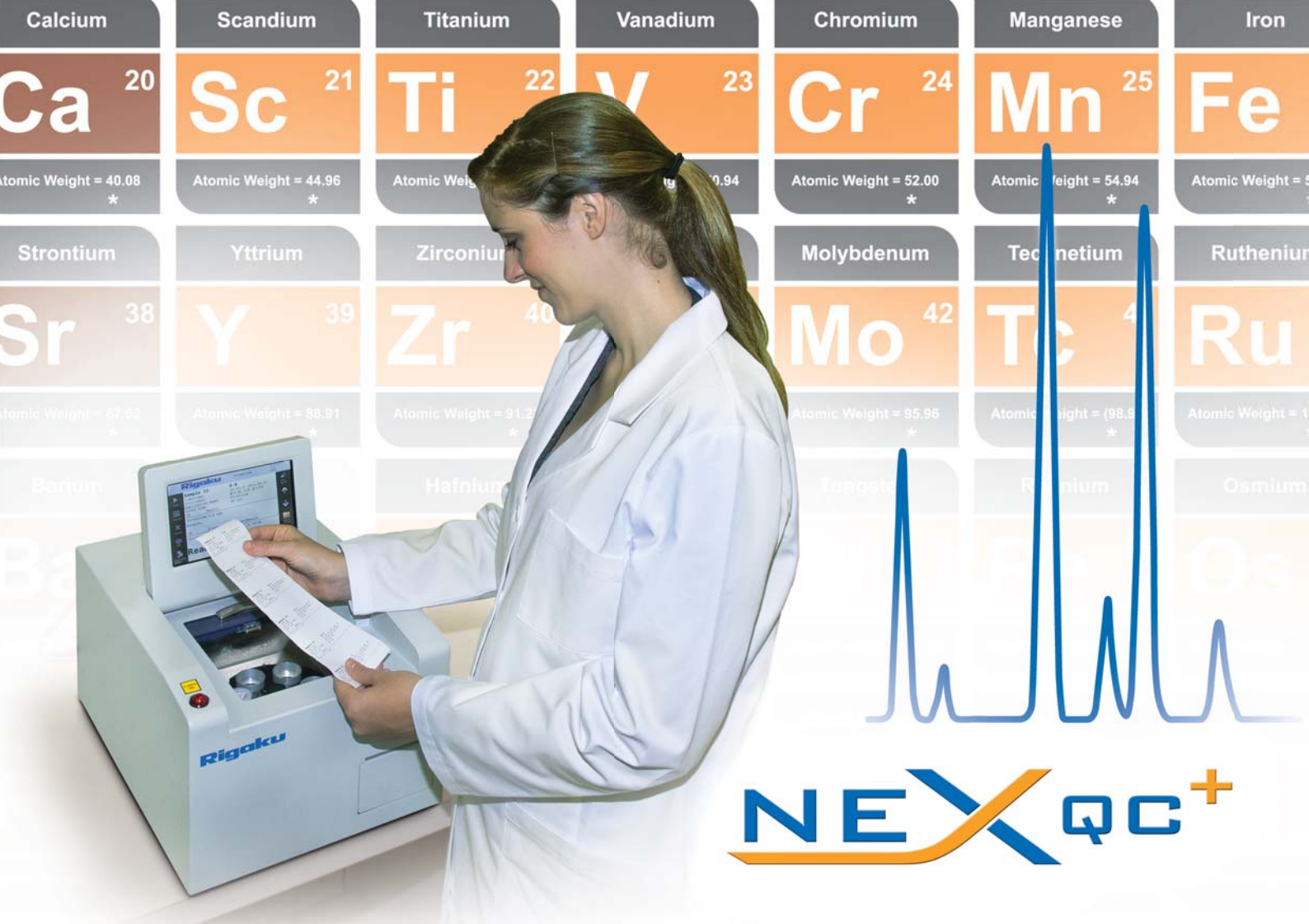
Calibration curves and statistics are accessible with a familiar touchscreen style interface



Analytical results, spectra and instrument status are icon selectable with the touch of a finger



Validation mode may be easily set up to afford automatic pass/fail interpretation of analytical results

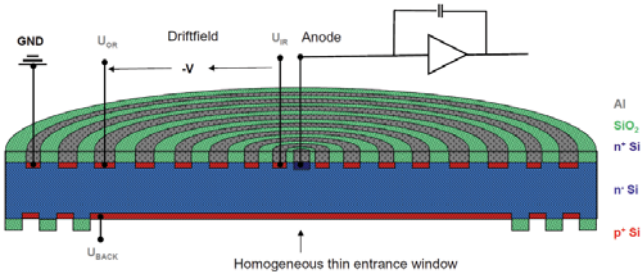


NEX QC+ for exceptional spectral resolution and throughput

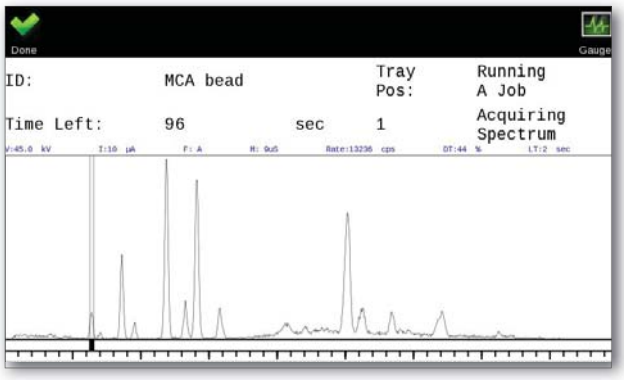
For more demanding applications, or for situations where analysis time or sample throughput is critical, Rigaku offers the NEX QC+ spectrometer. Employing the next generation silicon detector technology, the enhanced NEX QC+ affords significant improvements in elemental peak resolution and counting statistics, resulting in superior calibrations and precision for the most challenging measurements.

Silicon drift detector technology

A silicon drift detector (SDD) affords extremely high count rate capability with excellent spectral resolution. This enables NEX QC+ to deliver the highest precision analytical results in the shortest possible measurement times. The unique engineering feature of SDD is the transversal field generated by a series of ring electrodes that forces charge carriers to "drift" to a small collection electrode. Current generation SDD detectors, with the field effect transistor (FET) moved out of the radiation path, represent the state-of-the-art in conventional EDXRF detector technology.



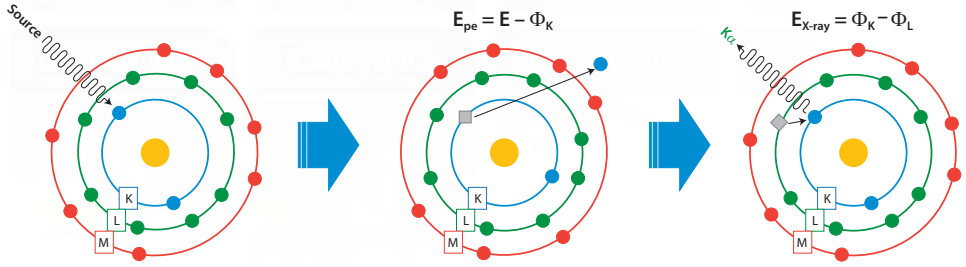
Simplified diagram of an SDD detector illustrating the concentric ring construction that allows for very high X-ray count rates



Live spectrum acquisition with the NEX QC+ spectrometer featuring the high-resolution SDD detector

How it works

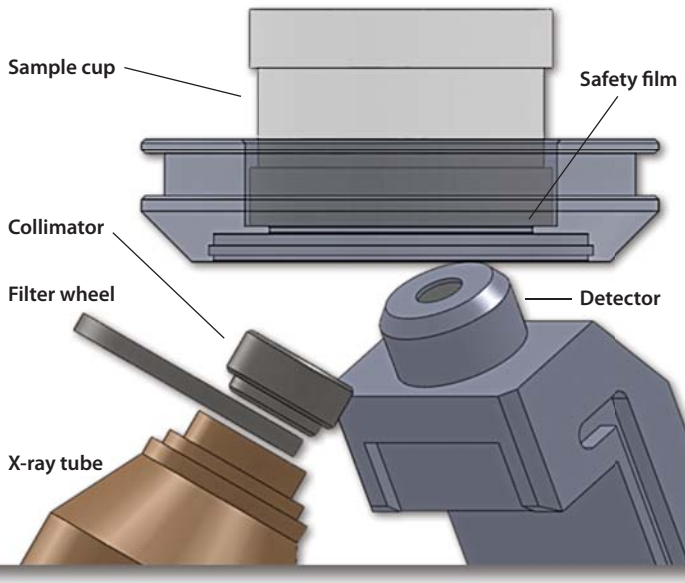
In X-ray fluorescence (XRF), an electron can be ejected from its atomic orbital by the absorption of light (photon) from an X-ray tube. The energy of the photon (hv) must be greater than the energy with which the electron is bound to the nucleus of that atom. When an inner orbital electron is ejected from an atom (middle image), an electron from a higher energy level orbital transfers to fill the vacant orbital. During this transition, a photon may be emitted (right image). Because the energy difference between two specific orbital shells is always the same for a specific element, the emitted photon will always have the same characteristic energy (keV). For a fluorescent emission line, for a given element, the number of photons per unit time (counts per second or cps) is related to the amount of that element in a sample. Counting rates are calculated by measuring, for a set time, the number of photons detected for the various observed elemental X-ray fluorescence lines (spectral peaks). Thus, qualitative and quantitative elemental analysis is achieved by determining the energy of X-ray peaks in a sample spectrum and measuring their associated count rates.



X-ray fluorescence schematic

Computational dexterity

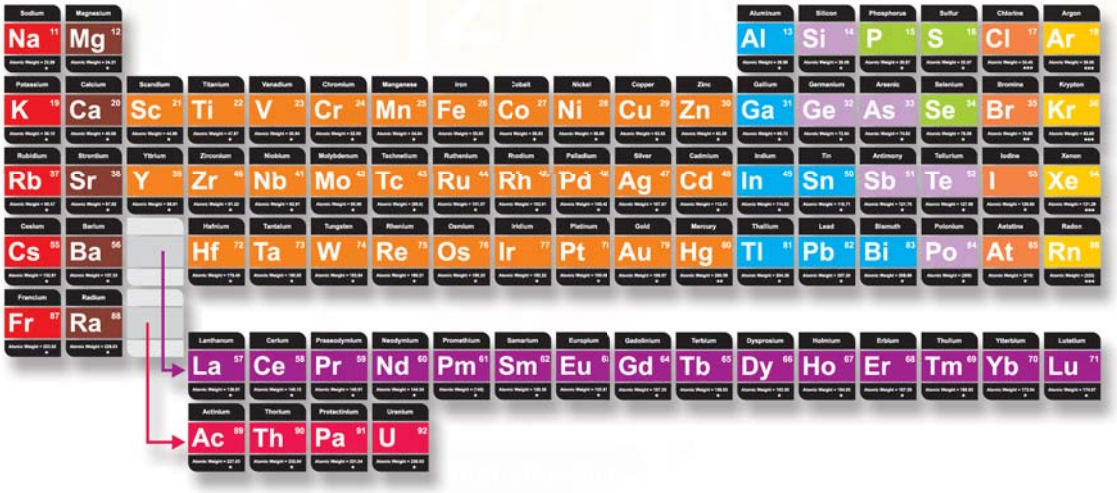
In addition to being remarkably easy to use, each Rigaku NEX QC series elemental analyzer is powered by sophisticated software running on an embedded computer. Empirical calibration curves may be linear, quadratic or hyperbolic fits. In addition, to compensate for the presence of other elements, intensity-based or concentration-based alpha (α) corrections may be enabled (automatically calculated given sufficient standards). C/H correction is also available to compensate for light element matrix changes and/or changes in average atomic number. All calibration functions are accessible via intuitive icons at the touch of a finger.



State-of-the art X-ray optics

The NEX QC series employs a 50 kV X-ray tube, and Peltier cooled semiconductor detector technology to deliver exceptional short-term repeatability and long-term reproducibility with excellent elemental peak resolution. The high voltage, along with multiple automated X-ray tube filters, provides multi-element analysis capability for unmatched performance with low limits-of-detection (LOD). Optics are protected by a safety film that requires no tools to change.

Nondestructively analyze from sodium through uranium



Touchscreen interface

High-resolution, modern, user-friendly touch screen navigation and instrument control; display interface is "petro pump" quality and hardened for heavy industrial use.

No tools safety film

No tools are required to change the safety film protecting the optical kernel, enabling easy and rapid replacement.

Built-in printer

Thermal printer provides fast hard copy results when and where you need them.

X-ray tube conservation

By operating only during data collection, X-ray tube wear and tear is minimized — lowering operating costs.

Silicon detector technology

High-resolution, high-throughput thermo-electrically cooled Si-detector is standard on the NEX QC. Even higher performance is available with the SDD equipped NEX QC^{+}.

Up to 38 calibrations

A large number of calibrations are available at the touch of a finger, supporting a vast array of applications and sample types.

Digital data output

Ethernet RJ-45 jack and USB port for output to LIMS or memory stick. Data is available in either CSV or PDF format.

Single position or autosampler

Standard single position configuration can be supplemented with an optional autosampler.

Removable sample trays

Interchangeable optional autosampler trays may be pre-loaded, and swapped in and out, to increase efficiency or where throughput is important. Supports 32 mm and 40 mm cups.

Applications span global industries

Catalysts

EDXRF analysis of heterogeneous and homogeneous catalysts can be used to determine heavy metal content or stoichiometry and/or to quantify poisoning agents. Determination of the value of precious metals content in recycled automotive catalysts is a cost effective application for the NEX QC^{+}.

Cement

The Rigaku NEX QC series of elemental analyzers are reliable and rugged low-cost systems for quality control measurements at cement plants, making them ideal tools throughout the production process and as backups to WDXRF systems. They are applicable to clinker and raw meal, and may be used to measure gypsum (SO_3) in finished cement.

Coatings

Paper and plastic may be coated with a thin layer of silicone as a release coating in the manufacture of tape or other adhesives or as a barrier coating for protection against air in the packaging of food and other materials. Metallic coatings, either electroplated or sputtered onto some substrate material, may also be quantified with NEX QC series.

Cosmetics

Since many additives in cosmetics are minerals or inorganic compounds, EDXRF is ideal. Applications include Ti and Zn oxides as UV blockers as well as Fe, Ti and Zn oxides and metallic dyes as pigments. Rigaku's NEX QC series of elemental analyzers can also screen cosmetics for toxic metals and inspect incoming raw materials.

Education

An understanding of the basis of atomic spectroscopy is one of the key tenets underpinning the core sciences of physics and chemistry. Low cost EDXRF is an ideal way to give students instrumentation time in the lab to support their classroom instruction. Unlike AA or ICP, no routine maintenance or consumables are required.

Geology

In studying Earth, geologists routinely analyze the composition of rock and mineral samples. Rapid elemental analyses can be accomplished with NEX QC series of elemental analyzers without sample digestion. Common industrial geological applications include analysis of limestone, kaolin clay and silica sand.

Metals and alloys

Elemental analysis is typically used as a basis for classifying metals and alloys, controlling their production processes, or verifying their designation. Rigaku's NEX QC series of elemental analyzers are specifically designed for routine QC applications, such as the non-destructive measurement of iron and other elements in aluminum alloys.

Mining and refining

Foundries, smelters and mills are characterized by having continuous production, demanding control of both the process and the quality of incoming and outgoing materials. NEX QC series of elemental analyzers may be used to analyze ores, feeds, slags and tails. Low cost EDXRF also makes an ideal backup analyzer.

Paint and pigments

Many paints and pigments contain metal dyes, opacifiers and other inorganic stabilizers that can be analyzed by EDXRF. One specific application is titanium dioxide and lead chromate in white and yellow road paint respectively. NEX QC series is the ideal low cost solution for industrial quality control, as well as for forensic identification of paint chips.

Petroleum

From the quantification of heavy elements in crude oil to sulfur in fuels to a variety of elements in lubricating oils, EDXRF is a well established technique for the petroleum and petrochemical industries. For sulfur in crude oil, bunker fuel and ULSD, NEX QC series is specific to ASTM D4294, ISO 20847 and 8754, IP 496 and 336, JIS K 2541-4, as well as ISO 13032.

Plastics

Plastics, polymers, and rubber are combined with different additives to afford specific properties. Commonly analyzed as beads, pressed or molded into plaques, typical applications include Br and Sb as fire retardants; stabilizers and lubricants such as P, Ca, Ba, and Zn, as well as Mg, Al, Si, Fe in fiberglass and S in polyurethane.

RoHS

RoHS provides that plastics for consumer goods — as well as new electrical and electronic equipment put on the market for the first time from July 1, 2006 — should not contain certain heavy metal toxins, including: Pb, Cd, Hg, and hexavalent chromium (Cr). NEX QC series can help manufacturers comply with RoHS by providing routine elemental analysis.

Wood

Processes undertaken to prevent wood rot fall under the definition of wood preservation or timber treatment. The NEX QC can help control a number of different chemical preservatives and processes used to extend the life of wood and engineered wood products, including: CCA, IPBC, PENTA, copper (CA-B, CA-C), and ACZA.

Wovens and non-wovens

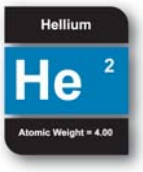
Fabrics of all kind are either created with inorganic chemical additives or treated with compounds to modify the behavior of the material. The NEX QC series of Rigaku elemental analyzers is ideal for quantifying compounds such as fire retardants, UV stabilizers, anti-microbial treatments and electromagnetic shielding.

Options

Sample spinner

Coarse grained, inhomogeneous and rough finished samples should be rotated during analysis to provide an averaged presentation and to suppress diffraction peaks. Thus, a single-position 32 mm sample spinner is offered as an option. Extremely robust in design, the spinner is almost completely silent while rotating at its nominal speed of 32 rpm. It may be used in autosampler equipped models by replacing the automatic sample tray as needed.

Helium purge



Light element performance is dramatically improved by use of a helium (He) environment during analysis. Helium flow rate is 0.2 liters per minute (SLM).

Autosampler

In addition to the standard single-position (32 mm) sample holder (right image) and large object adapter, two automatic sample changers are offered as options. A six-position changer (left image) accommodates 32 mm samples while the five-position variation accepts 40 mm samples. Both autosampler trays take the respective industry standard XRF sample cups. Extra trays may be used to preload trays for easy batch analysis.

NEX QC+ QuantEZ

The NEX QC+ QuantEZ benchtop EDXRF analyzer is designed specifically for heavy industrial use, whether on the plant floor, lab, or in remote field environments. The superior flexibility and ease-of-use of the NEX QC+ QuantEZ adds to its broad appeal for an ever expanding range of applications, including exploration, research, education and industrial QA/QC. Its advanced QuantEZ software offers all the functionality required for calibration and routine operation. In addition, Rigaku offers an advanced RPF-SQX Standardless Fundamental Parameters package.

NEX DE series

The NEX DE Series benchtop EDXRF elemental analyzers employs a 60 kV excitation source and high throughput and resolution Silicon Drift Detector for rapid variable spot size elemental analysis, covering a wide elemental range with the easy-to-learn Windows®-based QuantEZ software. Non-destructively analyze from sodium (Na) through uranium (U) in almost any matrix, from solids and alloys to powders, liquids, slurries, multi-layer coatings and RoHS materials. Its advanced QuantEZ software offers all the functions required for calibration and routine operation. In addition, Rigaku offers an advanced RPF-SQX Standardless Fundamental Parameters package.

NEX CG

The Rigaku NEX CG delivers rapid qualitative and quantitative determination of major and minor atomic elements in a wide variety of sample types — with minimal standards. Unlike conventional EDXRF analyzers, the NEX CG was engineered with a unique close-coupled Cartesian Geometry (CG) optical kernel that dramatically improves signal to noise. By using monochromatic secondary target excitation, instead of conventional direct excitation, sensitivity is further improved. The resulting dramatic reduction in background noise, and simultaneous increase in element peaks, result in a spectrometer capable of routine trace element analysis even in difficult sample types.

Specifications

Excitation
50 kV X-ray tube
4 W max power
6 tube filter positions

Detection
High performance semiconductor detector
Peltier thermo-electric cooling
Optimum balance of spectral resolution and count rate

Sample chamber
Large 190 x 165 x 60 mm sample chamber
Single position 32 mm sample aperture
Single position 40 mm sample aperture (optional)
Bulk sample aperture
6-position 32 mm automatic sample changer (optional)
5-position 40 mm automatic sample changer (optional)
Single position 32 mm sample spinner (optional)
Analysis in air or helium (optional)

Software
Qualitative and quantitative analysis
Normalization and validation feature
Data export function with LIMS compatibility
User selectable shaping times
Simple flow bar wizard to create new applications
Icon driven graphical user interface
Password protection

Environmental conditions
Ambient temperatures 10 – 35°C (50 – 95°F)
Relative humidity <85% non condensing
Vibration undetectable by human
Free from corrosive gas, dust, and particles

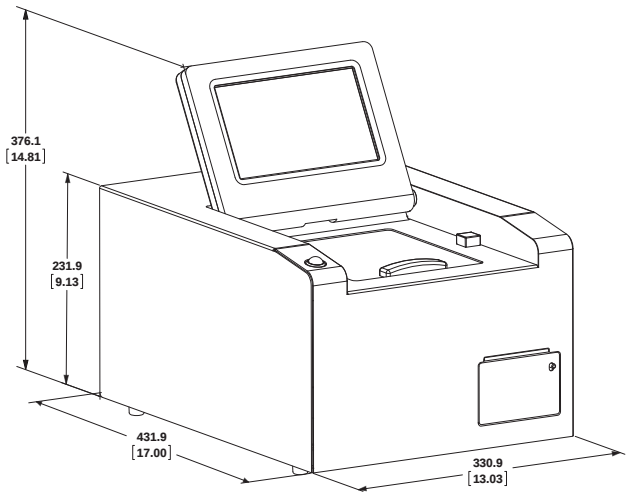
User interface
8" WVGA touch screen interface
Embedded computer
Internal thermal printer
USB and ethernet connections

Backed by Rigaku

Since its inception in 1951, Rigaku has been at the forefront of analytical and industrial instrumentation technology. Today, with hundreds of major innovations to our credit, the Rigaku Group of Companies are world leaders in the field of analytical X-ray instrumentation. Rigaku employs over 1,400 people worldwide in operations based in Japan, the U.S., Europe, South America and China.

Options
6-position 32 mm automatic sample changer
5-position 40 mm automatic sample changer
Single position 32 mm sample spinner
Helium purge

Spectrometer data	
Single phase AC	100/240 V, 1.4 A (50/60 Hz)
Dimensions:	331 (W) x 432 (D) x 376 (H) mm (13 x 17 x 14.8 in)
Weight:	16 kg (35 lbs.)



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