

# NANOHUNTER II

Benchtop Total reflection X-ray Fluorescence Spectrometer

Ultra-trace elemental analysis of aqueous liquids to parts-per-billion levels  
Trace elemental characterization of surface residues, surfaces and thin films

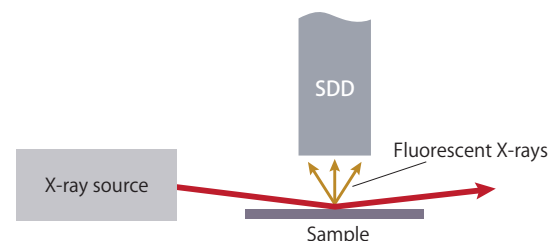


## Easily installed compact benchtop design

- Ultra-trace analysis
- Fast measurements
- High sensitivity for As, Se and Cd
- Thin film characterization
- Nano-particle analysis

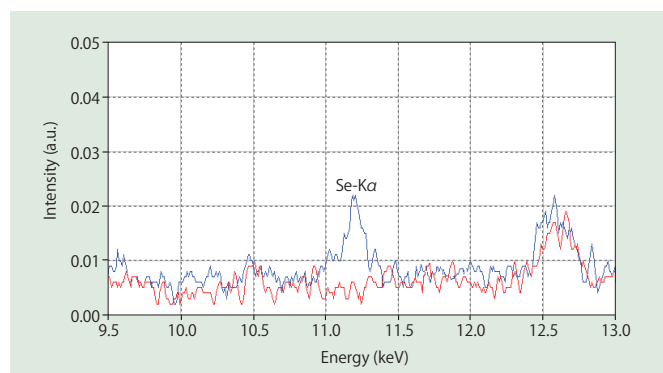
### Principle of operation

An incident X-ray beam impinges upon the sample at a shallow angle (below the critical angle for total reflection of X-rays for the substrate) resulting in virtually complete reflection of the excitation beam away from the silicon drift detector (SDD). This affords dramatically reduced background contributions in the measured energy dispersive X-ray fluorescence spectra. By efficiently exciting the surface elements, while virtually eliminating the background noise, the TXRF technique affords extremely high signal-to-noise performance resulting in ultra-trace elemental measurement sensitivity.



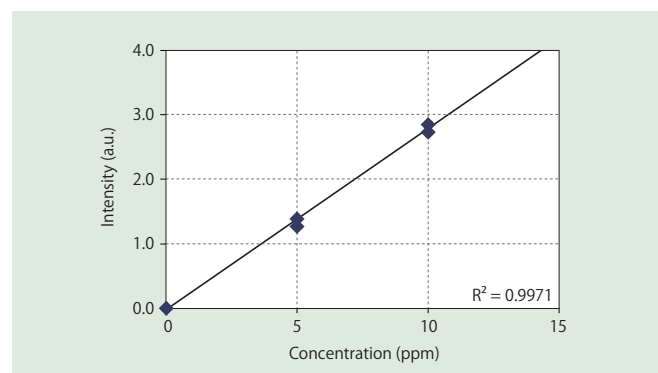


### Example: environmental analysis (effluent)



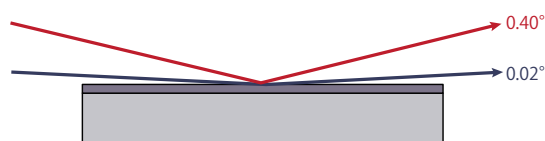
According to standards for hazardous pollutants in effluent, set by the Ministry of the Environment in Japan, arsenic (As) and selenium (Se) limits are set below 0.1 mg/L. The spectrum of 10 ppb Se in water solution clearly shows a prominent K $\alpha$  peak relative to the background (red spectrum). From this measurement, the calculated lower limit of detection (LLD) is about 0.8 ppb. The sample was easily prepared by pipetting 10  $\mu$ L of aqueous solution onto a glass substrate followed by drying. Large numbers of samples may be quickly prepared and measured with this "Drop & Dry" sample preparation technique.

### Example: palladium catalyst analysis



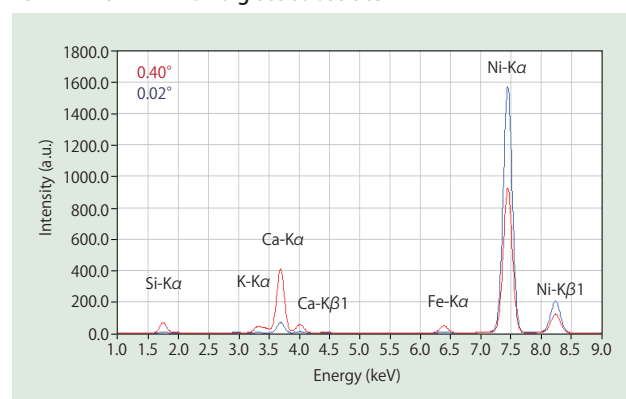
With a traditional direct excitation XRF spectrometer, it is difficult to obtain high signal-to-noise spectra for elements like palladium (Pd) or rhodium (Rh) due to high background intensities in the K-line energy range (20-22 keV). However, with the TXRF technique, it is possible to dramatically reduce the background present in the measured spectra. In this example, the calibration curve was calculated from measurements on samples made by pipetting 10  $\mu$ L of 5 ppm and 10 ppm respective aqueous Pd standards onto glass substrates followed by drying. A lower limit of detection (LLD) of 2 ppb was obtained from this curve.

### Unique variable angle GI-XRF capability



For thin film analyses, a methodology called grazing incidence X-ray fluorescence (GI-XRF) may be employed whereby elements on and beneath the surface are selectively excited by varying the grazing angle of the X-ray source. In this example, a 25 nm nickel (Ni) thin film on a glass substrate was measured at two different grazing angles: 0.02° and 0.40°. Only Ni was strongly excited at 0.02° GI excitation condition (blue spectrum). However, elements included in the glass substrate are excited at the higher 0.40° angle (red spectrum) because X-rays penetrate more deeply into the substrate.

### 25 nm Ni thin film on a glass substrate



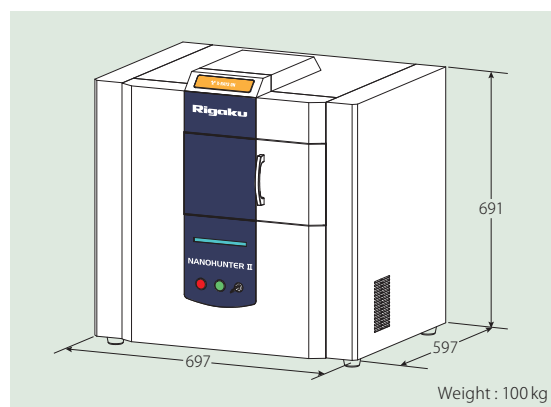
### Specifications

X-ray tube	Rated output	600 W
	Target material	Mo
XG	Voltage / Current	50 kV - 15 mA
Optics	Monochromator	Double stacked
	Grazing angle	-0.05 - +0.45
Detector	Type	SDD (Peltier thermo-electric cooling)
Sample chamber	Atmosphere	Air, N <sub>2</sub> *, He*
	Turret	16
	Sample size	26 x 76 mm, $\phi$ 30 mm
	Thickness	max. 5 mm
	Measuring area	10 mm

\* Optional

### Dimensions

Unit : mm



Specifications and appearance are subject to change without notice.

Rigaku Corporation and its Global Subsidiaries

e-mail: info@rigaku.com www.Rigaku.com