TX 2000 TOTAL REFLECTION AND TRADITIONAL ENERGY DISPERSIVE X-RAY FLUORESCENCE SPECTROMETER

Principles of the TXRF analytical method

TXRF is founded on the same principles of the EDXRF with, however, one significant difference. In contrast to EDXRF, where the primary beam strikes the sample at an angle of 45°, TXRF uses a glancing angle of a few milliradians. Owing to this grazing incidence, the primary beam is totally reflected. By illuminating the sample with a beam that is being totally reflected, absorption of the beam in the supporting substrate is largely avoided and the associated scattering is greatly reduced. This also reduces the background noise substantially. A further contribution to the reduction of the background noise is obtained by minimising the thickness of the sample. A small drop of the sample (5-100 microliters of the substance dissolved in an appropriate solvent) is placed on a silica carrier. On evaporation of the solvent a thin film, a few nanometers thick, remains. In practice the greater part of the scattering normally arising from the sample and its matrix is eliminated. This is because matrix effect cannot build up within minute residues or thin layers of a sample. Besides its high detection power, simplified quantitative analysis is made possible by an internal standard.

Main advantages of the TXRF

- No matrix effects
- A single internal standard greatly simplifies quantitative analyses
- Calibration and quantification independent from any sample matrix
- Simultaneous multi-element ultra-trace analysis
- Several different sample types and applications
- Minimal quantity of sample required for the measurement (5 µl)
- Unique microanalytical applications for liquid and solid samples
- Excellent detection limits (ppt or pg) for all elements from sodium to plutonium
- Excellent dynamic range from ppt to percent
- Possibility to analyse the sample directly without chemical pretreatment
- No memory effects
- Non destructive analysis
- Low running cost

Applications

- Environmental Analysis: water, dust, sediments, aerosol
- Medicine: toxic elements in biological fluids and tissue samples
- Forensic Science: analysis of extremely small sample quantities
- Pure chemicals: acids, bases, salts, solvents, water, ultrapure reagents
- Oils and greases: crude oil, essential oil, fuel oil
- Pigments: ink, oil paints, powder
- Semiconductor Industry: by VPD (vapor-phase decomposition)
- Nuclear Industry: measurements of radioactive elements

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INSTALLATION REQUIREMENTS

Electrical system

Power connection: 230 V single phase +/- 10%, 50 or 60 Hz,
Maximum mains current: 40 A
Main fuse: 32 A
Maximum power consumption: 5.5 kVA
Ground terminal: 6 mm^2

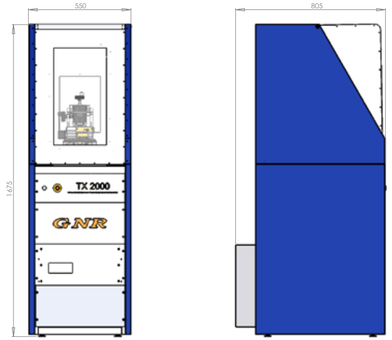
Power supply voltage fluctuation must not exceed 10%

Cooling water

Minimum flow rate: 4 l/min
Maximum pressure: 6 bars
Maximum inlet temperature: 35° C (minimum depends on dew point)

If the flow rate is lower than 4 l/min, the safety circuit for protection of the X-ray tube is activated, disabling the X-ray generating circuit. When minimum conditions of flow-rate cannot be fulfilled, use the water chiller, available as an optional extra.

EXTERNAL DIMENSIONS



Total weight: 185 Kg

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NEW

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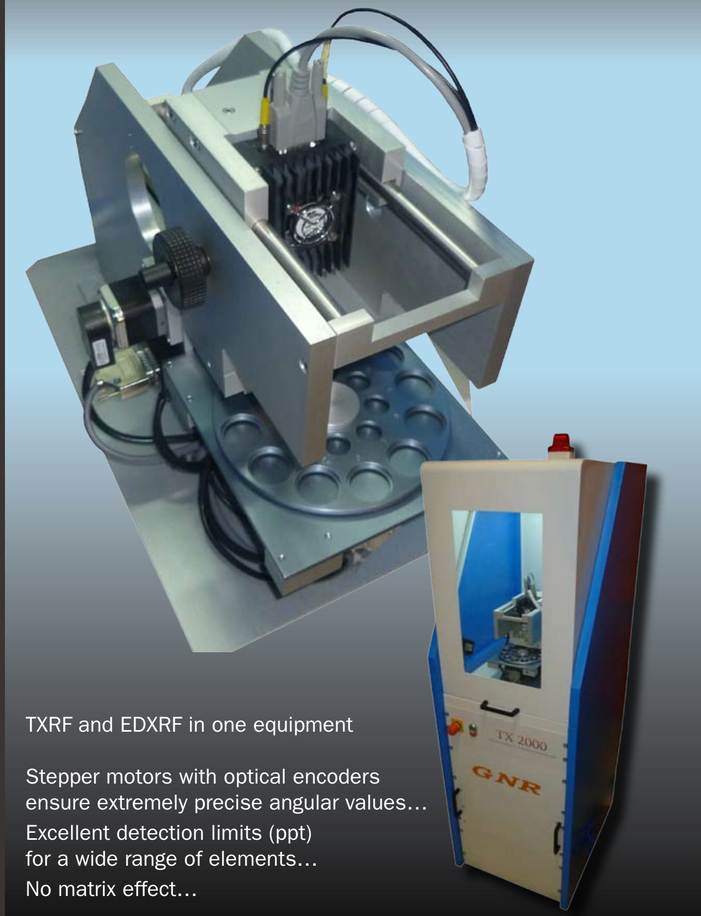
25 years of technology



TXRF and EDXRF in one equipment

Stepper motors with optical encoders ensure extremely precise angular values…

Excellent detection limits (ppt) for a wide range of elements…

No matrix effect…

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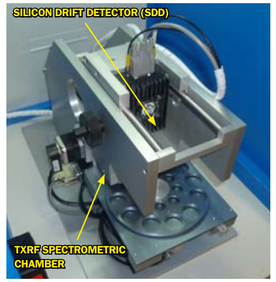
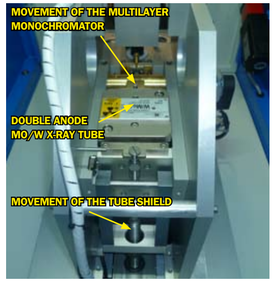
TX 2000 is the unique spectrometer that allows to perform Energy Dispersive X-Ray Fluorescence Analysis in both Total Reflection and Traditional (45 degrees) Geometry



Front view



Back view

The main features of the TX 2000 spectrometer

TXRF and EDXRF (traditional 45° geometry) spectroscopy in the same equipment.

Stepper motors with optical encoders ensure extremely precise angular values.

Automatic switching of primary beam (MoKα, WLα/Lβ and bremsstrahlung 33 keV) using double anode Mo/W X-ray tube, based on innovative software. We select the energy required using an high reflectivity 80% (WLα/Lβ/MoKα) multilayer. We can choose also other X-ray tubes and monochromatise the energy that you need.

Peltier-cooled Silicon Drift Detector with an energy resolution of 124eV FWHM@Mn Kα(shaping time 1 ms)

Minimal distance between the sample and the detector (mounted to the axis normal to the plane of the sample).

Instrumental detection limits for more than 50 elements below 10 pg.

Helium device to improve the detection limits for the light elements.

The Spectrometer is fully automated and you can control different total reflection conditions for different energies from the PC, using stepping-motors mowing monochromator and tube shield.

TXRFACQ32 acquisition program, which allows one to accomplish the following functions: X-ray generator load settings, multisample positioning, counter chain parameter settings, selection of radiation, centring procedure, K, L, & M markers, time or count selection, acquisition of data in both geometries (TXRF and EDXRF).

EDXRF32 for the elaboration of data that includes: Least square Marquardt fit procedure for the area calculation (spectral analysis), automatic/manual search function, manual or automatic calibration of energy, quantification via an internal standard using theoretical and experimental sensitivity curves for total reflection, several types of background correction.

TX 2000 - technical data

X-ray generator	Maximum output power	3 kW (option: 4 kW)
	Output stability	< 0.01 % (for 10% power supply fluctuation)
	Max. output voltage	60 kV
	Max. output current	60 mA (option: 80 mA)
	Voltage step width	0.1 kV
	Current step width	0.1 mA
	Ripple	0.03% rms < 1kHz, 0.75% rms > 1kHz
	Preheat and ramp	Automatic preheat and ramp control circuit
	Input voltage	220 Vac +/- 10%, 50 or 60 Hz, single phase
	Size	Width 48.3 cm, height 13.3 cm, depth 56 cm
X-ray tube	Type	Glass, Mo/W anode, long fine focus
	Focus	0.4 x 12 mm
	Max. output	2.5 kW
Multilayer monochromator	Type	Si/W
	Reflectivity	80% (WLα/Lβ/Mokα
Automatic sample	Sample seating	12 for TXRF - 1 for EDXRF (45°)
Detector	Type	Peltier-cooled Silicon Drift Detector (SDD)
	Active area	30 mm2 - (10 mm2, 50 mm^2 and 100 mm^2 as options)
	Energy resolution	Shaping time 1 ms:124eV FWHM@MnKα
Preamplifier	Type	Pulsed-reset charge-preamplifier
Case	Dimensions	Width 550 mm, heigh 1675 mm, depth 805 mm
	Leakage X-rays	< 1 mSv/Year (full safety shielding according to the international guidelines)
Processing unit	Computer type	Personal Computer, the latest version
	Items controlled	X-ray generator, tube shield, monochromator, detector, counting chain
	Basic data processing	Multisample positioning Counter chain parameter settings Selection of radiation Centring procedure K, L, & M markers Time or count selection Acquisition of data in both geometries (TXRF - EDXRF) Least square Marquardt fit procedure for the area calculation (spectral analysis) Automatic/manual search function Manual or automatic calibration of energy Quantification via an internal standard using theoretical and experimental sensitivity curves for total reflection

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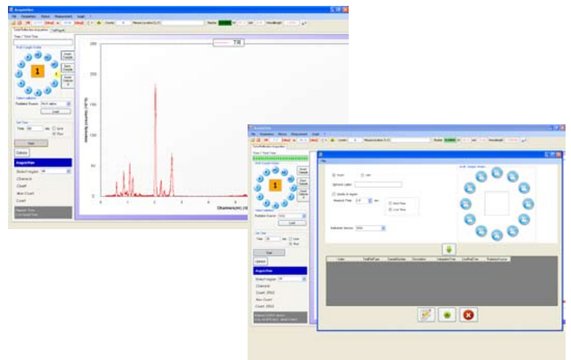
Easy to use, Easy to understand



Example of detection limits Chromlum in distilled water

Tungsten Radiation (40 kV – 30 mA)

Concentration (ppb)	Volume ml (5 x N)	Live Time (seconds)	Detection Limit (ppt)	Detection Limit (pg) = ppt x ml/1000
24.5	10 (5 x 2)	500	370	3.70
24.5	**50 (5 x 10)**	500	120	6.00
24.5	50 (5 x 10)	**300**	170	8.50
24.5*	**100 (5 x 20)**	**500**	**70**	7.00
24.5	100 (5 x 20)	**1000**	**55**	5.50
24.5	100 (5 x 20)	**5000**	**35**	3.50
1.97	10 (5 x 2)	500	400	4.00
1.97	10 (5 x 2)	**300**	440	4.40
1.97	**50 (5 x 10)**	500	**80**	4.00
1.97	50 (5 x 10)	**300**	125	6.25

* See the attached spectrum