



Molecular Spectroscopy & XRF (2026) - Near Infrared (NIR) -

A small technical talk on NIR

1. NIR is not different from other spectroscopic technologies such as UV-Vis, FT-IR, and Raman. They all look at Molecular Vibrations of organics. Only difference is the absorption signals of NIR are very weak. Is this Bad? If you are looking for % concentration of a sample, then it is excellent because UV-Vis and FT-IR cannot do it.
2. NIR's relationship with sample is much stronger (complicated) than UV-Vis, and FT-IR. There are special NIR platforms for different types of samples (coarse granule, power, fine powder, slurry, opaque solution, transparent solution, etc, etc.). NIR never work well with liquid that have lots of bubbles!
3. Because of this, FT-NIR could only be used for measuring clear liquids!
4. The only ways to solve the sample inhomogeneity problem is to have the illumination light with biggest possible spot size while maintaining the needed illumination energy! That is the sample should be illuminated as close to the sample as possible with the largest available spot size of the illuminating light.
5. People talked about AI analytics a lot more recently, and NIR is the first analytical technique employed this. Data analytics bases on sample size (population) and quality of samples because the analysis is based on statistically treatment (model building). Just like all AIs, users have to train the NIR system before it could be used efficiently.
6. There are factory-supply calibration models. These are built upon samples that the manufacturers have and could not be readily used. User have to add some samples of their own into the Pre-installed model to make the Model robust. As samples may change over the time, the calibration model has to be "maintained" if you want to use it correctly.

It is the NIR hardware to work with your samples, not the other way round because you are not supposed to pre-condition the sample to suit the hardware! NIR is a non-destructive analytical method.

NightLight - NIR (On-Line Process) - China

Near InfraRed (NIR) Spectrometer is the first scientific instrument ever used AI to conduct data analysis. At that time, no one call it as AI. Tens of thousands of samples are used to build a statistical model to reflect the quality of Pharmaceutical, Chemical, Petrochemical, Food/Feed, Dairy, Wine, Agricultural and Natural Products, etc.

Products include:

- DA60: Mobile / Portable NIR
- DA200: On Line System
- DA300 / 310: On Line Systems
- DA2000: On Line System
- DA3000: On Line System
- FTATR 600



Spot Size of about 10 cm



On-Line Process NIR Systems

Molecular Spectroscopy

Yooning - Nucleic Acid Quantification Systems - China

Most popular products include:

- FD-100 Fluorometer
- **NanoOne** & NanoOne S / **NanoAccu S** & NanoAccu Microspectrophotometer
- **Plate Reader**



Fluorometer



NanoOne



NanoAccu S



Plate reader

ppq sense - Saturated-absorption Cavity Ringdown CRD Spectroscopy - Italy

CRDS (Cavity Ring Down Spectroscopy) is not exactly a new technology. First of all, it has been around for about 20 years. It is an IR-based (infrared) technology. There are not that many manufacturers supply this for one simple reason. Gases of interest has to be informed to the supplier. Supplier then build one according to user's needs.

ppq sense's C14 SCAR (Saturated-absorption Cavity Ringdown) is a special form of CRDS designed for ^{14}C analysis. It is a high-precision, laser-based Radiocarbon analyzer.

Applications include:

Environmental monitoring and Certification of CO_2 emission quotes make CO_2 become the products to measure, valorize and exchange on global financial markets. Therefore, accurate and high resolution $^{14}\text{CO}_2$ measurement is essential to differentiate emissions from fossil or biogenic origins. Knowing the biogenic fraction of textile, plastics, oil, fuels is important for assessing their environmental impact.

Life/biomedical sciences ^{14}C is used as a marker of drugs / treatments, to monitor their metabolism and efficacy.

Monitoring of nuclear sites Areas around nuclear power plants / waste repositories has a higher concentration of radiocarbon dioxide, whose radioactivity might raise health issues for resident people.

Radiocarbon dating The most classic application of radiocarbon measurement for dating archaeological and cultural heritage: the radiocarbon content in a biological sample allows to trace the age of cessation of organic activity.



^{14}C Analyzer

Misc - UV-Vis, NIR, FT-IR, Raman, Photo-Acoustic, QCL (Quantum Cascade Laser), CRDS - Misc

There are simply too many of these around. Just let us know the nature of your sample and what you want to know out of the sample. Once known, we would recommend you the best one that would suit your analytical needs.

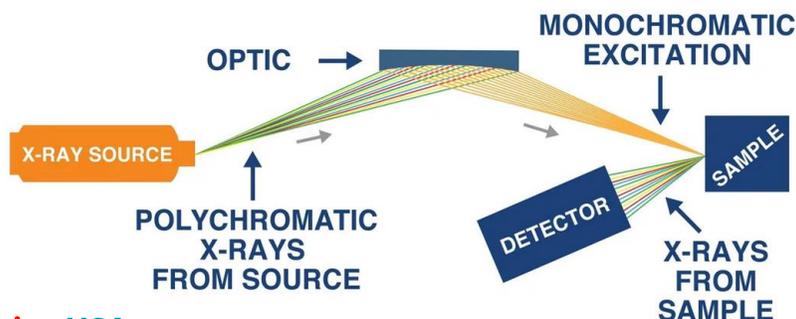


Hi-Definition XRF

XRF Technologies - Simplified Technical Talk

When X-ray is irradiated to a sample, electrons are excited to higher energy levels, and then fall back to their ground with release of fluorescence signals. These signals are characteristics of a that sample and the strength of the signals are related to the concentration of the irradiated sample. Therefore, XRF is both a quantitative and qualitative analyzer. All these are done without complicated sample treatments.

Because of the high concentration of elements in alloys, irradiation efficiency is not that critical. For heavy metal contamination of food and soil (of much lower concentrations), a special designed irradiation mechanism is needed. This is known as the **High Definition XRF** (as shown on the right diagram).



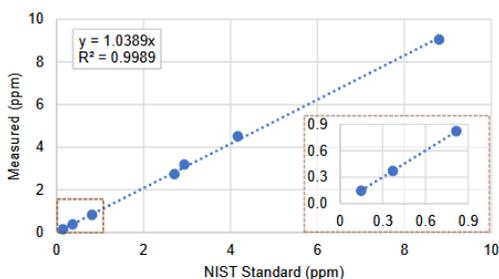
Z-Spec HDXRF - sub-ppm Elemental Analysis - USA

Portable XRF Analyzer for Low Level Heavy Metal Concentration in Food & Soil Samples

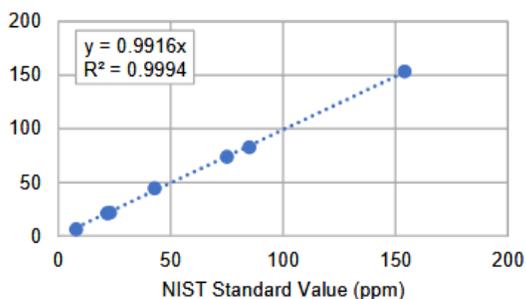
E-max is a robust and portable analyzer designed for rapid analysis of low concentration heavy-metals in soil and food. For agricultural inspection or environmental assessment, E-max enables screening or qualitative results in few minutes. This supports a more thorough analysis for improved site remediation and land-use decisions.



HDXRF Analyzer (for Soil and Food)

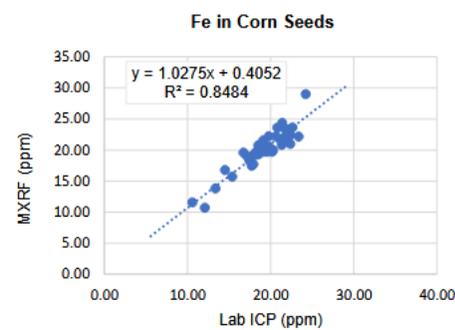
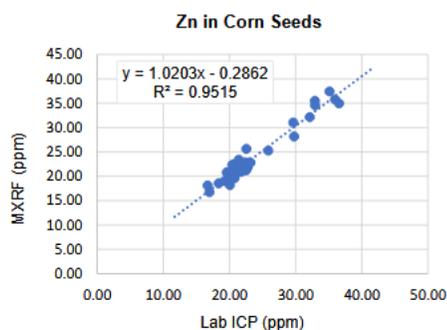


Cadmium (Cd)



Nickel (Ni)

Sample	Zn (unit: ppm)			Fe (unit: ppm)		
	Lab ICP	MXRF	RDF	Lab ICP	MXRF	RDF
1	32.94	34.58	5.0%	10.59	11.57	8.5%
2	22.39	22.85	2.1%	13.38	13.83	3.3%
3	25.88	25.28	-2.3%	14.52	16.77	13.4%
4	18.38	18.56	1.0%	15.40	15.71	2.0%
5	22.33	21.25	-4.8%	17.45	18.32	4.7%
6	21.52	22.64	5.2%	17.73	17.48	-1.4%
7	19.27	19.06	-1.1%	17.94	17.70	-1.4%
8	16.98	16.77	-1.2%	18.12	19.29	6.1%
9	21.41	23.38	9.2%	18.31	19.75	7.3%
10	22.75	21.95	-3.5%	18.53	19.29	3.9%
11	29.77	28.20	-5.3%	19.10	21.02	9.1%
12	20.63	20.77	0.7%	19.11	21.53	11.2%
13	29.65	31.03	4.7%	19.17	19.73	2.8%
14	21.84	21.13	-3.3%	19.62	19.73	0.6%
15	20.97	21.11	0.7%	20.32	19.99	-1.7%
16	20.20	20.98	3.9%	20.66	22.21	7.0%
17	23.17	22.83	-1.5%	21.21	21.65	2.0%
18	35.12	37.43	6.6%	21.42	24.36	12.1%
19	23.04	22.83	-0.9%	21.97	21.86	-0.5%
20	35.96	35.81	-0.4%	22.20	23.09	3.9%
21	21.74	21.29	-2.1%	22.64	23.65	4.3%
22	20.08	18.21	-9.3%	23.36	22.16	-5.4%
23	19.91	19.94	0.2%	24.05	22.12	-8.7%



Handheld XRF

Scensor – Alloy, Soil & Mineral Applications - China

Basically, **ALL** handheld XRFs use the “**SAME**” X-ray tube (irradiation source) and detector, the difference among all brands are very minimal **except the designs from Scensor**:

- Scensor’s unique internal vortex action cooling fan design is the only one available among all handheld XRF!
- Scensor’s unique double-handle design with front handle equipped with a power management circuit to isolate the noises from the main unit (heat source and the electronic noises)!
- Scensor’s X-ray tube and the detector are powered separately to prevent noises interferences between them.
- Scensor uses **4 different CPUs** for different purposes (**CPU 1** provides Android operating system, APP and algorithm operation; **CPU 2** is for hardware control, including the switch of light tube detector, light strip color control, trigger switch, etc.; **CPU 3** is designed for power management, including lithium battery charging and discharging, instrument switch, etc.; and **CPU 4** is designed for spectrum processing).
- When something went wrong, replacing **ONE** small circuit board instead of the main board. Most other XRF used one single circuit board.
- The 5.5-inch touch screen is the largest in handheld XRF, and it has a 1080-pixel resolution
- Scensor’s 6-piece 18650 Lithium battery-pack provide much longer use than other handheld XRF.

With all these unique feature, Scensor’s HX-5 could easily analyze:

- Content & thickness
- Mg ~ U in ppm to % level (Suitable for Mining and Alloy applications)
- Samples of solid, powder, liquid, slurry, film thickness



Cooling Module



Double-Handle Design



Noise Reduction Design



Whole Design of HX-5: From 5.5” Touch Screen at the Top to Battery-Pack of 6 Li-Battery pack at the Bottom



4 CPU Architect



Large 5.5” Touch Screen



XRF for Alloy Analysis

Guyline (Asia) Ltd.

Rm 1611, Eastern Harbour Centre, 28 Hoi Chak Street, Quarry Bay, Hong Kong

Tel: (852) 2856 0605

Fax: (852) 2811 3379

E-mail: admin@guyline-asia.com

Website: www.guyline-asia.com

香港 . 北京 . 上海 . 广州 . 深圳 . 成都 . 武汉 . 长沙 . 长春