

Sorting, Identification and Analysis of Metals and Alloys in the Recycling Industry

Thermo Scientific NITON® XL3 Handheld Alloy Analyzers – Simply Superior



Introduction and Overview

Fast and accurate metal alloy sorting and analysis has never been more important to maximizing the efficiency and profitability of a scrap yard. In the past, many metal recycling companies used little analytical testing equipment. Expert sorters with decades of experience could sort many alloys using a combination of common sense, simple chemical tests, and sparking samples on grinding wheels. Even so, throughput was limited, and sorting mistakes were common. Consequently, scrap consumers often resorted to re-testing incoming loads – or simply settled for the occasional costly mix-up. As sorting technology has advanced, the practice of accepting misidentified material is no longer tolerated. Today, such errors result in rejection of entire loads, as well as a loss of confidence and damaged business relationships.

Modern Sorting Technology

At a time when many older, experienced metal sorters have left the industry and been replaced by less knowledgeable workers, the need for fast, reliable sorting methods has never been greater. Fortunately, today's scrap yard workers are able to sort alloy samples faster and more accurately than ever before using handheld Thermo Scientific NITON XL3 Series analyzers. Point-and-shoot is truly a reality with these powerful, versatile, and easy-to-use tools. With just a short test, alloy grade and chemistry appear on the built-in VIP™ tilting color touch-screen display. The testing time is often less than one second for routine sorting, and just a few seconds longer to obtain lab-quality chemistry. Little or no sample preparation is usually needed, regardless of shape or size (see sidebar on page 2). From a single strand of 1 mm wire to turnings, to massive structures such as reaction vessels, all can be easily tested with a simple trigger pull.

NITON Analyzers – Anatomy of a Revolution

In 1999, the company led the way to an industry-wide revolution with its introduction of the XL-801S, the first handheld, lab-quality XRF analyzer for metal alloy analysis. Within one year of its introduction, we had become the leading supplier of handheld XRF analyzers worldwide. Since then, rapid growth has been fueled by technological advances, and partly by a vigorous recycling industry that has embraced the powerful capabilities of these constantly improving analyzers. Now, as part of Thermo Fisher Scientific, we continue to work intensively with our recycling customers to improve existing capabilities and add new features, enabling them to increase productivity, streamline operations, and maximize their opportunity for profit.

Rock-Solid Calibration and Grade Identification

One of the keys to success of Thermo Scientific NITON analyzers has been the instruments' fast, accurate, and precise fundamental parameters (FP) based calibration. The NITON XL3's proprietary FP analysis algorithm includes nearly every element of interest in virtually all types of metal alloys and does not require special calibration or other user input.

NITON XL3 Benefits At-a-Glance

- Fastest throughput for the highest productivity
- Most accurate analysis available with a handheld XRF analyzer
- Waterproof, dustproof, rugged housing – purpose built for recycling use
- Confidence – the vast majority of recyclers worldwide choose Thermo Scientific NITON instruments
- Fast, simple reporting and certificate generation



Sort mixed material quickly and accurately.
Photo courtesy Universal Metals Corp, Worcester, MA.

The robust FP method utilized in Thermo Scientific NITON analyzers provides accurate analysis for all measured elemental concentrations ranging from trace to 100 percent.

Yet, providing accurate alloy chemistry is only part of the equation. Using our extensive experience with the metals industry, we have incorporated an alloy grade library that simultaneously provides users with the common trade name of the alloy on the instrument display. By incorporating a hybrid approach, which combines the book value alloy grade specifications with knowledge of the “as produced” chemistries of these alloys, the NITON XL3 provides unmatched accuracy in grade identification.

Thermo Scientific NITON XL3 Series Analyzers – Simply Superior Alloy Analysis

Thermo Scientific XRF analyzers continue to lead the handheld alloy analysis field with technology that responds directly to the needs of the recycling industry. The NITON XL3 800 Series brings the scrap recycling industry the latest in a series of cutting-edge, rugged, dependable tools with improved ergonomics, speed, and performance, while still retaining the trademark point-and-shoot simplicity that has been a hallmark of NITON XRF analyzers.

Available in x-ray tube source (XL3t) and radioisotope source (XL3p) configurations, the Thermo Scientific NITON XL3 800 Series is the only handheld XRF analyzer that allows customers to select the x-ray source that best suits their business needs.

Combining advanced electronics, materials technology and the most powerful x-ray tubes ever used in handheld XRF instruments, the NITON XL3t is in

a class by itself. With multiple filters for optimized excitation and a helium-purge option to target light elements from magnesium (12) to sulfur (16), the NITON XL3t provides the greatest analytical range, speed, and precision of any handheld XRF analyzer.

Meanwhile, the groundbreaking NITON XL3p features our patented Infiniton™ technology, which consistently provides fast, reliable, nondestructive alloy ID with accuracy that compares favorably to lab XRF instrumentation, in a rugged, dependable Infiniton radioisotope configuration that is virtually maintenance-free.

No matter which configuration you choose, a host of new features directly benefits your operation. From the integrated tilting color touch-screen display to customizable menus for ease of use, the ergonomic NITON XL3 Series analyzers are both the lightest weight and most ruggedly constructed instruments that we’ve ever made, making them appropriate for use under all environmental conditions, both indoors and out. Couple these features with integrated Bluetooth™, USB, and serial communications, and cumbersome download procedures of PDA synchronization become a thing of the past. In addition, all Thermo Scientific NITON analyzers use third-generation lithium-ion batteries, providing the longest usage cycle of any handheld XRF analyzer.

XL3 Series Performance

Thermo Scientific NITON XL3 800 Series analyzers provide alloying chemistry for up to 30 of the most common elements in tens of thousands of alloy grades, with additional elements available on request. Families of alloys that can be accurately analyzed with a standard system include:

- Stainless Steels
- Nickel (Ni) alloys
- Cobalt (Co) alloys
- Ni/Co alloys
- Tool steels
- Chromium-Molybdenum (Cr-Mo) steels
- Copper (Cu) alloys
- Titanium (Ti) alloys
- Wrought Aluminum (Al) alloys
- Low alloy steels
- Zirconium (Zr) alloys
- Zinc (Zn) alloys
- Exotic alloys of most types, e.g., alloys of Tantalum (Ta), Hafnium (Hf), Tungsten (W)

Additional grades that can be accurately sorted with the addition of the Helium Purge Light Element Analysis Package include:

- Aluminum alloys including those sorted based on Si or Mg content
- Aluminum and silicon bronzes
- Direct measurement of aluminum content in titanium alloys
- Magnesium alloys
- Zinc alloys based on Al content

Samples that may require preparation (generally consisting of minimal grinding):

- Painted, coated or plated parts
- Shot-blasted material (shot blasting deposits iron on the surface of the material)
- Parts with heavy scale or oxidation
- Parts with significant grease or dirt buildup (wipe with rag)
- Any surface that is not representative of the underlying material

Evaluating Performance

When potential users are evaluating the performance of analytical instrumentation, they are generally concerned with two criteria: speed and accuracy. What many do not understand is that there are two distinct factors to consider when asking “How accurate is it?”:

- Precision – This is a measure of repeatability, or the degree of agreement between individual measurements of a set of measurements, all of the same quantity.
- Accuracy – This is a measure of reliability, and is the difference between the *true value* of a measured quantity and the *measured value*.

Most analytical instrumentation reports statistical precision data along with the quantitative measurement results. Precision is a function of the statistical analysis of the raw data, whereas accuracy must be determined by testing samples with known values, and comparing the measured results to the known values. However, since even the best laboratory methods used to provide these values have statistical limitations in both precision and accuracy, true value is never known, even in a “certified standard.”

Regarding XRF instrumentation, the time of measurement improves the precision. With XRF analysis, each fourfold increase in measurement time improves the precision for each element by a factor of 2. At some point, however, increase of measurement time will reach a point of diminishing returns.

NITON Analyzers Measure Up

NITON XRF instruments report a two-sigma precision along with the result for each analyzed element. This represents an error band of two standard deviations on either side of the result. Two sigma precision represents a 95 percent confidence interval for the data. The precision, or +/- error band is not an indication of accuracy, but a measurement of repeatability around a most probable value. Accuracy must be assessed by comparing the measured result and precision to known values from a reference standard.



Analyze turnings right in the barrel.

Photo courtesy Universal Metals Corp, Worcester, MA.

SS 316	CA316-1				
	Cert	5 Sec	+/-	20 Sec	+/-
Grade ID		316		316	
Cr	17.44	17.37	0.31	17.45	0.14
Ni	11.21	11.37	0.50	11.37	0.24
Mo	2.08	2.14	0.07	2.15	0.03
Mn	1.54	1.59	0.32	1.61	0.15
Cu	0.43	0.43	0.15	0.42	0.07
Nb	0.02	0.02	0.01	0.02	0.00

Table 1: Performance data for Stainless Steel 316

CDA 932	BS 932E				
	Cert	5 Sec	+/-	20 Sec	+/-
Grade ID		C932		C932	
Sn	7.33	7.35	0.35	7.36	0.18
Pb	7.30	7.82	0.37	7.84	0.19
Zn	2.86	2.71	0.22	2.69	0.11
Ni	0.16	0.16	0.09	0.17	0.04
Cu	82.15	81.45	0.54	81.47	0.27

Table 2: Performance data for CDA 932

Hast C-276	BS H2B				
	Cert	5 Sec	+/-	20 Sec	+/-
Grade ID		C-276		C-276	
Cr	15.43	15.03	0.36	15.07	0.17
Mo	15.54	15.99	0.33	16.01	0.16
Fe	6.52	6.50	0.40	6.58	0.21
W	4.13	4.42	0.47	4.47	0.23
Mn	0.57	0.63	0.34	0.66	0.17
Co	0.39	0.39	0.23	0.40	0.11
Ni	56.75	56.49	0.64	56.33	0.32

Table 3: Performance data for Hastelloy C-276

Unparalleled Accuracy

In our performance testing, each alloy sampled was measured under the same conditions multiple times using multiple production instruments. The performance data listed can be considered typical of the instrument configuration used to produce it. Performance of individual instruments of this configuration under varying conditions may differ slightly from those shown here.

Table 1 illustrates both the outstanding accuracy and the precision of the NITON XL3t 800 Series alloy analyzer against the values of a certified reference material* for stainless steel (SS) 316. The indicated times are the seconds of measurement per filter.

Similarly, Table 2 and Table 3 show the typical accuracy obtainable with the NITON XL3t 800 analyzer for nickel-based alloy Hastelloy® C-276 and copper-based alloy CDA 932, measured under the same conditions.

The accuracy of the measurements coupled with the NITON XL3’s unparalleled speed means high throughput with real-time traceable results you can depend on.

**Note that the certified values of each standard are those provided by the supplier(s) of the individual reference materials. Neither Thermo Fisher Scientific nor its subsidiaries make any guarantee, expressed or implied, as to the accuracy of the certification data of the materials used in this configuration.*

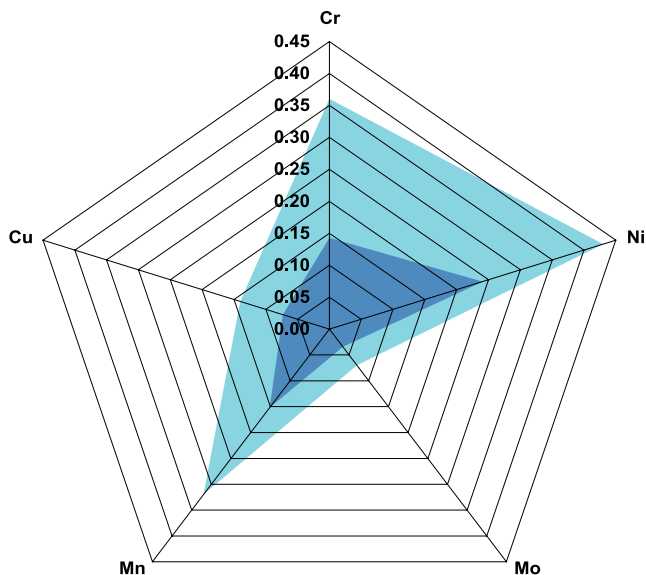


Figure 1: Instrument error comparison for Stainless Steel 316. Note the dramatic increase in precision for all elements.

Four Times Faster – Twice as Precise

For comparison testing against another instrument, we measured ourselves against the best – the previous generation Thermo Scientific NITON XLt 898. The graphical comparisons in Figures 1 and 2 compare the error bands of the older XLt 898 instrument to the NITON XL3t 800. Note that the area of uncertainty (or average statistical precision) of the NITON XL3t 800, represented in the darker blue, shows a two-fold improvement or better for most elements over that of the XLt 898, represented in light blue. Since measurement time relates directly to precision, the NITON XL3t 800 is literally four times faster, or twice as precise when compared to the older generation XLt 898.

Service and Support

Thermo Scientific NITON XL3 800 Series analyzers have been designed to be the most durable and dependable portable analyzers ever made. From the rugged Lexan EXL housing to the precision semiconductor detector, each individual component has been engineered to be dependable as well as easily serviceable. When routine service is required, we have more than 30 NITON Analyzers service centers located on six continents.

Configurations and Accessories

Providing the right XRF tools for almost any organization's analytical and budgetary requirements, Thermo Scientific NITON analyzers offer the widest range of options in models and accessories.

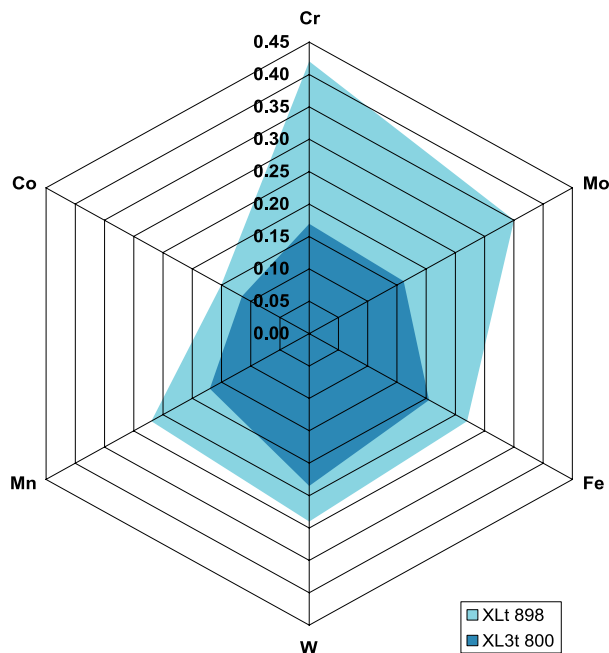


Figure 2: Instrument error comparison for Nickel-based alloy Hastelloy C-276. Note the greatly improved precision for both Cr and Mo.

With the choice of the most powerful x-ray tubes ever offered in a handheld XRF instrument or the new second generation Infiniton with dramatically higher performance, these powerful tools will again revolutionize the way recyclers conduct their business.

All NITON XRF analyzers come with a shielded, waterproof carrying case, shielded belt holster, and PC-compatible NITON Data Transfer (NDT[®]) software for remote operation, file transfer, data management, and advanced data analysis. Optional items include test stands, welding masks, hot surface adaptors, and extension handles.

NITON XL3 800 Series – for All Your Sorting Needs

The bottom line is that Thermo Scientific NITON XL3 800 Series analyzers provide the versatility, the greatest number of options, and the best sorting performance and throughput. With many users performing more than 1000 readings in an 8-hour shift, confidence in the correct ID is absolutely critical. Doing business with Thermo Fisher Scientific means that you are dealing with a company that understands alloys, understands the recycling business, and understands what the recycler needs to be profitable – there's a reason why the vast majority of all recyclers worldwide have chosen Thermo Scientific NITON analyzers for their sorting and analysis needs.

With these instruments, we have set new standards for scrap sorting performance in all key areas: speed, accuracy, ease of use, reliability, ruggedness, minimum down time, and expert training and support.

In addition to these offices, Thermo Fisher Scientific maintains a network of representative organizations throughout the world.

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Specifications, terms and pricing are subject to change. Not all products are available in all countries. Please consult your local sales representative for details.

All competitive references are based on an internal direct comparison of commercially available handheld XRF analyzers, July 2007.

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