Analysis of Precious Metals in Jewelry and Dental Alloys with the Thermo Scientific Niton XL3t Series

Niton XL3 Series Handheld Analyzers – Simply Superior XRF

Introduction

Precious metals are rare metallic elements of high economic value. In the past, they were significant as currency, but now are regarded mainly as investment and industrial commodities.

The best-known precious metals are gold (Au) and silver (Ag). While both have some industrial uses, they are more highly regarded for their uses in art, coin collection, dental alloys, and especially, jewelry. Other precious metals include the platinum group metals: ruthenium (Ru), rhodium (Rh), palladium (Pd), osmium (Os), iridium (Ir), and platinum (Pt), of which platinum is the most widely traded.

The demand for precious metals is driven not only by their everyday use, but also by their role as investment commodities. Historically, precious metals have commanded much higher prices than commonly used industrial metals. In April 2009, gold was about US$925/troy ounce and silver was about US$13/troy ounce, compared to industrial metals like copper at US$1.80/lb. and nickel (Ni) at less than US$5/lb.

Application

Jewelry is commonly analyzed to determine precious metal content and verify grade. However, it may also be important to screen for toxic metals such as lead (Pb) and cadmium (Cd) or other elements that should not be present in the material.

Dental alloys are composed of "noble metals" as well as a number of other elements. Aside from the obvious requirements of being non-toxic and hypoallergenic, these alloys must be castable and have physical properties such as hardness and thermal expansion to suit a variety of dental applications.

XRF Analyzer

The Thermo Scientific Niton XL3t 800 Series brings the precious metal market the latest in a series of cutting-edge, rugged, dependable tools with improved ergonomics, speed, and performance, while still retaining the point-and-shoot simplicity that has been our hallmark.

These superior instruments provide the precious metal market with the following key benefits:

- Instant positive alloy grade identification
- High-throughput – increased productivity
- Nondestructive analysis – test finished product with confidence
- Optional modes to analyze sweeps and catalysts
- Laboratory-quality composition analysis
- Real-time, traceable results – not questionable paperwork
- Fast, simple reporting and certificate generation

Method

The analyzer was placed directly on each alloy sample. Total elapsed time for each measurement varied from 10 to 30 seconds.

Results

Figure 1 shows the correlation curve for palladium with laboratory results vs. the Niton® XL3t 800 handheld XRF results. Data for 114 alloys is shown in the correlation plot. A similar curve for platinum is show in Figure 2.

The Niton XL3t analyzer gives you the near instantaneous feedback you need for success.

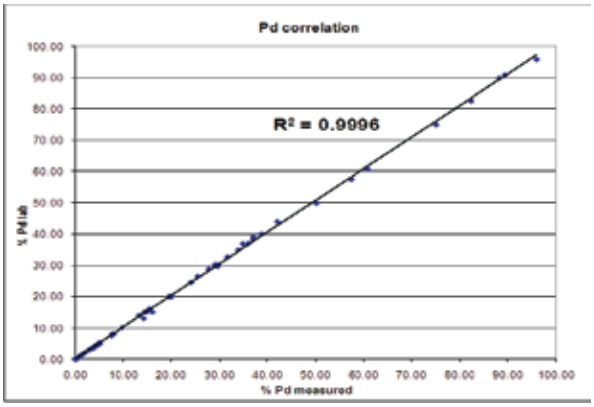

Figure 1. Correlation curve for palladium – Laboratory results vs. the Niton XL3t 800

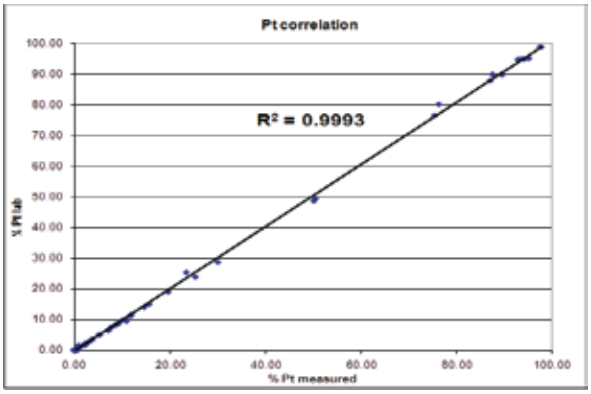

Figure 2. Correlation curve for platinum – Laboratory result vs. the Niton XL3t 800

Table 1 details the analysis results of three certified jewelry alloys. These standards were measured for 10 seconds each. The analyzer also determined the alloy grade identification as shown in the second column.

Figure 3 shows a screen shot of the analyzer display for two unknown samples. Results are based on the factory calibration of the unknown samples. Note that both the elemental composition and alloy grade identification are displayed for the user almost immediately. Encrypted data also can be downloaded to a computer immediately via integrated Bluetooth™ or USB cable.

Figure 4 shows an example of a dental alloy as displayed on the analyzer. The dental alloy is identified as Argenco 60. Additional alloys can be added easily to the onboard alloy grade identification.

Comments

Results achieved using the Thermo Scientific Niton XL3t 800 XRF analyzer demonstrate excellent agreement with laboratory results. Jewelry and dental alloys can be analyzed rapidly for determining precious metal and base metal content as well as screening for contaminant elements such as Pb and Cd. Analysis is completely nondestructive with minimal to no sample preparation required.

To discuss your particular applications and performance requirments, or to schedule an on-site demonstration, please contact your local Thermo Scientific Niton Analyzer representative or contact us directly by email at niton@thermofisher.com, or visit our website at www.thermo.com/niton.

Figure 3. Based on factory calibration, results of analysis of unknown samples are displayed

Figure 4. Example of dental alloy result

Sample	Alloy I.D.	Au %, cert	Au	Ag %, cert	Ag	Cu %, cert	Cu
Pure Au	Au 24 K	99.9985	99.99	00.00	00.00	00.00	00.00
RAuA5	YellAu 18 K	75.0400	75.02	18.02	17.78	06.93	06.60
RTA 4	YellAu 22 K	93.0000	92.71	04.50	04.46	02.49	02.34
RTA 14	RedAu 9 K	37.5200	37.30	09.78	09.78	52.54	51.72

Table 1. Analysis results for three certified Au alloys and pure Au

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