

Analysis of Precious Metals in Automobile Catalytic Converters with the Thermo Scientific NITON® XL3t Series

NITON XL3 Series Handheld Analyzers – Simply Superior XRF



Application

The analysis of scrap automotive catalytic converters to determine precious metal content – platinum (Pt), palladium (Pd), and rhodium (Rh) – is important to the recycling industry for assessing accurate scrap values. In 2005, we developed a special program for the analysis of automobile catalytic converters, which was based on a dual isotope Thermo Scientific NITON XRF analyzer using Cd 109 and Am 241 as the x-ray sources. This application study reports on data obtained with our latest instrument, the Thermo Scientific XL3t Series analyzer, on samples provided by a scrap recycling customer.

With the introduction of the high-powered XL3t, it is now possible to use an x-ray tube source instrument for this analysis. Cerium (Ce) and lanthanum (La) are commonly present in the ceramic substrate of the converters and must be included in the analysis to obtain accurate results for the precious metals. The XL3's 50kV x-ray tube source provides sufficient excitation of the 34.72 keV Ce and 33.44 keV La lines, so that accurate analysis no longer has to depend on radioisotope-based sources.

Method

For the purpose of direct comparison with laboratory data, seven lab-analyzed samples were measured using an XL3t in the Industrial Bulk Mode. The samples were pulverized and loaded into standard 32 mm XRF sample cups. A total measurement time of 120 seconds was used, 60 seconds with the main filter and 60 seconds with the high filter.

Results

Results from the external laboratory were compared against the results from the NITON XL3t Series analyzer. The relative percent difference (RPD) between the laboratory readings and the XRF readings for the Pd, Rh, and Pt is shown in Table 1. The coefficient of

determination (R^2) for each element is provided in Figures 1 through 3. The R^2 value is a measure of how closely the data sets correlate with each other, where a perfect correlation would have an R^2 of 1.

Pd, % lab	Pd, % read	RPD
0.325	0.319	1.8
0.099	0.101	2.0
0.033	0.031	6.1
0.347	0.349	0.6
0.104	0.105	1.0
0.323	0.326	0.9
0.019	0.020	5.3
Rh, % lab	Rh, % read	RPD
0.071	0.069	2.8
0.023	0.024	4.3
0.016	0.016	0.0
0.072	0.072	0.0
0.022	0.022	0.0
0.067	0.069	3.0
0.005	0.004	20.0
Pt, % lab	Pt, % read	RPD
0.125	0.121	3.2
0.043	0.042	2.3
0.020	0.017	15.0
0.119	0.123	3.4
0.039	0.038	2.6
0.101	0.100	1.0
0.014	0.019	35.7

Table 1: Comparison of lab results and NITON XRF analyzer results

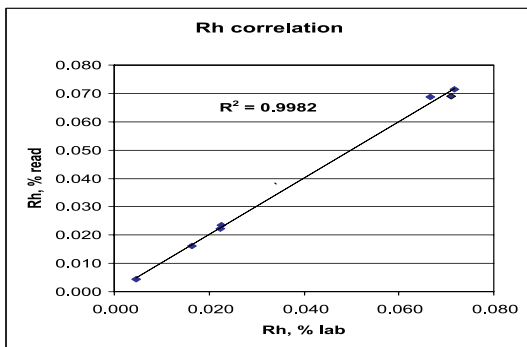


Figure 1: Correlation curve for rhodium – Laboratory vs. Thermo Scientific NITON analyzer

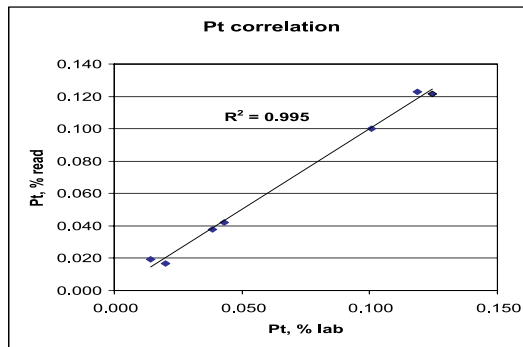


Figure 3: Correlation curve for platinum – Laboratory vs. Thermo Scientific NITON analyzer

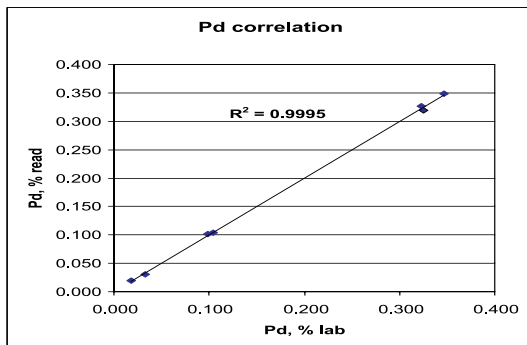
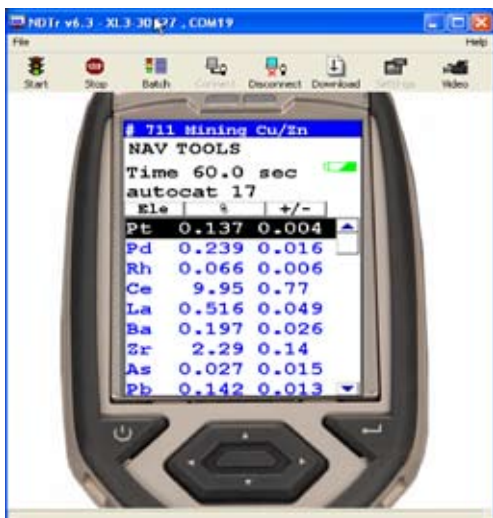


Figure 2: Correlation curve for palladium – Laboratory vs. Thermo Scientific NITON analyzer

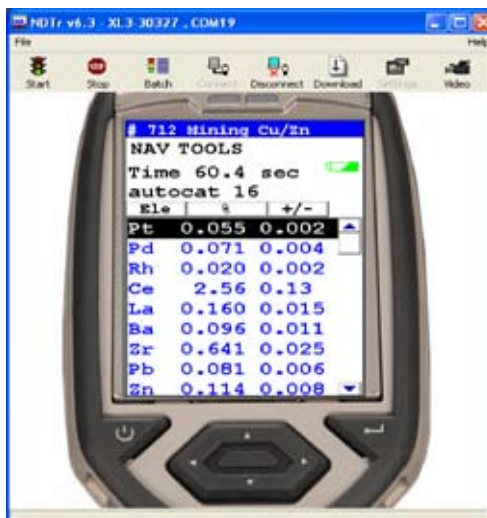
Comments

Results achieved using the Thermo Scientific NITON XL3t Series analyzer demonstrate excellent agreement with the laboratory results. The total measurement time was 120 seconds. For successful completion of the analysis, the ceramic converter material must be pulverized to at least 60 mesh (250 micrometers) and loaded in XRF cups or samples bags for analysis.

Relative accuracy for a lab is generally on the order of 5 to 10 percent. Therefore, the results using our XRF analyzer are essentially comparable.

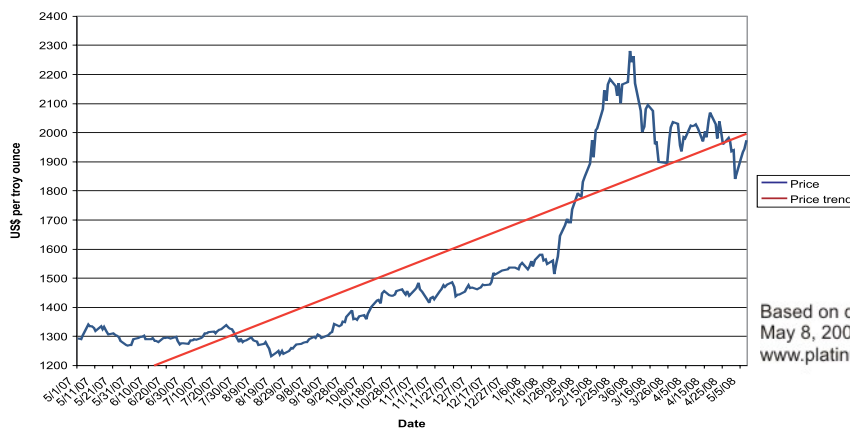


Example of high Pt analysis result



Example of low Pt analysis result

Platinum Prices May 2007 - 2008



Based on data from Platinum Today
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