



FIRST Newsletter

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New Portable XRF On-Board Calibration for Automobile Catalysts

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An important emission control component of a gasoline engine is the auto catalytic converter (ACC). Installed in the exhaust system, it converts NO_x, hydrocarbons, and carbon monoxide into carbon dioxide and water to comply with exhaust emission regulations.

ACCs typically have a stainless-steel housing containing a monolithic catalyst support made of ceramic and synthetic cordierite in a honeycomb structure. The catalysts used are a mix of precious metals such as platinum (Pt), palladium (Pd), and rhodium (Rh). Catalyst metals are suspended in a washcoat, usually aluminum oxide, titanium oxide, or silicon oxide, to help disperse them over the monolith's large surface area.

Catalytic converters which are no longer useful are recycled. The precious metals recovered are sold to use for other applications. Therefore, it is critical to know the composition of the precious metals recovered from ACCs.

Portable XRF for ACC Precious Metals Analysis

Portable XRF (PXRF) is a fast, easy, and economical tool for precious metals analysis. Bruker PXRF analyzers can be pre-loaded with a comprehensive Catalysts Calibration which includes rhodium (Rh), palladium (Pd), and platinum (Pt) metals as well as



at least 19 other elements. That means that out of the box, Bruker PXRF analyzers are ready to measure ACC samples and provide results.

Sample Preparation

To recycle an ACC, the stainless-steel housing is cut open and the ceramic honeycomb structure is removed to recover the precious metals. Direct measurement of the ceramic honeycomb core is possible; however, it only provides elemental identification of the surface.



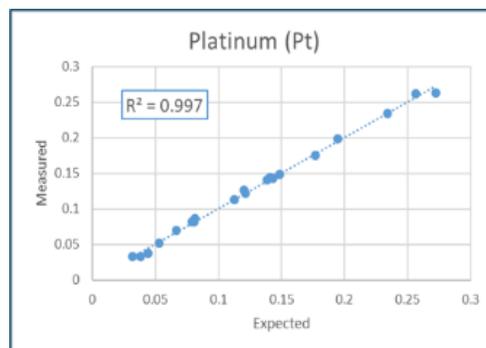
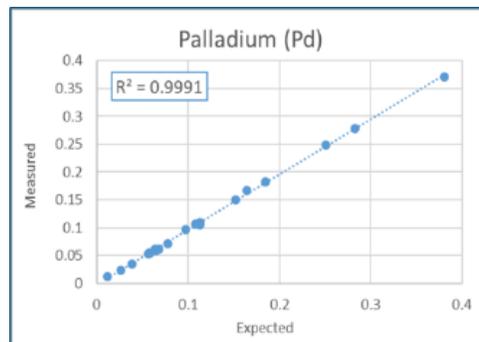
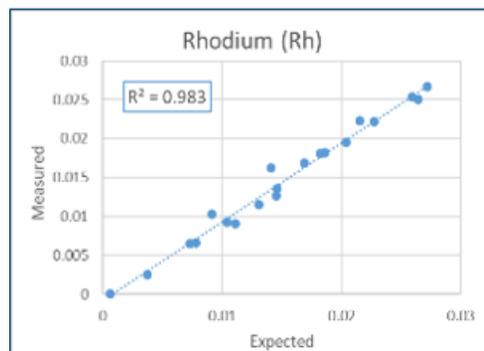
The most accurate and precise measurement results require that the honeycomb cores be finely ground into a homogenous powder and placed in a sample cup or sample bag to analyze for their full elemental composition.

NEW S1 TITAN and CTX Catalysts Calibration

The new S1 TITAN and CTX car catalysts calibration is designed for these well-prepared samples in order to provide optimum analysis of Rh, Pd, and Pt from catalytic converters. However, it is possible to measure ground powder through a sample bag, but with some reduced accuracy. Homogeneity of the powder can be tested by making multiple measurements.

The most important thing for measurement accuracy is sample preparation because the resultant correlation with reference samples and other well-prepared and characterized samples is typically over 99%. Correlation can be lower if samples are not fully homogeneous. It is also important to take multiple samples from the material batch and use the averaging feature in order to take into account possible sample variability.

Bruker's portable and handheld XRF analyzers can provide very consistent measurement results for well-prepared samples using the car catalysts calibration. Measurement precision can be tested with repeated measurements using a known auto catalytic converter powder sample.



Meas	Rh (ppm)	Pd (ppm)	Pt (ppm)
1	236	3781	407
2	219	3800	392
3	210	3745	384
4	214	3722	376
5	220	3756	417
6	230	3802	415
7	207	3711	386
8	225	3781	393
9	228	3791	378
10	210	3792	395
11	224	3785	366
12	221	3768	396
13	229	3772	409
14	225	3813	388
15	220	3780	400
16	235	3832	407
Average	222	3777	394
Stdev	8.2	28.9	14.6
Rel Stdev	3.7%	0.8%	3.7%

The car catalysts calibration can be preloaded on Bruker's portable XRF analyzers. Everyday operation consists of three simple steps. The sample is placed in position on the analyzer, the "CarCatalysts Application" is selected, and the start trigger is pressed. Measurement results are viewed on the screen.

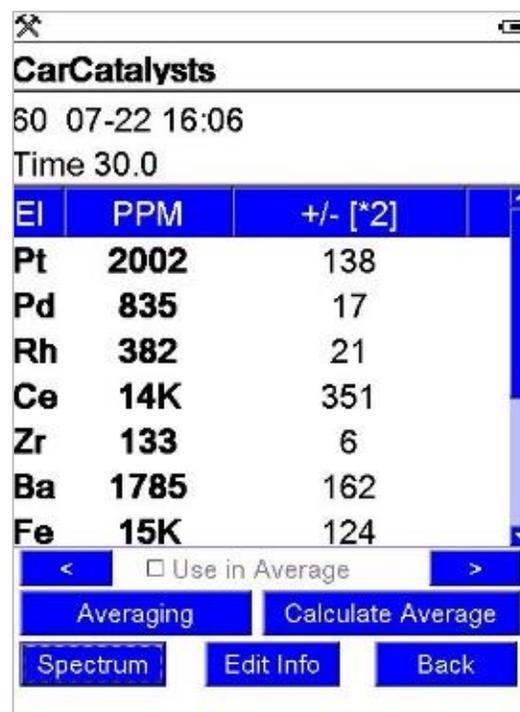
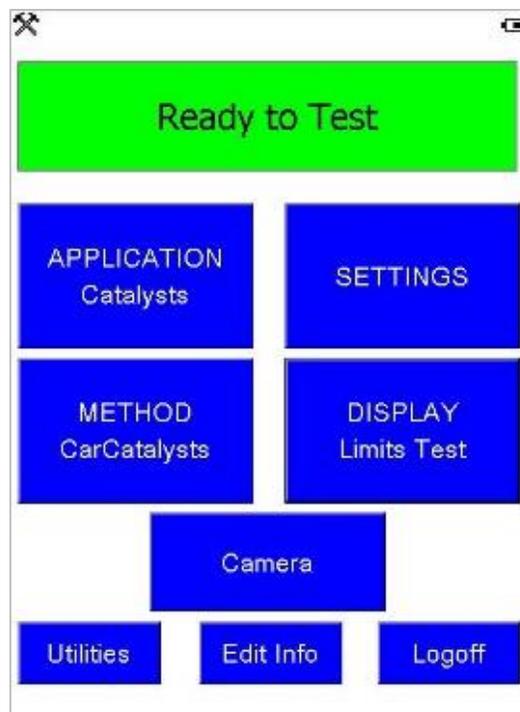
The new calibration analyzes Rh, Pd, and Pt as well as 19 other elements which improve the analysis reliability to account for all common matrix effects and overlaps. For example, the presence of selenium (Se) and tantalum (Ta) sometimes falsely increase Pt values because they overlap with Pt peaks. These overlaps are compensated for in order to prevent costly mistakes with Se or Ta spiked catalyst powders.

This new calibration can also be used for direct measurement of a ceramic core honeycomb, but the result does not represent the overall composition of the honeycomb structure.

- Surface measurements can indicate the presence of precious metals, but not the actual average concentrations
- Surface of the honeycomb does not represent the overall composition of the monolith and measurement results do not reflect the average composition
- Surface measurement typically ends up providing very little or no actual value

XRF Analysis is a Key Component of ACC Recycling

XRF analysis is a key component in the recycling process of auto catalytic converters and particulate filters. In addition to precious metals, XRF analysis provides a full chemical composition of the recycled materials. This technology supports both specialized catalytic converter recyclers and precious metal refineries for precious metals analysis and measurement of other elements to optimize PGM recovery and refining.



Bruker's CTX and S1 TITAN PXRF Analyzers

Bruker's CTX portable XRF analyzer is ideal for high accuracy and precision measurements of small samples and prepared powder auto catalytic converter samples. This self-contained analyzer is easy to use in a production environment or in a laboratory. The CTX is rugged and well-sealed for use in harsh conditions and there are no active cooling filters which can clog in dusty recycling facilities. The CTX has a very small footprint which is perfect when space is limited and the front facing touchscreen provides easy operational and results access.



Bruker's S1 TITAN handheld XRF is the most versatile portable XRF because not only does it enable "point-and-shoot" measurements, but with the optional desk or bench top stand and PC, it also easily measures small samples and prepared powder car catalyst samples. The handheld operation is particularly useful for recyclers who purchase and sell multiple material types, like scrap metal, electronic scrap, and jewelry. It quickly helps sort materials to keep business going in the yard, at the back of a truck, and even in the office.



Bruker's CTX portable and S1 TITAN handheld XRF analyzers can both be equipped with the catalytic converter application providing an economical way to successfully measure catalysts.

- High performance Rh X-ray tube
- Bruker patented SharpBeam™ geometry
- Large area graphene window SDD detector
- Bruker patented DetectorShield™
- Easy data transfer with USB Flash drive

