

X-MET8000

X-MET8000 for the analysis of Pt, Pd and Rh in catalytic converters

INTRODUCTION

Ceramic-based automotive catalytic converters contain the precious metals platinum (Pt), palladium (Pd) and rhodium (Rh). Due to the high value of precious metals, spent catalytic converters are recycled. Following the decanning from the metal surround, the honeycomb core is removed and ground to a fine powder. This can then be smelted to extract the pure precious metals or sold directly to a refiner. Either of these processes requires accurate analysis of the Pt, Pd and Rh content for accurate pricing.

Portable X-ray fluorescence (XRF) provides fast and accurate determination of precious metals in the catalyst powder, maximising testing throughput and profits.

INSTRUMENTATION

The X-MET8000 is a high performance handheld XRF analyser. Its simple “point and shoot” operation and lightweight design make it the ideal tool for analysis throughout the recycling and refining process.

The X-MET’s rugged design withstands the harshest environments and weather conditions. It includes impact-resistant plastic housing with environmental sealing, rubber bumpers for protection against shocks, and is splash water and dust proof (IP54 compliant).

Incorporating a high-performance X-ray tube and Hitachi High-Tech’s large area silicon drift detector (SDD), the X-MET8000 delivers fast analysis with results you can trust. Its 4.3” rugged touchscreen and intuitive user interface ensure the analyser can be used with gloves on, and with minimum user training.

The optional window-shield provides superb protection against sharp objects, significantly decreasing the risk of puncturing the analyser’s detector window, thus, minimising repair costs and downtime.



EMPIRICAL CALIBRATION

The “Car Catalyst” calibration is pre-loaded on the instrument so it is ready to use straight out of the box.

The calibration was created using a combination of catalyst reference materials, and well-analysed samples provided by leading global refiners. Each standard was measured for 120 seconds.

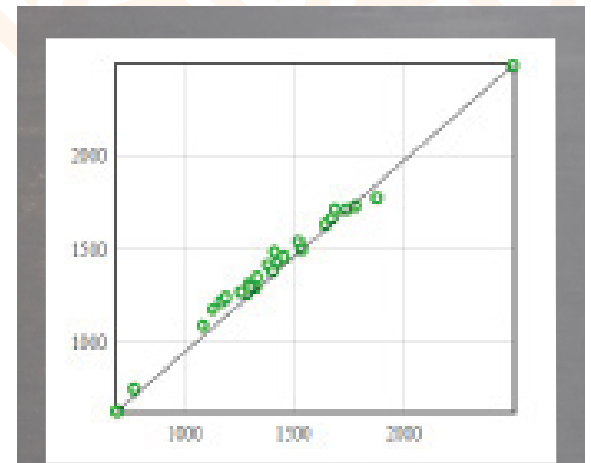
The converter’s honeycomb core is usually ceramic-based but its composition varies across automotive manufacturers. The X-MET8000’s Car Catalyst calibration takes into account this variation, and automatically compensates for varying concentrations of ceramic elements (e.g. Al, Si, Zr, Sr, Ba, La and Ce), Fe (present if a stainless steel core is used), and Pb (which may originate from leaded gasoline passing through the exhaust). W, which can be added to artificially inflate the reported Pt content, is calibrated with the precious metals Pt, Pd and Rh. There is no need for operator intervention and no wasted time investigating and separating batches.

Calibration Range:

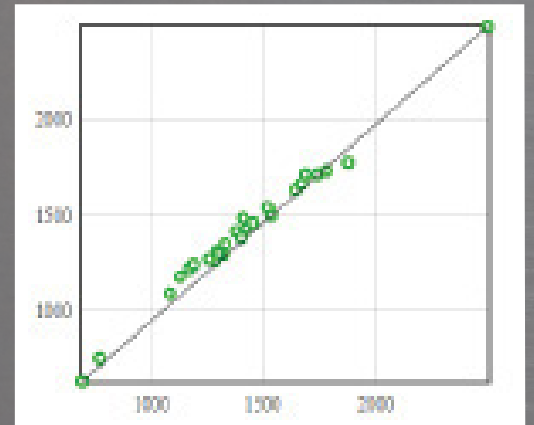
Element	Pt	Pd	Rh	W
Range, ppm	89-5700	233-6740	51 - 344	140-67200

SAMPLE PREPARATION

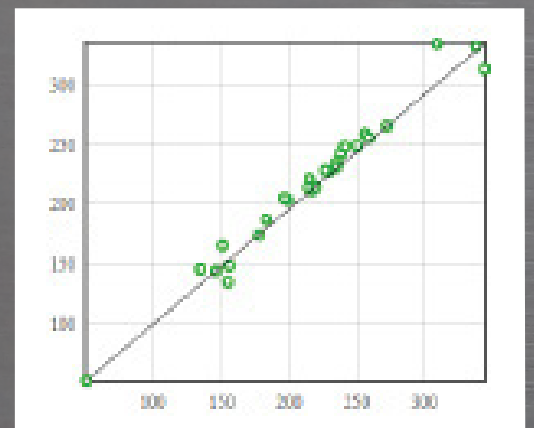
Samples are prepared simply by breaking a piece of the catalyst converter’s honeycomb, grinding it finely with a pestle and mortar, and placing the resulting powder into a sample cup fitted with Mylar® film. Use of the light stand and safety shield to measure the sample cup ensures full radiation safety during analysis.



Platinum



Palladium



Rhodium

ANALYTICAL PERFORMANCE

Validation of the method was carried out by the analysis of 2 certified reference materials. Results below show the accuracy and precision which can be expected from this method using a 120 second measurement time.

Table 1 – Repeatability data (3 repeats)

ppm	NIST SRM2557			BAM ERM-EB504		
	Certified Value	Average Value	Measurement Precision (95% confidence)	Certified Value	Average Value	Measurement Precision (95% confidence)
Pt	1131	1136	33	1777	1737	7
Pd	233	233	3	279	308	4
Rh	135	143	4	338	333	7

Our Applications Support lab also participated to a European proficiency test program for the analysis of two used auto catalytic converters. Eight labs/companies took part, using a wide range of XRF analysers, from high-power, floor-standing analysers to benchtop and handheld. Each sample was tested twice. Their composition was kept unknown until the final results were published. The results from all the labs were compounded in a report, and included the following data:

Table 2 – Proficiency test results

Rh (ppm)	Certified value	X-MET result 1	X-MET result 2	Results range – All labs included
Sample 1	295	301	300	267 to 347
Sample 2	242	278	278	208 to 322

Rh (ppm)	Certified value	X-MET result 1	X-MET result 2	Results range – All labs included
Sample 1	1770	1786	1800	1657 to 1894
Sample 2	465	451	439	422 to 525

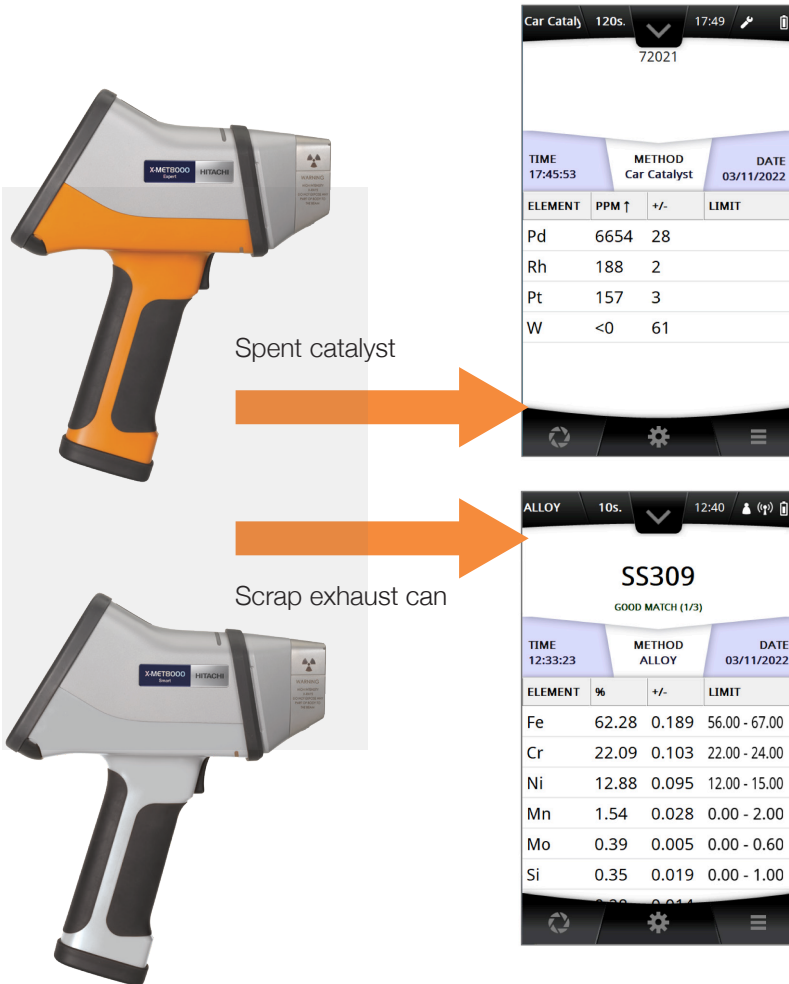
Rh (ppm)	Certified value	X-MET result 1	X-MET result 2	Results range – All labs included
Sample 1	1673	1666	1674	1546 to 1892
Sample 2	1075	1115	1112	977 to 1303

The results further demonstrated that the X-MET8000 provides reliable results for the rapid screening of spent catalytic converters straight out of the box.

Note: to expand the scope of the calibration (e.g. include different matrices, extend the elements' calibration ranges, or add new elements of interest), additional standards can easily be added to the existing calibration. There is no need to return the analyser to the factory. The calibration can be modified directly by the end-user, or remotely by your local Hitachi High-Tech representative. Please consult our applications teams for support and training if required.

SUMMARY

The X-MET8000 series handheld analysers provide fast, on-site analysis of spent car catalysts, with minimum sample preparation required. Hitachi High-Tech X-MET8000's Car Catalyst calibration delivers reliable results for the determination of platinum, palladium and rhodium at various stages in the recycling and refining process of automotive catalytic converters. The empty exhaust converter cans, manifolds and pipes can also be sorted on-site using the X-MET's alloy calibration (included as standard), adding further value to the recycling process.



ORDERING INFORMATION

- | X-MET8000 Smart Optimum or Expert.
- | Car Catalyst calibration.

Recommended accessories for this application:

- | Light stand and safety shield (to stop scattering from the sample).
- | Sample cups (bag of 100).
- | Mylar® sample film (roll of 100m).

Visit www.hitachi-hightech.com/hha for more information.

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Part number: 182/0820