Bundesanstalt für Materialforschung und -prüfung (BAM)

in cooperation with the Committee of Chemists of the GDMB
Gesellschaft der Metallurgen und Bergleute e.V.

Certified Reference Material

BAM-M504b

Used Automobile Catalyst

Certified Values

Element	Mass fraction [1] in mg/kg	Uncertainty [2] in mg/kg
Pt	1159	8
Pd	1128	9
Rh	314.2	2.6

[1] Unweighted mean value of the means of accepted sets of data (consisting of at least 4 single results), each set being obtained by a different laboratory and/or a different method of measurement.

[2] Estimated expanded uncertainty U with a coverage factor of $k = 2$, corresponding to a level of confidence of approx. 95 %, as defined in the Guide to the Expression of Uncertainty in Measurement, (GUM, ISO/IEC Guide 98-3:2008).

This certificate is valid until 02/2052.

Sample Description

The material is a mixture of used automobile catalysts supplied and prepared by a commercial manufacturer. The material was ignited, ground to a particle size below 100 µm and homogenised thoroughly before bottling in 200 g units in screw cap bottles. The carbon content is ca. 0.1 %, the sulphur content is ca. 0.24 %.

Recommended Use

This material is intended for use as a reference material in the development, validation or quality control of analytical methods for the determination of Platinum group elements (PGE) in automobile catalysts. The material may also be applicable to other matrices where suitable reference materials are not available.

Instructions for Use

Prior to use, the material should be thoroughly mixed by several inversions of the bottle. Before weighing, the material has to be dried for 8 h at 105 °C.

Transport and Storage

The material should be stored in a dry and clean environment at room temperature. Transport can be done under normal ambient conditions.

Participating Laboratories

ALS Minerals Division, Inspection Services, Knowsley Business Park, Prescot (United Kingdom)
Alfred Knight Int. Ltd, St. Helens (United Kingdom)
Allgemeine Gold- und Silberscheideanstalt AG, Pforzheim (Germany)
AnRec® GmbH & Co. KG, Gelnhausen (Germany)
Aurubis AG, Hamburg (Germany)
Bureau Veritas Commodities UK Ltd, Witham, Essex (United Kingdom)
Forschungsinstitut Edelmetalle & Metallchemie, Schwäbisch Gmünd (Germany)
Institut für Materialprüfung Glörfeld GmbH, Willich (Germany)
Ledoux & Company, Teanec NJ (USA)
ReMetall Deutschland AG, Drochow (Germany)
Umicore AG & Co. KG, Hanau (Germany)
Umicore Precious Metals, Hoboken (Belgium)
W.C. Heraeus, Hanau (Germany)
WRC World Resources Company GmbH, Wurzen (Germany)

Means of Accepted Data Sets

Certified values (mass fraction in mg/kg)

Line No.	Pt	Pd	Rh
1	1140	1109	309.1
2	1148	1120	310.2
3	1152	1123	310.5
4	1154	1124	312.0
5	1156	1125	312.3
6	1158	1126	312.7
7	1158	1127	313.0
8	1158	1128	314.3
9	1162	1128	315.6
10	1165	1129	316.0
11	1166	1131	316.3
12	1167	1132	316.8
13	1168	1134	316.9
14	1168	1141	319.0
15	1169	1142	319.0
M	1159	1128	314.2
s_M	8.5	8.2	3.2
$\bar{s}_i$	5.7	4.6	2.0

The laboratory mean values have been examined statistically to eliminate outlying values. A data set consists of at least 4 single values of one laboratory.

M : mean of laboratory means

s_M : standard deviation of laboratory means

$\bar{s}_i$: averaged repeatability standard deviation (square root of the mean of laboratory variances)

Safety guidelines

Used car catalyst powder is not known to be toxic. No hazardous effect is to be expected if the material is used under conditions usually adopted in analytical laboratories when handling finely dispersed powder materials.

Analytical Method used for Certification

Element	Line Number	Method
Pt	1, 2, 3, 10, 15	ICP-OES, after collection with Cu
	4	ICP-OES, after collection with NiS
	5, 7, 13	ICP-OES, after collection with Sn/Te
	6	ICP-OES, after decomposition with Na_2O_2/HCl
	8, 12	ICP-OES, after collection with Pb
	9	XRF, after collection with Cu
	11, 14	ICP-OES, after collection with Te
Pd	1, 9, 11	ICP-OES, after collection with Sn/Te
	2, 6, 7, 8, 12	ICP-OES, after collection with Cu
	3, 14	ICP-OES, after collection with Te
	4, 13	ICP-OES, after collection with Pb
	5	ICP-OES, after decomposition with Na_2O_2/HCl
	10	XRF, after collection with Cu
	15	ICP-OES, after collection with NiS
Rh	1, 3	ICP-OES, after collection with Pb
	2, 5, 8, 9, 14	ICP-OES, after collection with Cu
	4, 10, 11	ICP-OES, after collection with Sn/Te
	6, 13	ICP-OES, after collection with Te
	7	ICP-OES, after decomposition with Na_2O_2/HCl
	12	ICP-OES, after collection with NiS
	15	XRF, after collection with Cu

Abbreviations:

ICP-OES	Inductively coupled plasma optical emission spectrometry
XRF	X-ray fluorescence spectrometry

Metrological Traceability

To ensure traceability of the certified mass fractions to the SI (Système International d'Unités) calibration was performed using standard solutions prepared from pure metals or stoichiometric compounds or with traceable commercial calibration solutions.

Certification Report

A detailed technical report describing the analysis procedures and the treatment of the analytical data used to certify BAM-M504b is available on request or can be downloaded from BAM website (www.bam.de).

Accepted as BAM-CRM on 2022-02-10

Bundesanstalt für Materialforschung und -prüfung (BAM)

Dr. S. Richter
Committee for Certification

Dr. S. Recknagel
Project Coordinator

BAM holds an accreditation as a reference material producer according to ISO 17034. This accreditation is valid only for the scope as specified in the certificate D-RM-11075-01-00.
DAkkS is a signatory of the multilateral agreement (MLA) between EA, ILAC and IAF for mutual acceptance.

DAkkS
Deutsche
Akkreditierungsstelle
D-RM-11075-01-00

This Reference Material is offered by:

Bundesanstalt für Materialforschung und -prüfung (BAM)
Richard-Willstätter-Str. 11, 12489 Berlin
Phone: +49 30 8104 2061
Fax: +49 30 8104 72061
Email: sales.crm@bam.de
Internet: www.webshop.bam.de