in cooperation with the WG 'Precious Metals'
of the Committee of Chemists of GDMB

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CERTIFICATE OF ANALYSIS

ERM®-EB504

Platinum Group Elements in Used Automobile Catalyst		
	Certified value [1]	Uncertainty [2]
Element	Mass fraction in mg/kg	
Pt	1777	± 15
Pd	279	± 6
Rh	338	± 4

[1] Unweighted mean value of the means of accepted sets of data, each set being obtained in a different laboratory and/or with a different method of measurement. The values are traceable to the SI (Système International d'Unités) by the use of sufficiently pure substances of known stoichiometry for calibration.

[2] Estimated expanded uncertainty *U* with a coverage factor of *k*=2, corresponding to a level of confidence of about 95 %, as defined in the Guide to the Expression of Uncertainty in Measurement (1995) ISO, Geneva.

This certificate is valid until 06/2017; this validity may be extended as further evidence of stability becomes available.
The minimum sample size for wet chemical analysis is 5 g.

Accepted as an ERM®, September 2007

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NOTE

European Reference Material ERM®-EB504 was certified under the responsibility of Bundesanstalt für Materialforschung und –prüfung (BAM) in cooperation with the Committee of Chemists of the GDMB, Gesellschaft für Bergbau, Metallurgie, Rohstoff- und Umwelttechnik according to the principles laid down in the technical guidelines of the European Reference Materials® co-operation agreement between BAM-LGC-IRMM. Information on these guidelines is available on the Internet (http://www.erm-crm.org).

DESCRIPTION OF THE SAMPLE

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 250 g units in screw cap amber glass bottles.

INTENDED 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.

Information on how to compare an analytical result with the certified value can be found in ERM Application Note 1; www.erm-crm.org

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.

STORAGE

The material should be stored at ambient conditions in a dry and clean environment.

PARTICIPANTS

- Alex Stewart (Assayers) Ltd, Knowsley (United Kingdom)
- Alfred Knight Int. Ltd, St. Helens (United Kingdom)
- Allgemeine Gold- und Silberscheideanstalt AG, Pforzheim (Germany)
- AMI Doduco, Pforzheim (Germany)
- BASF, Carteret NJ (United States)
- Inspectorate International Ltd, Reno NV (United States)
- Inspectorate International Ltd, Witham (United Kingdom)
- Forschungsinstitut Edelmetalle & Metallchemie, Schwäbisch Gmünd (Germany)
- Institut für Materialprüfung Glörfeld GmbH, Willich (Germany)
- Ledoux & Company, Teanec NJ (United States)
- Nickelhütte Aue GmbH, Aue (Germany)
- Norddeutsche Affinerie AG, Hamburg (Germany)
- Saxonia Edelmetalle GmbH, Halsbrücke (Germany)
- Umicore AG, Hanau (Germany)
- Umicore Precious Metals, Hoboken (Belgium)
- W.C. Heraeus, Hanau (Germany)
- Wieland Dental und Technik GmbH & Co. KG, Pforzheim (Germany)

MEANS OF ACCEPTED DATA SETS (FOR ONE METHOD AT ONE LABORATORY, RESPECTIVELY)

Certified values
Mass fraction in mg/kg

Line No.	Pt	Pd	Rh
1	---	270.0	329.7
2	1757	275.0	331.0
3	1767	275.3	333.6
4	1767	275.7	334.2
5	1768	275.8	334.8
6	1770	278.1	335.0
7	1770	278.2	336.6
8	1770	278.4	336.7
9	1772	279.5	337.1
10	1773	280.0	337.3
11	1774	280.5	338.4
12	1777	280.6	339.9
13	1779	281.4	340.2
14	1780	281.7	340.4
15	1784	282.3	341.3
16	1785	282.4	343.2
17	1785	282.9	346.0
18	1789	285.8	347.7
19	1790		
20	1803		
M :	1777	279	338
s_M:	11	4	5
$\overline{s_i}$:	7	2.4	2.2

The laboratory mean values have been examined statistically to eliminate outlying values. Where a ” --- ” appears in the table it indicates that an outlying value has been omitted (Grubbs).

M: mean of means of data sets
s_M: standard deviation of means of data sets*
$\overline{s_i}$: mean of standard deviations of individual data sets

*calculated of at least 4 but normally 6 single values

ANALYTICAL METHOD USED FOR CERTIFICATION

Element	Line no.	Method
Pt	2, 4, 6, 8, 13	ICP OES, after collection with nickel sulfide
	3, 5, 7, 10, 11, 12, 14, 15, 17	ICP OES, after collection with copper
	9, 20	ICP OES
	16	FAAS, after collection with tellurium
	18, 19	ICP OES, after collection with lead
Pd	1, 13	ICP OES
	2, 17, 18	ICP OES, after collection with lead
	3, 4, 8, 9, 10	ICP OES, after collection with nickel sulfide
	5, 6, 7, 12, 14, 15, 16	ICP OES, after collection with copper
	11	FAAS, after collection with tellurium
Rh	1, 17, 18	ICP OES, after collection with lead
	2, 6, 8, 11, 15	ICP OES, after collection with nickel sulfide
	3, 7, 9, 10, 12, 13, 14	ICP OES, after collection with copper
	4, 16	ICP OES
	5	FAAS, after collection with tellurium

Abbreviations:

ICP OES	Inductively coupled plasma – optical emission spectrometry
FAAS	Flame atomic absorption spectrometry

TECHNICAL REPORT

A detailed technical report (in German) describing the analysis procedures and the treatment of the analytical data used to certify ERM®-EB504 is available on request.

Supply of Reference Materials by Bundesanstalt für Materialforschung und –prüfung:

Richard-Willstätter-Straße 11, D-12489 Berlin, Germany

Phone: +49 30 8104 2061 e-mail: sales.crm@bam.de

Fax: +49 30 8104 1117 internet: www.bam.de

Safety Data Sheet

according to Regulation (EC) No 1907/2006 (REACH)

1. Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier: ERM-EB504, Abgaskatalysator
Index No: -
EC No: -
REACH Registration No: -
CAS No: -

1.2 Relevant identified uses of the substance or mixture and uses advised against: Certified reference material for the use in the chemical laboratory

1.3 Details of the supplier of the safety data sheet:

Supplier:	BAM Federal Institute for Materials Research and Testing Unter den Eichen 87 12200 Berlin / Germany Tel. +49(0)30 8104-0
Information contact:	BAM Department I Analytical Chemistry; Reference Materials Dr. Sebastian Recknagel phone: +49(0)30 8104-1111 email: sebastian.recknagel@bam.de
E-Mail (competent person):	petra.schulte@bam,de

1.4 Emergency telephone number: +49(0)30 8104-1111 Only available during office hours.

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2. Hazards identification

2.1 Classification of the substance or mixture

2.1.1 Classification according to Regulation (EC) No 1272/2008 [CLP/GHS]
This substance is not classified as hazardous according to Regulation (EC) No 1272/2008.

2.1.2 Classification according to Directive 67/548/EEC or Directive 1999/45/EC
This substance is not classified as hazardous according to Directive 1999/45/EC.

2.2 Label elements

2.2.1 Labelling according to Regulation (EC) No 1272/2008 [CLP/GHS]:

Hazard picograms	---
Signal word:	---
Hazard statements:	---
Supplemental Hazard information (EUH):	---
Precautionary statements:	P260 Do not breathe dust.
Special rules for supplemental label elements for certain mixtures:	---

2.2.2 Labelling according to Directive 67/548/EEC or Directive 1999/45/EC

Symbol:	---	
R-phrases:	---	
S-phrases:	22	Do not breathe dust.

2.3 Other hazards:
Adverse human health effects and symptoms: For aluminium magnesium silicate the general threshold limit value for dust has to be considered. Please observe the information given in this safety data sheet.

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3. Composition/information on ingredients

Name/chemical formula	CAS No	EC No	% by Weight	Classification: Annex VI to Regulation (EC) No 1272/2008
Silicic acid, aluminum magnesium salt ($Mg_2Al_4Si_5O_{18;}$*Cordierite)*	1327-43-1	215-478-8	> 90	not classified
Platinum (Pt)	7440-06-4	231-116-1	< 0.1	not classified
Palladium (Pd)	7440-05-3	231-115-6	< 0.1	not classified
Rhodium (Rh)	7440-16-6	231-125-0	< 0.1	not classified

4. First aid measures

4.1 Description of first aid measures

4.1.1 In case of inhalation: Remove to fresh air and keep at rest in a position comfortable for breathing. Get medical advice/attention if you feel unwell.

4.1.2 In case of skin contact: Remove contaminated clothing immediately. Wash with plenty of soap and water.

4.1.3 In case of eye contact: In case of contact with eyes flush immediately with plenty of flowing water for 10 to 15 minutes holding eyelids apart and if eye irritation persists, get medical advice/attention.

4.1.4 In case of ingestion: Rinse mouth. Drink one glass of water. Get medical advice/attention if you feel unwell.

4.2 Most important symptoms and effects, both acute and delayed
Not available.

4.3 Indication of any immediate medical attention and special treatment needed
Not available.

5. Firefighting measures

5.1 Extinguishing media
The product itself does not burn. Use extinguishing measures that are appropriate to local circumstances and the surrounding environment, Water spray, Powder, Foam, Carbon dioxide (CO_2).

5.2 Special hazards arising from the substance or mixture
Substance is not combustible and not dust explosible. Adjust fire and explosion protection measures to the flammable substances in the area.

5.3 Advice for firefighters
Substance is not combustible and not dust explosible. Adjust fire and explosion protection measures to the flammable substances in the area.

6. Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures: Do not breathe dust. Avoid generation of dust. Provide adequate ventilation. Wear personal protection equipment.

6.2 Environmental precautions: No special environmental measures are necessary.

6.3 Methods and material for containment and cleaning up
Take up mechanically, dry (avoid generation of dust) and placing in appropriate containers for disposal. Subsequent ventilate affected area and clean contaminated objects and areas.

6.4 Reference to other sections
None.

7. Handling and Storage

7.1 Precautions for safe handling
7.1.1 Protective measures: If handled uncovered, arrangements with local exhaust ventilation should be used if possible. If local exhaust ventilation is not possible or not sufficient, the entire working area must be ventilated by technical means. Do not breathe dust.
7.1.2 Advice on general occupational hygiene
Handle in accordance with good industrial hygiene and safety practice.
7.2 Conditions for safe storage, including any incompatibilities
7.2.1 Technical measures and storage conditions: Store in dry conditions.
7.2.2 Packaging materials: For quality reasons: keep/store only in original container.
7.2.3 Requirements for storage rooms and vessels: Keep container tightly closed. Storage temperature: without restrictions.
7.2.4 Hints on storage assembly: Storage class (VCI concept): 10 – 13
7.2.5 Further information on storage conditions: None.
7.3 Specific end use(s)
None.

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8. Exposure controls/personal protection

8.1 Control parameters
8.1.1 Occupational exposure limit values:
TRGS 900 – Occupational exposure limit values: (DE) - general threshold limit value for dust
alveolar fraction: 3 mg/m^3
respirable fraction: 10 mg/m^3
Peak limitation: 2 (II)
8.2 Exposure controls
8.2.1 Appropriate engineering controls: If handled uncovered, arrangements with local exhaust ventilation should be used if possible.
8.2.2 Personal protection equipment:
Protective clothing should be selected specifically for the working place, depending on concentration and quantity of the hazardous substances handled. The resistance of the protective clothing to chemicals should be ascertained with the respective supplier.

Eye protection:	Sufficient eye protection should be worn when dust-emitting activities occur: dust protection eye glasses.
Skin/hand protection:	Abrasive resistant gloves.
Respiratory protection:	Only required when dusts are generated and exceeding the limited value e.g. half mask with P1 filter.

8.2.3 Environmental exposure controls:
None.

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9. Physical and chemical properties

9.1 Information on basic physical and chemical properties
Physical state and appearance: solid powder
Colour: grey
Odour: odourless

	Value	Remark	Method
pH value (20 °C) at 100 g/l H_20	not determined		
Melting point / melting range:	> 1000 °C		
Boiling temperature / boiling range:	not determined		
Vapour pressure: (20°C)	ca. 0 hPa		
Auto Ignition temperature	not applicable		
Flash point	not applicable		
Flammability (solid, gaseous.)	not flammable		

Oxidising properties	not oxidising	
Explosion limits:		
Lower:	not applicable	
Upper:		
Dust explosibility	The formation of explosive dust-air-mixtures is not possible.	
Explosive properties	not explosive	
Density (20 °C)	not determined	
Bulk density	not determined	
Water solubility (20 °C)	Insoluble in water.	
Partition coefficient n-octanol/water (log Pow):	not applicable	Substance is inorganic.
Dynamic viscosity (mPa s):	not applicable	
Thermal decomposition	not determined	

9.2 Other information
No information available.

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10. Stability and Reactivity

10.1 Reactivity: Reactive with oxidizing agents.
10.2 Chemical stability: The product is stable.
10.3 Possibility of hazardous reactions: Polymerization will not occur.
10.4 Conditions to avoid: No information available
10.5 Incompatible materials: Avoid powerful oxidizing agents such as fluorine, chlorine trifluoride and oxygen difluoride.
10.6 Hazardous decomposition products: No information available

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11. Toxicological information

11.1 Toxicokinetics, metabolism and distribution
None known.
11.2 Information on toxicological effects
Acute toxicity: Not available.
Skin corrosion/irritation: May cause skin irritation.
Serious eye damage/irritation: May cause eye irritation.
Respiratory or skin sensitisation: May cause respiratory tract irritation.
Germ cell mutagenicity: Not available.
Carcinogenicity: Not available.
Reproductive toxicity: Not available.
STOT-single exposure: Not available.
STOT-repeated exposure: Not available.
Aspiration hazard: Not available.
Further toxicological information:
On the basis of the morphology of the product, no hazardous properties are to be expected when it is handled and used with appropriate care. Inhalation or swallowing can lead to health damage. Dust may irritate the respiratory tract and eyes. Temporary troubles such as cough, constipation can occur.

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12. Ecological information

12.1 Toxicity: Quantitative data on the ecological effect of this product are not available.
12.2 Persistence and degradability: is not biodegradable (almost water insoluble, inorganic)
12.3 Bioaccumulative potential: no data available
12.4 Mobility in soil: The Methods for the determination of biodegradability are not applicable to inorganic substances.
12.5. Results of PBT and vPvB assessment: no data available

12.6 Other adverse effects: no data available
12.7 Additional information:
Due to the low water solubility of the substance no ecological problems are to be expected when the substance is handled and used with due care and attention.

13. Disposal considerations

13.1 Waste treatment methods
Can be disposed of as non-hazardous waste in accordance with local, state and federal regulations. Contact local authorities or disposal companies for advice.

14. Transport information

The product is not subject to any international regulations concerning its transport.

15. Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture
15.1.1 EU regulations
Directive 96/82/EC for danger control following severe accidents with dangerous substances: Not subject to 96/82/EC.
15.1.2 National regulations (Germany)
TRGS 900 Occupational exposure limit values: The general threshold limit value for dust has to be considered.
Technische Anleitung Luft (TA-Luft): Total dust emission value may not be exceeded (see number 5.2.1).
Storage class (VCI concept): 10-13
15.2 Chemical Safety Assessment: No chemical safety assessment is required.

Observe in addition any national regulations!

16. Other information

The information is based upon the present state of our knowledge. It characterizes the product with regard to the appropriate safety precautions. It does not represent a guarantee of the properties of the product.

Revision Information: SDS according to Commission Regulation (EU) No 453/2010 of 20 May 2010 amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)