Certificate of Analysis

Certified Reference Material: LPPM Pt RM1

Trace Elements in High Purity Platinum

General Information

The London Platinum and Palladium Market (LPPM) promotes quality and good practice in the area of platinum and palladium refining and trade. The production and the sale of the Reference Materials referred to herein represents part of this effort. This Reference Material was produced by Tanaka Kikinzoku Kogyo K.K. on behalf of the LPPM, under the guidance of the LPPM Referees and the LPPM Consultants. The composition reflects the needs expressed by LPPM accredited refiners.

The following table lists the elements for which certified values have been established with expanded uncertainty ($U_{CRM} = ku_c$, where u_c is the combined standard uncertainty calculated according to the ISO Guide [1] and k=2 is the coverage factor).

LPPM Pt RM1
Element Concentrations, mg/kg

Ag	**13.9**	**±**	**1.3**
Al	**93.9**	**±**	**7.1**
As	**58.2**	**±**	**5.4**
Au	**11.1**	**±**	**2.4**
Cr	**9.3**	**±**	**0.5**
Cu	**26.1**	**±**	**1.5**
Fe	**12.4**	**±**	**1.8**
Ir	**204**	**±**	**17**
Ni	**11.1**	**±**	**2.3**
Pb	**12.3**	**±**	**3.0**
Pd	**10.5**	**±**	**1.3**
Rh	**13.7**	**±**	**2.4**
Ru	**11.4**	**±**	**1.4**
Sb	**19.5**	**±**	**2.3**
Si	**47.5**	**±**	**4.9**
Sn	**47.6**	**±**	**5.0**
Tl	**6.2**	**±**	**0.8**
Zn	**44.9**	**±**	**2.2**
Zr	**1.2**	**±**	**0.2**

Disclaimer

The LPPM, the LPPM Referees Committee, the manufacturer and the laboratories (LPPM associates) involved in the fabrication and analysis of these reference materials have used their best endeavors to ensure that the reference materials are homogeneous in respect of the contained trace elements and that their concentrations are determined as accurately as possible; however, the LPPM and the LPPM associates cannot be held liable for the consequence of any use of these reference materials, or reliance upon any of the estimates of homogeneity or concentrations of trace elements.

London, UK December 2015

The London Platinum and Palladium Market
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Manufacture of the Reference Materials
These reference materials were produced by melting high-purity platinum with master alloys in order to include trace impurities of number elements in the 1-250 mg/kg range. Melt was cast into a vertical cylinder metal mould designed for rapid cooling. The ingot was shaped into an octagonal sided bar. The bar was cut into individual slices, 4 mm thick.

Homogeneity
Ten pieces were selected randomly from the sliced bar. Samples were analysed on the top face in four different places in a random order in duplicate. Concentration data was obtained by two different laboratories using spark optical emission spectrometry. Results from these tests were evaluated using ANOVA and found to be satisfactory.

Quantitative analysis of trace elements
Shavings were obtained by milling sample pieces and collecting the shavings. The shavings were acid washed in 50% HCl, rinsed several times with distilled deionized water, and then dried in a clean hood. Portions of the shavings of the reference material were distributed to 10 laboratories for analysis. All the laboratories determined the trace element concentrations by solution inductively coupled plasma optical emission spectrometry.

Instructions for the storage, handling and correct use of these reference materials
Keep the materials in a box to avoid exposure to industrial environment. Metallic dusts or vapour may deposit on the surface. In case of doubt, clean with ethanol, then high-purity water.

Hazardous information: There are no hazards associated with this material.

Intended use
These reference materials are intended to be used for the validation of analytical methods for trace metallic impurities in platinum. They can also be used in the calibration of analytical instruments.

Traceability
The results in this certificate are traceable to the SI through gravimetrically prepared standards of established purity and international measurement intercomparisons.

Date of certification: December 2015

Expiration date of the certificate: December 2025. This platinum reference material and the certified property values are expected to remain unchanged for more than 50 years.

LPPM: The following individuals directed the manufacture and certification of this reference material:

Referees:

David Grimwood, Johnson Matthey, UK	Dr. Jonathan J. Jodry, Metalor Technologies, Switzerland
Daniela Manara, Umberto Magro, PAMP, Switzerland	Hiroshi Sawai, Ichimitsu Itabashi, Hitoshi Kosai, Tanaka Kikinzoku Kogyo K.K., Japan
Fabio Ticozzelli, Michael Mesaric, Valcambi, Switzerland	

Consultants: John Fairley, Wallace Trading Ltd., UK; Dr. Michael Hinds, Royal Canadian Mint, Canada.

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Anglo American (South Africa)	Argor-Heraeus (Switzerland)
BASF (Germany)	Cendres+Métaux (Switzerland)
Heraeus (Germany)	Johnson Matthey (UK)
Metalor Technologies (Switzerland)	PAMP (Switzerland)
Tanaka Kikinzoku Kogyo K.K (Japan)	Valcambi (Switzerland)

References
[1] Guide to Expression of Uncertainty in Measurement, ISBN 92-67-10188-9, 1st ed. ISO, Geneva, Switzerland (1993).