INSTITUTE OF NON-FERROUS METALS

Analytical Chemistry Department
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CERTIFICATE OF ANALYSIS

Refined Lead

The average results of chemical analysis in ppm

No / Element	PL1	PL2	PL3	PL4	PL5	PL6	PL7
Ag	193	97,0	17,0	10,3	27,3	64,3	151
As	3,6	2,6	2,5	345	159	318	(74,3)
Bi	729	460	101	59,9	296	48,3	61,7
Cu	7,3	14,9	105	197	9,1	4,7	6,8
Fe	4,5	4,4	(2,4)	-	-	(2,0)	-
In	-	-	5,9	-	287	104	-
Ni	136	159	39,4	8,5	6,7	5,5	-
Mn	(0,20)	(0,17)	(0,60)	-	-	(0,50)	-
Sb	15,4	7,2	8,0	3,4	572	310	77,7
Se	-	33,3	2,7	2,7	-	-	-
Sn	3,0	2,6	2,1	-	13,7	7,6	26,3
Te	145	349	235	23,6	13,6	8,2	270
Cd	-	218	15,7	5,1	-	623	53,2
Ca	-	-	(3,4)	-	-	-	-
Tl	569	228	26,4	21,5	135	494	99,2
Zn	-	(1,7)	1,8	-	-	-	3,5

- elements are present but not certified

Director of the Institute

Prof. Ph. D. Zbigniew Śmieszek

Gliwice, June 2004

The uncertainity in [ppm] at the probability level of 0,05

No / Element	PL1	PL2	PL3	PL4	PL5	PL6	PL7
Ag	6,04	1,7	1,54	0,20	2,63	3,42	5,78
As	0,32	0,69	0,95	14,52	10,43	12,71	-
Bi	10,31	16,01	1,90	1,60	7,66	1,43	3,03
Cu	0,79	1,10	2,01	1,92	0,95	0,30	0,65
Fe	0,88	0,98	-	-	-	-	-
In	-	-	5,9	-	20,5	3,70	-
Ni	4,75	3,15	1,28	0,56	0,65	0,42	-
Mn	-	-	-	-	-	-	-
Sb	2,46	0,53	0,26	0,58	16,4	8,3	4,30
Se	-	3,08	2,70	0,59	-	-	-
Sn	0,43	0,47	0,23	-	0,21	0,77	1,97
Te	7,17	8,47	5,65	2,70	2,24	3,3	5,37
Cd	-	9,16	0,56	0,40	-	26,81	1,73
Ca	-	-	-	-	-	-	-
Tl	10,79	9,94	0,5	5,04	2,24	10,99	1,46
Zn	-	-	0,5	-	-	-	0,69

Analytical methods applied:

Ag - atomic emission spectrometry with ICP and low voltage spark, atomic absorption spectrometry

As - atomic emission spectrometry with ICP and low voltage spark, atomic absorption spectrometry

Bi - atomic emission spectrometry with ICP and low voltage spark, atomic absorption spectrometry

Cu - atomic emission spectrometry with ICP and low voltage spark, atomic absorption spectrometry, spectrophotometric with cuprizone

Fe - atomic emission spectrometry with ICP and low voltage spark, atomic absorption spectrometry, spectrophotometric after lead separation

In - atomic emission spectrometry with ICP, atomic absorption spectrometry

Ni - atomic emission spectrometry with ICP and low voltage spark, atomic absorption spectrometry, spectrophotometric with DMG after lead separation

Mn - atomic emission spectrometry with ICP, atomic absorption spectrometry

Sb - atomic emission spectrometry with ICP and low voltage spark, atomic absorption spectrometry after separation on MnO_2

Se - atomic emission spectrometry with ICP and low voltage spark, atomic absorption spectrometry

Sn - atomic emission spectrometry with ICP and low voltage spark, spectrophotometric with extration with fenylofluoron

Te - atomic emission spectrometry with ICP and low voltage spark, atomic absorption spectrometry

Cd - atomic emission spectrometry with ICP and low voltage spark, atomic absorption spectrometry

Ca - atomic emission spectrometry with ICP and low voltage spark, atomic absorption spectrometry

Tl - atomic emission spectrometry with ICP and low voltage spark, atomic absorption spectrometry

Zn - atomic emission spectrometry with ICP and low voltage spark, atomic absorption spectrometry

The chemical analysis have been carried out in three specialistic industrial laboratories from Poland and two laboratories from the Institute of Non-Ferrous Metals. Melts have been performed using induction furnace. Lead CRMs are in form of discs 40 mm in diameter and 27 mm height. Homogeneity testing were made taking into account over 30 % of the material produced. Investigations were carried out using atomic emission spectrometry method with low voltage spark.

Homogeneity was estimated statistically with application of the test F.

Application of CRMs - Atomic emission spectrometry

- X-Ray spectrometry for higher concentrations

CRMs are stable in time.