



INSTITUTE OF NON-FERROUS METALS

Analytical Chemistry Department

44-101 Gliwice, ul. Sowińskiego 5

CERTIFICATE OF ANALYSIS

Sn - bronzes

The average results of chemical analysis in wt %

Element ^{No}	BL1	BL2	BL3	BL4	BL5
Sn	2,58	4,04	6,12	8,38	11,05
P	0,49	0,29	0,084	0,010	0,0042
Fe	0,38	0,21	0,10	0,014	0,0061
Pb	0,25	0,14	0,065	0,013	0,0069
Al.	0,11	0,15	0,019	-	0,00052
Zn	0,68	0,40	0,15	0,017	0,0078
Ni	0,25	0,37	0,13	0,015	0,0074
As	0,058	0,039	0,025	0,0089	0,00057
Cd	0,060	0,040	0,022	0,0092	0,0015
Mg	0,051	0,11	-	-	0,0030
Sb	0,053	0,039	0,021	0,0095	0,0039
Mn	0,062	0,055	0,026	0,0092	0,0011
Bi	0,024	0,014	0,0099	0,0058	0,0015
Si	0,059	0,031	0,015	0,011	(0,0038)
Cu	the rest	the rest	the rest	the rest	the rest

Director of the Institute

Prof. Ph.D. Zbigniew Śmieszek

Gliwice, April 2003

The uncertainty in weight \pm [%] at the probability level of 0,05

Element No	BL1	BL2	BL3	BL4	BL5
Sn	0,023	0,075	0,035	0,022	0,090
P	0,0092	0,015	0,00081	0,00044	0,000076
Fe	0,0070	0,0076	0,0022	0,0012	0,00031
Pb	0,0054	0	0,0012	0,00076	0,00023
Al.	0,0070	0,0094	0,0011	-	0,0000076
Zn	0,0018	0,015	0,0031	0,0044	0,000082
Ni	0,0062	0,0011	0,0031	0,00044	0,00022
As	0,0014	0,0019	0,00046	0,00018	0,000013
Cd	0,0016	0,0012	0,00062	0,000070	0,000076
Mg	0,0019	0,0054	-	-	0,000046
Sb	0,00076	0,0011	0,00098	0,00020	0,00040
Mn	0,00098	0,00062	0,0016	0,00029	0,000062
Bi	0,0013	0,0016	0,00043	0,00024	0,00024
Si	0,0027	0,00017	0,00076	0,0013	-

Analytical methods applied:

- Sn - atomic absorption spectrometry (directly), atomic emission spectrometry with ICP
- P - spectrophotometric, atomic emission spectrometry with ICP, weight method
- Fe - atomic absorption spectrometry (directly), atomic emission spectrometry with ICP
- Pb - atomic absorption spectrometry (directly), atomic emission spectrometry with ICP
- Al - atomic absorption spectrometry (directly) and after co precipitation on $Fe(OH)_3$ atomic emission spectrometry with ICP
- Zn - atomic absorption spectrometry (directly), atomic emission spectrometry with ICP
- Ni - atomic absorption spectrometry (directly), atomic emission spectrometry with ICP
- As - atomic absorption spectrometry (directly), atomic emission spectrometry with ICP
- Cd - atomic absorption spectrometry (directly), atomic emission spectrometry with ICP
- Mg - atomic absorption spectrometry (directly) and after co precipitation on $Fe(OH)_3$ atomic emission spectrometry with ICP

- Mn - atomic absorption spectrometry (directly and after co precipitation on $\text{Fe}(\text{OH})_3$)
Bi - atomic absorption spectrometry (directly and after co precipitation on $\text{Fe}(\text{OH})_3$, atomic emission spectrometry with ICP)
Si - weight method, atomic emission spectrometry with ICP

The chemical analysis have been carried out in three specialistic industrial laboratories from Poland and in the laboratory of the Institute of Non-Ferrous Metals (atomic absorption, atomic emission and classical laboratory). Melts have been performed using induction furnace.

Sn - bronze CRMs are in form of discs 40 mm in diameter and 27 mm height. Homogeneity investigations 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.

Materials have been produced and certified with the requirements of ISO Guide 31, ISO Guide 32, ISO Guide 33 and ISO Guide 34.

Application of CRMs - Atomic emission spectrometry
- X-Ray spectrometry

CRMs are stable in time.

Sale:

Institute of Non-Ferrous Metals

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