



INSTITUTE OF NON-FERROUS METALS

Analytical Chemistry Department

44-101 Gliwice, ul. Sowińskiego 5

CERTIFICATE OF ANALYSIS

Sn-P bronzes – BC series

The average results of chemical analyses in wt %

Element	No.	BC1	BC2	BC3	BC4	BC5	BC6
Sn		8,43	8,98	9,78	10,46	11,00	11,58
P		1,43	1,10	0,87	0,56	0,29	0,051
Zn		0,60	0,43	0,34	0,25	0,15	0,024
Pb		0,83	0,63	0,47	0,32	0,20	0,020
Mn		0,0024	0,31	0,22	0,27	0,067	0,13
Al		-	0,031	0,024	0,045	0,015	0,0045
Fe		0,58	0,50	0,37	0,26	0,11	0,020
Si		0,058	0,053	0,033	0,040	0,048	0,041
Sb		0,11	0,30	0,57	0,051	0,51	0,36
Bi		(0,037)	(0,047)	(0,0021)	(0,028)	(0,010)	(0,021)
As		0,077	0,12	0,051	0,099	0,024	0,0050
Mg		(0,0005)	(0,019)	(0,0021)	(0,027)	(0,0097)	(0,018)
Ni		0,39	0,12	0,0078	0,23	0,60	0,48
Cu		(87,17)	(87,16)	(87,44)	(87,41)	(86,95)	(86,93)

Director of the Institute

Prof. Ph.D. Zbigniew Śmieszek

The confidence interval in wt % at the probability level of 0,05

Element No.	BC1	BC2	BC3	BC4	BC5	BC6
Sn	0,018	0,015	0,037	0,022	0,020	0,011
P	0,010	0,009	0,0053	0,0064	0,0018	0,00051
Zn	0,0052	0,0039	0,0047	0,0039	0,0018	0,00030
Pb	0,0087	0,0070	0,0058	0,0031	0,0024	0,00032
Mn	0,00014	0,0032	0,0027	0,0030	0,00029	0,0027
Al	-	-	-	-	-	-
Fe	0,0065	0,0032	0,0042	0,0066	0,0020	0,00024
Si	0,00066	0,00067	0,00073	0,0005	0,00075	0,00067
Sb	0,0056	0,0085	0,0070	0,00083	0,011	0,0046
Bi	-	-	-	-	-	-
As	0,00071	0,0060	0,00040	0,0013	0,00061	0,00011
Mg	-	-	-	-	-	-
Ni	0,0061	0,0018	0,00009	0,0039	0,0047	0,0027

Analytical method applied:

Sn - Iodometric, Titration

P - Gravimetric, Spectrophotometric

Zn - Atomic absorption spectrometry

Pb - Atomic absorption spectrometry, Titration, Iodometric

Mn - Atomic absorption spectrometry, spectrophotometric

Al - Spectrophotometric

Fe - Spectrophotometric, Gravimetric

Si - Spectrophotometric, Gravimetric

Sb - Atomic absorption spectrometry, Spectrophotometric

Bi - Atomic absorption spectrometry

As - Spectrophotometric

Mg - Atomic absorption spectrometry

Ni - Atomic absorption spectrometry, Gravimetric.

The chemical analyses have been carried out in four laboratories including laboratory of the Institute of Non-Ferrous Metals using different methods. Sn-P bronzes CRMs were made by melting of all components in the corelles induction furnace and by casting into special cast iron moulds.

Homogeneity investigations were made taking account 30 % of the material produced. Investigations were carried out using atomic emission spectrometry method with high voltage spark.

Homogeneity was estimated statistically with application of the test F.

The set consists of 6 CRMs is in form of discs ~ 40 mm in diameter and ~ 25 mm in height or rods 10 mm in diameter and 100 mm long.

Application of CRMs – AES

CRMs are stable in time.