



INSTITUTE OF NON-FERROUS METALS
Analytical Chemistry Department

CERTIFICATE OF ANALYSIS
Bronze BP series

The average results of chemical analyses in wt %

No Element	BP1	BP2	BP3	BP4	BP5
Al	8,935	6,136	7,120	4,632	3,769
Ni	0,243	1,032	1,850	2,522	3,528
Sn	0,00043	0,00199	0,0106	0,0229	0,0336
Cd	0,00054	0,00214	0,00928	0,0226	0,0356
Fe	0,00305	0,0184	0,0743	0,131	0,200
Zn	0,0100	0,0240	0,176	0,343	0,459
Pb	0,00055	0,00238	0,0103	0,0229	0,0347
As	0,00094	0,00215	0,00980	0,0238	0,0361
Cr	0,00037	0,00267	0,0104	0,0217	0,0374
Mn	0,00535	0,0189	0,152	0,304	0,411
P	0,00055	0,00208	0,00661	0,0238	0,0189
Sb	0,00052	0,00468	0,0108	0,0215	0,0356
Zr	(0,00069)	(0,00258)	(0,0198)	(0,0433)	(0,0630)
Bi	0,00053	0,00222	0,0102	0,0207	0,0349
Si	(0,00544)	0,0220	0,0804	0,183	0,266
Cu	the rest	the rest	the rest	the rest	the rest

Director of the Institute

Prof. Ph.D. Zbigniew Śmieszek

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

No Element	BP1	BP2	BP3	BP4	BP5
Al	0,051	0,164	0,085	0,132	0,040
Ni	0,011	0,062	0,070	0,311	0,283
Sn	0,00006	0,00034	0,0019	0,0037	0,0019
Cd	0,00004	0,00023	0,00018	0,0007	0,0015
Fe	0,00025	0,0021	0,0024	0,003	0,010
Zn	0,0006	0,0013	0,006	0,013	0,029
Pb	0,00011	0,00010	0,0008	0,0014	0,0024
As	0,00006	0,00036	0,00054	0,0008	0,0011
Cr	0,00009	0,00016	0,0019	0,0032	0,0015
Mn	0,00019	0,0024	0,023	0,021	0,015
P	0,00004	0,00034	0,00032	0,0036	0,0022
Sb	0,00006	0,00067	0,0002	0,0012	0,0014
Zr	-	-	-	-	-
Bi	0,00004	0,00023	0,0009	0,0022	0,0005
Si	-	0,00018	0,0029	0,023	0,035
Cu	-	-	-	-	-

Analytical methods applied:

- P - atomic emission spectrometry with ICP, spectrophotometric,*
- Fe - atomic emission spectrometry with ICP, atomic absorption spectrometry,*
- Ni - atomic emission spectrometry with ICP, atomic absorption spectrometry,*
- Pb - atomic emission spectrometry with ICP, atomic absorption spectrometry,*
- Zn - atomic emission spectrometry with ICP, atomic absorption spectrometry,*
- Bi - atomic emission spectrometry with ICP, atomic absorption spectrometry,*
- Sb - atomic emission spectrometry with ICP, atomic absorption spectrometry,*
- Cd - atomic emission spectrometry with ICP, atomic absorption spectrometry,*
- As - atomic emission spectrometry with ICP, atomic absorption spectrometry,*
- Cr - atomic emission spectrometry with ICP, atomic absorption spectrometry,*
- Al - atomic emission spectrometry with ICP, atomic absorption spectrometry,*
- Sn - atomic emission spectrometry with ICP, atomic absorption spectrometry,*
- Mn - atomic emission spectrometry with ICP, atomic absorption spectrometry,*
- Zr - atomic emission spectrometry with ICP, spectrophotometric,*
- Si - atomic emission spectrometry with ICP, spectrophotometric, gravimetric*

The chemical analyses have been carried out in four specialistic laboratories from Poland, by various parallel methods. The bronze CRM were made by melting of all components in the coreless induction furnace and by casting into special cast iron moulds preventing elimination of segregation of the components during solidification. Homogeneity testing were made taking into account over 25% of the material produced. Investigation were carried out using atomic emission spectrometry method with low voltage spark. Homogeneity was estimated statistically with application of the test F. The set consists of 5 standard certified reference materials in form of discs 40 mm in diameter and ~30 mm height.

Application for:

- atomic emission spectrometry with low voltage argon spark,
- XRF spectrometry.

Certified Reference Materials BM series is stable in time

Sale:

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