



INSTITUTE OF NON-FERROUS METALS

Analytical Chemistry Department

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CERTIFICATE OF ANALYSIS

Zn-Sn bronze

The average results of chemical analysis in wt %

Element No.	WL 1	WL 2	WL 3	WL 4	WL 5	WL 6
Ni	0,44	0,32	0,22	0,019	0,0014	0,091
Al	0,082	0,057	0,0034	---	0,0014	0,10
Fe	0,072	0,13	0,20	0,012	0,0025	0,31
Mn	0,0041	0,0038	0,38	---	0,00073	0,14
Co	0,0010	0,0065	0,0096	0,013	0,019	0,019
P	0,012	0,016	0,021	---	---	0,032
Mg	(0,00036)	0,00097	0,0016	---	---	0,015
Pb	0,013	0,011	0,0083	0,0066	0,0030	0,016
As	0,0010	0,0078	0,020	0,0034	0,0011	0,024
Cd	0,0017	0,0023	0,010	0,0068	0,0038	0,025
Sb	---	0,0050	0,0085	---	0,0006	0,011
Sn	0,22	0,32	0,37	0,55	0,73	0,80
Si	0,057	0,046	0,0037	0,0019	0,0009	0,13
Bi	0,0093	0,0073	0,0050	0,0026	0,0011	0,012
S	0,020	0,0070	0,0088	0,0050	0,0019	0,017
C	(0,0050)	(0,0082)	(0,010)	(0,0032)	---	(0,016)
Zn	3,52	1,56	2,21	2,97	1,61	2,48
Cu	95,54	97,49	96,51	96,41	97,62	95,76

Director of the Institute

Prof. Ph.D. Zbigniew Śmieszek

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

Element No.	WL 1	WL 2	WL 3	WL 4	WL 5	WL 6
Ni	0,014	0,0086	0,0066	0,0012	0,00018	0,0047
Al	0,0035	0,0016	0,00034	---	0,00015	0,0023
Fe	0,0024	0,0069	0,011	0,00092	0,00010	0,0086
Mn	0,00026	0,00024	0,014	---	0,000030	0,0047
Co	0,000096	0,00018	0,00063	0,00057	0,00072	0,0010
P	0,00074	0,0011	0,0022	---	---	0,0039
Mg	0,000085	0,000030	0,00017	---	---	0,00051
Pb	0,0011	0,0074	0,00054	0,00031	0,00026	0,00096
As	0,00055	0,00023	0,0011	0,00027	0,00012	0,0019
Cd	0,00010	0,00019	0,00037	0,00024	0,00028	0,0014
Sb	---	0,00046	0,00069	---	0,000074	0,0011
Sn	0,010	0,013	0,026	0,026	0,013	0,013
Si	0,0027	0,0046	0,00049	0,00047	0,00013	0,012
Bi	0,00042	0,00036	0,00036	0,00031	0,000051	0,00092
S	0,0021	0,00058	0,00064	0,00051	0,00025	0,0011
C	0,00025	0,0026	0,0018	0,0011	---	0,0025
Zn	0,025	0,042	0,026	0,038	0,020	0,039
Cu	---	---	---	---	---	---

Analytical methods applied:

- Ni - atomic absorption, spectrophotometric, OES-ICP*
- Al - atomic absorption, spectrophotometric, OES-ICP*
- Fe - atomic absorption after coprecipitation on lanthanum carrier, OES-ICP*
- Mn - atomic absorption, OES-ICP*
- Co - atomic absorption, spectrophotometric, OES-ICP*
- P - spectrophotometric, titration, OES-ICP*
- Mg - atomic absorption, OES-ICP*
- Pb - atomic absorption after coprecipitation on $Fe(OH)_3$, OES-ICP*
- As - atomic absorption after coprecipitation on $Fe(OH)_3$ at pH 4, OES-ICP*
- Cd - atomic absorption, OES-ICP*
- Sb - atomic absorption after coprecipitation on $Fe(OH)_3$ at pH 4, OES-ICP*
- Sn - atomic absorption, titration*
- Si - gravimetric, spectrophotometric after extraction*

- Bi - atomic absorption after coprecipitation on $\text{Fe}(\text{OH})_3$ at pH 4, OES-ICP
S - method of combusting and infrared determination of SO_2 ,
OES-ICP, titration with alkali solution
C - method of combusting and infrared determination of CO_2
Zn - atomic absorption, OES-ICP

The chemical analyses have been carried out in two industrial laboratories and at the Institute of Non-Ferrous Metals by two parallel methods. The Zn-Sn bronze SRM 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.

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

The set consists of 6 standards reference materials in form of discs 40 mm in diameter and 25 mm in height.