



INSTITUTE OF NON-FERROUS METALS

Analytical Chemistry Department

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CERTIFICATE OF ANALYSIS

Cartridge brasses M 68, M 70

(in co-operation with the National Institute of Standards and Technology NIST, USA)

The average results of chemical analyses in wt %

Element	No.	MH 1	MH 2	MH 3	MH 4	MH 5
Fe		0,017	0,027	0,081	0,13	0,19
Pb		0,0065	0,021	0,078	0,33	0,20
Ni		0,26	0,22	0,10	0,052	0,0072
Mn		0,035	0,011	0,085	0,0017	0,072
Cd		0,026	0,018	0,0089	0,0029	0,0012
Sb		0,0004	0,024	0,013	0,017	0,0035
Sn		0,14	0,097	0,024	0,011	0,0021
Ag		0,0029	0,011	0,0065	----	0,025
As		0,067	0,041	0,016	0,0011	0,0038
Bi		0,0037	0,0022	0,0011	0,0006	----
P		0,016	0,0055	0,0035	0,0022	0,0011
S		(0,0034)	(0,0055)	(0,0090)	(0,0043)	(0,018)
Al		0,0010	0,019	0,0081	0,0027	0,014
Te		0,0004	0,0015	0,0046	0,0035	0,0047
Be		0,0088	0,0015	0,0003	0,0045	0,00004
Si		0,074	0,054	0,031	0,016	0,0039
Cu		65,93	68,25	71,28	69,94	72,87
Zn		the rest	the rest	the rest	the rest	the rest

Director of the Institute

Prof. Ph.D. Zbigniew Śmieszek

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

Element No.	MH 1	MH 2	MH 3	MH 4	MH 5
Fe	0,00036	0,00055	0,0011	0,00057	0,0053
Pb	0,00021	0,00099	0,0012	0,013	0,0064
Ni	0,0055	0,068	0,0040	0,00081	0,00016
Mn	0,0010	0,0038	0,00064	0,00011	0,0020
Cd	0,00079	0,00066	0,00019	0,000084	0,000063
Sb	0,000083	0,0021	0,0012	0,00014	0,00017
Sn	0,0053	0,0021	0,00046	0,00038	0,000095
Ag	0,00019	0,00046	0,00022	----	0,0010
As	0,0016	0,0013	0,00087	----	0,00014
Bi	0,00018	0,0013	0,000059	0,000090	----
P	0,0012	0,00058	0,00022	0,00021	0,000077
S	----	----	----	----	----
Al	0,00011	0,0013	0,00041	0,00030	0,00087
Te	0,000054	0,00023	0,00023	0,00027	0,00032
Be	0,00018	0,00013	0,000036	0,00025	0,0000074
Si	0,0020	0,0028	0,0025	0,0012	----
Cu	0,069	0,048	0,036	0,051	0,069

Analytical methods applied:

- Pb* - AAS directly and after co-precipitation on $Fe(OH)_3$ at pH 9;
- Sb* - AAS with co-precipitation on $Fe(OH)_3$ at pH 4, ICP-AES;
- As* - AAS after co-precipitation on $Fe(OH)_3$ at pH 4, ICP-AES, distillation, colorimetric;
- Si* - extraction, spectrophotometric with ammonium molybdenate, weight method;
- Ag* - AAS directly, ICP-AES;
- Mn* - AAS directly, AAS after electrolysis Cu, ICP-AES;
- S* - ICP-AES;
- Ni* - AAS after electrolysis Cu, ICP-AES;
- Te* - AAS after co-precipitation on $Fe(OH)_3$ at pH 4, ICP-AES;
- Bi* - AAS after co-precipitation on $Fe(OH)_3$ at pH 4 or after co-precipitation on $La(OH)_3$, ICP-AES;
- P* - extraction, spectrophotometric, titration, ICP-AES;

- Sn* - AAS after co-precipitation on $\text{Fe}(\text{OH})_3$, spectrophotometric after co-precipitation on MnO_2 , ICP-AES;
- Cd* - AAS directly or after electrolysis Cu, ICP-AES;
- Fe* - AAS directly or after co-precipitation on $\text{La}(\text{OH})_3$,
AAS after electrolysis Cu, ICP-AES;
- Be* - AAS directly, ICP-AES;
- Al* - AAS directly, ICP-AES;
- Cu* - electrolysis.

The chemical analyses have been carried out in five laboratories, four from Poland (W.M "Dziedzice", HMN "Szopienice", W.M "abdy" and in laboratory of the Institute of Non-Ferrous Metals using minimal when possible three different methods) and one from Germany (Huttenwerke Kayser AG). Cartridge brasses SRMs were made by melting of all components in the coreless induction furnace and by casting into special cast iron moulds. Final product of SRMs has been obtained after extrusion in form of discs 39 mm in diameter and 25 mm in height.