



INSTITUTE OF NON-FERROUS METALS

Analytical Chemistry Department

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CERTIFICATE OF ANALYSIS

Gilding metal M90, M95

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

The average results of chemical analyses in wt %

No. Element	MI 1	MI 2	MI 3	MI 4	MI 5
Fe	0,24	0,15	0,085	0,040	0,015
Pb	0,0060	0,016	0,042	0,071	0,096
Ni	0,0059	0,018	0,073	0,14	0,25
Mn	0,0030	0,0081	0,035	0,050	0,069
Cd	0,023	0,016	0,011	0,0054	0,0012
Sb	0,00044	0,0019	---	0,0006	0,0096
Sn	0,15	0,10	0,066	0,013	0,0040
Ag	0,0038	0,0090	0,019	0,026	0,032
As	0,072	0,054	0,034	0,0031	0,015
Bi	0,00063	0,00056	0,0026	0,0026	0,0043
P	0,028	0,022	0,015	0,0073	0,0027
S	0,047	0,049	0,023	0,012	0,0019
Al	0,040	0,055	0,015	0,0080	0,0021
Te	0,0065	0,011	0,0031	0,0021	---
Be	0,000091	0,00085	0,0019	0,0065	0,0072
Si	0,0032	0,012	0,031	0,060	0,082
Zn	3,54	6,19	8,01	11,13	4,44
Cu	95,71	93,35	91,46	88,35	94,69

Director of the Institute

Prof. Ph.D. Zbigniew Śmieszek

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

Element	No.	MI 1	MI 2	MI 3	MI 4	MI 5
Fe		0,013	0,010	0,0012	0,0033	0,00098
Pb		0,00021	0,00086	0,00079	0,0012	0,00077
Ni		0,00013	0,00077	0,0013	0,0060	0,0039
Mn		0,000091	0,00023	0,0012	0,0011	0,0024
Cd		0,0012	0,00058	0,00071	0,00014	0,000074
Sb		0,000037	0,000099	---	0,000013	0,00026
Sn		0,0056	0,0015	0,0025	0,00069	0,00016
Ag		0,00015	0,00023	0,00065	0,0011	0,0016
As		0,0015	0,0012	0,0014	0,00023	0,00098
Bi		0,000040	0,000025	0,00013	0,00023	0,00012
P		0,0014	0,0013	0,00092	0,00017	0,00018
S		0,0043	0,0020	0,0013	0,00096	0,00028
Al		0,0013	0,0024	0,0011	0,00014	0,00022
Te		0,00021	0,0051	0,00018	0,00019	---
Be		0,0000031	0,0000038	0,00017	0,00037	0,00038
Si		0,00032	0,0070	0,0013	0,0029	0,0024
Zn		0,062	0,036	0,045	0,086	0,052
Cu		0,058	0,051	0,081	0,054	0,037

The following methods have been 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, spectrophotometric
- 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
- Zn - titration, ICP-AES

The chemical analyses have been carried out in five laboratories from Poland (W.M. "Dziedzice", HMN "Szopienice", W.M. "Eabedy", "Hutmen" Wroclaw and in laboratory of the Institute of Non-Ferrous Metals) using minimal when possible three different methods. Gilding metal 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 38 mm in diameter and 25 mm in height.