INSTITUTE OF NON-FERROUS METALS

Analytical Chemistry Department
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CERTIFICATE OF ANALYSIS

Ni - Al bronzeThe average results of chemical analyses in wt %

No. / Element	BJ 1	BJ 2	BJ 3	BJ 4	BJ 5
Ni	6,97	6,47	5,87	5,49	5,00
Al	2,88	2,46	1,97	1,50	1,09
Fe	0,011	0,038	0,12	0,20	0,28
Mn	0,60	0,42	0,21	0,013	0,0030
Co	0,027	0,020	0,014	0,0076	0,0024
P	0,0022	0,011	0,014	0,013	0,019
Mg	0,0058	0,0098	0,0065	0,0035	0,0017
Pb	0,0025	0,0043	0,0081	0,010	0,017
As	0,011	0,0089	0,0072	0,0031	0,0018
Cd	0,016	0,011	0,0076	0,0048	0,00075
Sb	0,0012	0,0030	0,0056	0,0088	0,010
Sn	(0,11)	(0,080)	(0,049)	(0,014)	(0,0034)
Si	(0,11)	(0,091)	(0,047)	(0,015)	(0,0071)
Bi	0,013	0,0095	0,0071	0,0042	0,0013
S	0,021	0,014	0,0082	0,0049	0,0023
C	(0,005)	(0,007)	(0,015)	(0,020)	(0,024)
Zn	0,020	0,038	0,22	0,36	0,51
Cu	(88,93)	(89,97)	(91,25)	(92,00)	(92,88)

Director of the Institute

Prof. Ph.D. Zbigniew Śmieszek

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

No. / Element	BJ 1	BJ 2	BJ 3	BJ 4	BJ 5
Ni	0,035	0,17	0,034	0,051	0,052
Al	0,052	0,027	0,024	0,036	0,023
Fe	0,0010	0,0013	0,011	0,018	0,014
Mn	0,0047	0,0047	0,0066	0,00066	0,00014
Co	0,0012	----	0,0010	0,00033	0,00047
P	0,00024	0,0012	0,0016	0,0024	0,0028
Mg	0,00029	0,00045	0,00028	0,00029	0,00017
Pb	0,00029	0,00036	0,00021	0,00047	0,010
As	0,0037	0,00068	0,00037	0,00011	0,00016
Cd	0,0018	0,0012	0,00049	0,00042	0,000047
Sb	0,00032	0,00027	0,00024	0,00022	0,00085
Sn	----	----	----	----	----
Si	----	----	----	----	----
Bi	0,00081	0,00026	0,00027	0,00026	0,00019
S	0,0025	0,0018	0,00079	0,0011	0,00050
C	----	----	----	----	----
Zn	0,00094	0,0014	0,019	0,023	0,018
Cu	----	----	----	----	----

Analytical methods applied:

Ni - atomic absorption;

Al - atomic absorption, OES-ICP;

Fe - atomic absorption directly and after co-precipitation on lanthanum carrier, OES-ICP,

Mn - atomic absorption, OES-ICP,

Co - atomic absorption directly and after matrix separation, OES-ICP;

P - titration, spectrophotometric, OES-ICP;

Mg - atomic absorption, OES-ICP;

Pb - atomic absorption after co-precipitation on $Fe(OH)_3$, OES-ICP;

As - atomic absorption after co-precipitation on $Fe(OH)_3$ at pH 4, spectrophotometric, OES-ICP;

Cd - atomic absorption, OES-ICP;

Sb - atomic absorption after co-precipitation on $Fe(OH)_3$ at pH 4, OES-ICP;

Sn - spectrophotometric, atomic absorption;

Si - spectrophotometric after extraction, gravimetric;

Bi - atomic absorption after co-precipitation on $Fe(OH)_3$ at pH 4, OES-ICP

S - method of combusting and infrared determination of SO_2, OES-ICP;

C - method of combusting and infrared determination of CO_2,

Zn - atomic absorption, OES-ICP;
Cu - electrolysis.

The chemical analyses have been carried out at the Institute of Non-Ferrous Metals by various parallel methods.
The Ni-Al bronzes 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. The set consists of 5 reference materials in form of discs 40 mm in diameter and 25 mm in height.