



INSTITUTE OF NON-FERROUS METALS

Analytical Chemistry Department

44-101 Gliwice, ul. Sowińskiego 5

CERTIFICATE OF ANALYSIS

Nickel - Brass

The average results of chemical analysis in wt %

Element	No	WP1	WP2	WP3	WP4	WP5	WP6
Ni		5,45	7,79	10,24	12,38	15,63	4,27
Pb		0,52	0,82	1,52	(~ 2)*	(~ 1,8)*	2,41
Mn		0,0069	0,040	0,15	0,35	0,49	-
Fe		0,020	0,12	0,20	0,31	0,026	-
Sn		0,0042	0,11	0,18	0,26	0,33	-
Al.		0,020	0,0090	0,0020	0,039	0,049	-
As		0,0012	0,0049	0,011	0,015	0,021	-
Cd		0,0019	0,0052	0,011	0,016	0,026	-
Sb		0,0010	0,0052	0,012	0,015	0,028	-
Bi		0,00080	0,0052	0,012	0,016	0,021	-
P		0,020	0,0067	0,0079	0,011	0,0027	-
Si		(~ 0,01)*	(0,0091)*	(~ 0,03)*	(0,040)*	(0,027)*	-
Cu		67,15	65,08	63,05	60,91	58,70	69,37
Zn		the rest	the rest	the rest	the rest	the rest	the rest

* values non certified

Matrix influences occur if low voltage spark is used as an excitation source (Ni, Pb, As, P)

Director of the Institute

Prof. Ph.D. Zbigniew Śmieszek

Gliwice, June 2004

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

Element	No	WP1	WP2	WP3	WP4	WP5	WP6
Ni		0,051	0,068	0,043	0,074	-	0,025
Pb		0,019	0,019	0,038	-	-	0,11
Mn		0,00022	0,00080	0,080	0,010	0,014	-
Fe		0,0017	0,0046	0,0065	0,0065	0,0026	-
Sn		0,00017	0,0080	0,015	0,017	0,022	-
Al		0,00065	0,00018	0,00021	0,0017	0,0028	-
As		0,00018	0,000080	0,00046	0,00065	0,00080	-
Cd		0,00013	0,00029	0,00065	0,0092	0,00092	-
Sb		0,000018	0,00018	0,00046	0,00065	0,0016	-
Bi		0,00019	0,00032	0,00065	0,00065	0,00080	-
P		0,00065	0,00024	0,00057	0,00088	0,00037	-
Si		-	-	-	-	-	-
Cu		0,066	0,15	0,025	0,056	0,15	0,15

Analytical methods applied:

- Ni - ICP AES, AAS directly, weight method, titration*
- Pb - ICP AES, AAS directly*
- Fe - ICP AES, AAS directly*
- Mn - ICP AES, AAS directly*
- Sn - ICP AES, AAS directly and after coprecipitation on Fe (OH)₃*
- Al - ICP AES, AAS directly and after coprecipitation on Fe (OH)₃*
- As - ICP AES, AAS directly and after coprecipitation on Fe (OH)₃*
- Cd - ICP AES, AAS directly*
- Sb - ICP AES, AAS directly and after coprecipitation on Fe (OH)₃*
- Bi - ICP AES, AAS directly and after coprecipitation on Fe (OH)₃*
- P - ICP AES*
- Si - AAS directly, weight method*
- Cu - electrolysis, titration*

The chemical analysis have been carried out in three specialistic industrial laboratories from Poland and in the laboratory of the Institute of Non-Ferrous Metals. Melts have been performed using induction furnace. Nickel-brass CRMs are

in form of discs 40 mm in diameter and 30 mm height. Homogeneity investigations were made taking into account over 30 % of the material produced. Investigations were carried out using atomic emission spectrometry method with low voltage spark.

Homogeneity was estimated statistically with application of the test F.

Application of CRMs - Atomic emission spectrometry

- X-Ray spectrometry

CRMs are stable in time.