Łukasiewicz
Instytut Metali
Nieżelaznych

CERTIFICATE
OF REFERENCE MATERIAL

BJ
Ni - Al bronze

The assigned certified values[1] and uncertainties[2]

	BJ1		BJ2		BJ3		BJ4		BJ5	
Ni	%									
	6.97	±0.14	**6.47**	±0.12	**5.87**	±0.11	**5.492**	±0.092	**5.01**	±0.11
Zn	%									
	0.0203	±0.0017	**0.0378**	±0.001	**0.215**	±0.011	**0.3583**	±0.0041	**0.507**	±0.028
Al	%									
	2.878	±0.08	**2.46**	±0.05	**1.972**	±0.041	**1.497**	±0.024	**1.092**	±0.034
Mn	%						mg/kg			
	0.598	±0.01	**0.4217**	±0.0073	**0.2100**	±0.0065	**130.0**	±2.0	**29.8**	±5.0
Fe	%									
	0.0112	±0.0018	**0.0380**	±0.0022	**0.1233**	±0.0086	**0.2033**	±0.0077	**0.278**	±0.018
Co	%		mg/kg		%		mg/kg			
	0.0272	±0.0017	**200.0**	±4.5	**0.0135**	±0.0013	**75.7**	±5.7	**24.0**	±2.5
P	mg/kg		%							
	22.0	±4.1	**0.0108**	±0.0017	**0.0135**	±0.0025	**0.0130**	±0.004	**0.0190**	±0.0035
Mg	mg/kg									
	58.2	±5.4	**98.2**	±7.1	**65.2**	±2.7	**35.3**	±4.2	**17.2**	±2.5
Pb	mg/kg								%	
	24.5	±4.1	**43.2**	±4.6	**81.0**	±2.3	**101.7**	±5.2	**0.0168**	±0.0012
As	%		mg/kg							
	0.0106	±0.0015	**89.0**	±8.8	**71.8**	±3.3	**30.83**	±0.55	**18.2**	±2.5
Cd	%				mg/kg					
	0.0160	±0.0021	**0.0110**	±0.0014	**75.8**	±6.0	**48.0**	±6.1	**7.5**	±1.5
Sb	mg/kg									
	11.5	±3.7	**30.3**	±4.0	**55.5**	±8.1	**88.2**	±2.3	**103.8**	±7.3
S	%				mg/kg					
	0.0212	±0.0038	**0.0135**	±0.0024	**81.5**	±5.8	**48.5**	±4.5	**23.2**	±3.3
Bi	mg/kg									
	125.0	±4.2	**94.7**	±5.1	**71.3**	±6.4	**41.7**	±4.2	**12.8**	±2.6

[1] Unweighted mean value of the means of accepted sets of data, each set being obtained in a different laboratory and/or with a different method of determination.

[2] The certified uncertainty is the expanded uncertainty with a coverage factor k=2, corresponding to a level of confidence of about 95%.

Not certified values

	BJ1	BJ2	BJ3	BJ4	BJ5
Sn	%				mg/kg
	0.11	**0.080**	**0.049**	**0.014**	**34**
Si	%				mg/kg
	0.11	**0.091**	**0.047**	**0.015**	**71**
C	mg/kg		%		
	53	**70**	**0.015**	**0.020**	**0.024**
Cu	%				
	88.93	**89.97**	**91.25**	**92.01**	**92.88**

Value for Sn, Si, C and Cu are presented as informative because the values were reported only by one laboratory

Signature

SIEĆ BADAWCZA ŁUKASIEWICZ-
INSTYTUT METALI NIEŻELAZNYCH
DYREKTOR

dr inż. Barbara Juszczyk, MBA

Description of the material:

The certified reference material is available in the form of disc (40 mm in diameter and 25 mm height).

Traceability:

The certified values are traceable to the SI via calibration using pure metals, certified monoelement standard solutions and certified reference materials i.e. 32X ALB12 (batch A) produced by MBH Analytical Ltd. All values were confirmed in an inter-laboratory comparison using independent analytical methods.

Analytical methods applied for characterization:

Ni – Atomic absorption spectrometry (AAS)
Al – Inductively coupled plasma optical emission spectrometry (ICP-OES), Atomic absorption spectrometry (AAS)
Fe – Atomic absorption spectrometry (AAS) directly and after co-precipitation on lanthanum carrier, Inductively coupled plasma optical emission spectrometry (ICP-OES)
Mn – Inductively coupled plasma optical emission spectrometry (ICP-OES), Atomic absorption spectrometry (AAS)
Co – Atomic absorption spectrometry (AAS) directly and after matrix separation, Inductively coupled plasma optical emission spectrometry (ICP-OES)
P – Titration, spectrophotometric, Inductively coupled plasma optical emission spectrometry (ICP-OES)
Mg – Inductively coupled plasma optical emission spectrometry (ICP-OES), Atomic absorption spectrometry (AAS)
Pb – Atomic absorption spectrometry (AAS) after co-precipitation on $Fe(OH)_3$, Inductively coupled plasma optical emission spectrometry (ICP-OES);
As – Atomic absorption spectrometry (AAS) after co-precipitation on $Fe(OH)_3$ at pH 4, Spectrophotometric, Inductively coupled plasma optical emission spectrometry (ICP-OES)
Cd – Inductively coupled plasma optical emission spectrometry (ICP-OES), Atomic absorption spectrometry (AAS)
Sb – Atomic absorption spectrometry (AAS) after co-precipitation on $Fe(OH)_3$ at pH 4, Inductively coupled plasma optical emission spectrometry (ICP-OES)
Sn – Spectrophotometric, Atomic absorption spectrometry (AAS)
Si – Spectrophotometric after extraction, Gravimetric
Bi – Atomic absorption spectrometry (AAS) after co-precipitation on $Fe(OH)_3$ at pH 4, Inductively coupled plasma optical emission spectrometry (ICP-OES)
S – Method of combusting and infrared determination of SO_2, Inductively coupled plasma optical emission spectrometry (ICP-OES)
C – Method of combusting and infrared determination of CO_2,
Zn – Inductively coupled plasma optical emission spectrometry (ICP-OES), Atomic absorption spectrometry (AAS)
Cu – Electrolysis.

Participating laboratories:

1. Łukasiewicz Research Network - Institute of Non-Ferrous Metals, Analytical Chemistry Department

Intended use:

The CRM is intended for establishing or checking the calibration of chemical analysis methods, for validation and to demonstrate results traceability of samples with similar matrix composition (not verified for micro-analysis).

Minimum sample size:

Minimum 0.5 g of the CRM is required.

Instructions for storage and use:

Storage the material in a dry and clean environment at room temperature.
Transport at normal conditions.
Overheating of the material during preparation should be avoided. Samples should be prepared in the same way as the CRM. Such preparation does not result in change of certified values.

Brief description of the production and certification process:

The material was produced by Łukasiewicz - IMN. Homogeneity investigations were made taking into account about 30% of the material produced. Investigations were carried out using optical emission spectrometry with low voltage spark excitation source (spark-OES). Homogeneity was estimated statistically with analysis of variance (ANOVA).

The certification of BJ is valid 50 years, within the measurement uncertainties specified, provided the CRM is handled in accordance with the instructions given in this certificate.

Expired date:

50 years

Certificate Revision History: December 1993 (original certificate date); 30th of November 2024 (additional information about: expanded uncertainties, traceability, participating laboratories, methods used for certification, minimum sample size, instruction for storage and use and expire date was added, change of graphic design)

Since 2018 our production of the certified reference materials is carried out in accordance with requirements of the ISO 17034 standard.

The Łukasiewicz Research Network —Institute of Non-Ferrous Metals holds an accreditation of the Polish Centre for Accreditation as a reference material producer according to ISO 17034 with certificate number RM 006.

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