

# CERTIFICATE OF REFERENCE MATERIAL

NC  
Cupro-nickel  
The assigned certified values<sup>1</sup> and uncertainties<sup>2</sup>

	NC1		NC2		NC3		NC4		NC5	
Ni	%									
	<b>23.17</b>	±0.30	<b>24.21</b>	±0.42	<b>24.68</b>	±0.20	<b>25.40</b>	±0.14	<b>25.82</b>	±0.14
Al	%									
	-		<b>0.0218</b>	±0.0016	<b>0.230</b>	±0.015	<b>0.332</b>	±0.020	<b>0.0749</b>	±0.0029
Cd	%				mg/kg					
	<b>0.0142</b>	±0.0012	<b>0.0189</b>	±0.0020	<b>115</b>	±11	<b>49.2</b>	±5.0	<b>18.3</b>	±5.1
S	%				mg/kg					
	<b>0.0709</b>	±0.0043	<b>0.0838</b>	±0.0056	-		<b>21.9</b>	±2.9	-	
Sn	%				mg/kg					
	<b>0.0374</b>	±0.0030	<b>0.0453</b>	±0.0041	<b>0.0171</b>	±0.0011	<b>86.3</b>	±8.0	<b>44.1</b>	±6.2
Si	%									
	<b>0.0854</b>	±0.0036	<b>0.1961</b>	±0.0050	<b>0.0609</b>	±0.0027	<b>0.0197</b>	±0.0023	<b>0.0198</b>	±0.0019
Zn	%									
	<b>0.775</b>	± 0.029	<b>0.508</b>	±0.018	<b>0.2439</b>	±0.0038	<b>0.0985</b>	±0.0059	<b>0.0156</b>	±0.0011
Co	mg/kg				%					
	<b>61.5</b>	±7.5	<b>0.0115</b>	±0.0011	<b>0.0282</b>	±0.0020	<b>0.1009</b>	±0.0045	<b>0.1513</b>	±0.0084
Fe	%									
	<b>0.0501</b>	±0.0015	<b>0.2903</b>	±0.0064	<b>0.1057</b>	±0.0043	<b>0.426</b>	±0.011	<b>0.370</b>	±0.011
Sb	mg/kg								%	
	<b>23.6</b>	±4.3	<b>48.8</b>	±5.8	<b>83.7</b>	±6.1	<b>112.8</b>	±7.6	<b>0.0161</b>	±0.0014
P	%		%			mg/kg		%		
	<b>0.0147</b>	±0.0011	-		<b>0.0312</b>	±0.0013	<b>112.8</b>	±9.0	<b>0.0222</b>	±0.0018
Mg	mg/kg				%					
	<b>15.6</b>	±3.5	<b>23.7</b>	±5.3	<b>0.0561</b>	±0.0056	<b>0.0170</b>	±0.0036	<b>0.0861</b>	±0.0041
As	mg/kg				%					
	<b>56.1</b>	±3.2	<b>104.3</b>	±8.7	<b>0.01665</b>	±0.00089	<b>0.0251</b>	±0.0021	<b>0.0426</b>	±0.0016
Mn	%									
	<b>0.552</b>	±0.023	<b>0.413</b>	±0.016	<b>0.1484</b>	±0.0027	<b>0.0172</b>	±0.0012	<b>0.0623</b>	±0.0039
Pb	mg/kg				%					
	<b>25.2</b>	±9.9	<b>20.4</b>	±5.3	<b>27.1</b>	±5.9	<b>0.0120</b>	±0.0017	<b>0.0409</b>	±0.0044
Bi	mg/kg				%					
	<b>11.06</b>	±0.77	<b>45.6</b>	±2.1	<b>76.8</b>	±8.5	<b>0.0117</b>	±0.0014	<b>0.0213</b>	±0.0024
C	%				mg/kg					
	<b>0.0315</b>	±0.0035	-		-		<b>0.0498</b>	±0.0090	<b>49.8</b>	±6.1
Cu	The rest									

<sup>1</sup> 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.

<sup>2</sup> 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

	NC2	NC3
	mg/kg	
C	26	36
S	-	202

Value for C and S are presented as informative because the values were reported only by two laboratories

SIEĆ BADAWCZA ŁUKASIEWICZ-  
INSTYTUT METALI I ŻELAZNYCH  
D Y R E K T O R

dr inż. Barbara Juszczyk, MBA



Signature

### Description of the material:

The certified reference material is available in the form of disc (40 mm in diameter and 30 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. 36X CN2 (batch K), 36X CN4 (batch L) produced by MBH Analytical Ltd. All values were confirmed in an inter-laboratory comparison using independent analytical methods.

### Analytical methods applied for characterization:

Ni – DMG gravimetric, Electrolysis separation,

Al – Inductively coupled plasma optical emission spectrometry (ICP-OES), Atomic absorption spectrometry (AAS)

Cd – Inductively coupled plasma optical emission spectrometry (ICP-OES), Atomic absorption spectrometry (AAS)

S – Method of combusting and infrared determination of SO<sub>2</sub>, Inductively coupled plasma optical emission spectrometry (ICP-OES)

Sn – Spectrophotometric, Atomic absorption spectrometry (AAS)

Si – Spectrophotometric (blue colour) after extraction, Gravimetric, Optical emission spectrometry with low-voltage spark excitation (spark-OES)

Zn – Inductively coupled plasma optical emission spectrometry (ICP-OES), Atomic absorption spectrometry (AAS)

Co – Inductively coupled plasma optical emission spectrometry (ICP-OES), Atomic absorption spectrometry (AAS)

Fe – Atomic absorption spectrometry (AAS) directly and after coprecipitation on lanthanum carrier, Inductively coupled plasma optical emission spectrometry (ICP-OES)

Sb – Atomic absorption spectrometry (AAS) after coprecipitation on Fe(OH)<sub>3</sub> at pH 4, Inductively coupled plasma optical emission spectrometry (ICP-OES)

P – Spectrophotometric by molybdenum yellow complex, Inductively coupled plasma optical emission spectrometry (ICP-OES)

Mg – Inductively coupled plasma optical emission spectrometry (ICP-OES), Atomic absorption spectrometry (AAS)

As – Atomic absorption spectrometry (AAS) after coprecipitation on Fe(OH)<sub>3</sub>, Spectrophotometric, Inductively coupled plasma optical emission spectrometry (ICP-OES)

Mn – Inductively coupled plasma optical emission spectrometry (ICP-OES), Atomic absorption spectrometry (AAS)

Pb – Inductively coupled plasma optical emission spectrometry (ICP-OES), Atomic absorption spectrometry (AAS) after coprecipitation on Fe(OH)<sub>3</sub>

Bi – Inductively coupled plasma optical emission spectrometry (ICP-OES), Atomic absorption spectrometry (AAS) after coprecipitation on Fe(OH)<sub>3</sub>

C – Method of combusting and infrared determination of CO<sub>2</sub>, Optical emission spectrometry with low-voltage spark excitation (spark-OES)



Participating laboratories:

1. Łukasiewicz Research Network - Institute of Non-Ferrous Metals, Analytical Chemistry Department, Emission Spectrometry Laboratory, Gliwice, Poland
2. Łukasiewicz Research Network - Institute of Non-Ferrous Metals, Analytical Chemistry Department, Atomic Spectrometry Laboratory, Gliwice, Poland
3. Walcownia Metali Nieżelaznych „Łabędy” S.A., Gliwice, Poland
4. Walcowania Metali „Dziedzice” S.A., Czechowice – Dziedzice, Poland

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 NC 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: November 2008 (original certificate date); 30<sup>th</sup> 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.

**Contact:**

**Łukasiewicz Research Network — Institute of Non-Ferrous Metals  
Centre of Analytical Chemistry  
5 Sowińskiego Street  
44-100 Gliwice, Poland  
e-mail: [crm@imn.lukasiewicz.gov.pl](mailto:crm@imn.lukasiewicz.gov.pl)  
phone: +48 32 23 80 408**

[www.reference-materials.com](http://www.reference-materials.com)

