

CERTIFICATE OF ANALYSIS

IMZ 206

CERTIFIED REFERENCE MATERIAL NICKEL ALLOY

Analysis listed as percent by weight [% m/m]

	Certified value	Expanded Uncertainty		Certified value	Expanded Uncertainty
Al	4.99	± 0.04	Nb	0.023	± 0.003
C	0.035	± 0.002	P	0.0007	± 0.0003
Co	5.37	± 0.06	Si	0.028	± 0.010
Cr	9.78	± 0.04	Ta	11.95	± 0.14
Fe	0.036	± 0.006	Ti	1.36	± 0.01
Hf	0.36	± 0.02	W	4.08	± 0.04
Mo	0.064	± 0.007	Zr	0.004	± 0.001

the expanded uncertainty bases on statistical evaluation of the contributions of the material homogeneity and the interlaboratory certification analysis

Informational values:

B	(0.001)	Ni	(62.24)
Cu	(0.0003)	S	(0.0003)
Mn	(0.002)		

Certificate Number: IMZ 206-29072024
Certificate revision history on page 3

Analysis	Al	*	B**	*	C	*	Co	*	Cr	*	Cu**	*	Fe	*	Hf	*
1	4.83	5	0.0000	7	0.032	5	5.29	7	9.6925	7	0.0000	6	0.010	7	0.309	5
2	4.89	7	0.0005	5	0.0321	2	5.30	7	9.70	7	0.0000	7	0.0233	7	0.328	5
3	4.96	1	0.0005	11	0.0334	2	5.330	7	9.72	1	0.000	5	0.033	7	0.342	7
4	4.96	7	0.00073	7	0.0336	2	5.34	5	9.76	1	0.0002	11	0.034	1	0.3533	7
5	4.97	7	0.0011	5	0.0340	2	5.35	5	9.77	1	0.0002	7	0.0340	1	0.36	1
6	4.98	1	0.0013	5	0.0353	2	5.36	1	9.774	7	0.0008	7	0.035	11	0.36	1
7	5.009	7	0.0014	7	0.0354	5	5.37	1	9.79	7	0.002	7	0.0370	7	0.36	7
8	5.01	5	0.002	7	0.0370	5	5.42	1	9.79	7	0.0039	7	0.0379	7	0.3760	7
9	5.027	7		5	0.0391	2	5.429	7	9.80	5		5	0.0405	7	0.384	7
10	5.09	1					5.448	7	9.89	5		6	0.044	5	0.39	1
11	5.0910	7					5.4505	7	9.90	7		1	0.045	5	0.3955	7
12																
Average ¹	4.9850		0.0009		0.0345		5.372		9.775		0.0003		0.0356		0.3610	
SD ²	0.0470		0.0006		0.0019		0.057		0.0420		0.0003		0.0046		0.0250	
u characterization ³	0.01776		0.00027		0.00079		0.02153		0.01587		0.00013		0.00174		0.00944	
u homogeneity ⁴	0.0055		1E-05		0.00068		0.023		0.0091		5E-06		0.0027		0.0012	
Certified value ⁵	4.99				0.035		5.37		9.78				0.036		0.36	
Expanded uncertainty ⁶	0.04				0.002		0.06		0.04				0.006		0.02	

Analysis	Mn	*	Mo	*	Nb	*	Ni**	*	P	*	S**	*	Si	*	Ta	*
1	0.0001	6	0.0395	7	0.0188	7	61.89	1	0.0000	7	0.000	2	0.0029	5	11.59	7
2	0.0003	11	0.0555	7	0.02	1	62.20	1	0.00031	7	0.0000	2	0.0030	1	11.81	7
3	0.0005	1	0.061	1	0.0215	7	62.62	7	0.0005	11	0.00004	2	0.0150	7	11.81	5
4	0.0010	5	0.062	1	0.0223	7			0.0007	7	0.0001	2	0.0245	7	11.900	7
5	0.0015	7	0.0650	7	0.0225	7			0.0008	6	0.0003	2	0.027	11	11.93	1
6	0.0017	5	0.0689	7	0.024	1			0.0008	5	0.0007	2	0.030	7	11.93	5
7	0.0018	7	0.069	7	0.026	7			0.001	7	0.0007	5	0.03	7	11.94	1
8	0.0024	7	0.0749	7	0.026	11			0.0012	7	0.0007	7	0.034	1	12.136	7
9	0.0044	7			0.038	7				5		5	0.0396	7	12.15	1
10	0.0050	7								1			0.044	7	12.20	7
11																
Average ¹	0.0017		0.0635		0.0232		62.24		0.00069		0.00030		0.0281		11.946	
SD ²	0.0013		0.0077		0.0030		0.37		0.00034		0.00030		0.0130		0.170	
u characterization ³	0.00052		0.00341		0.00167				0.00013		0.00013		0.00491		0.06736	
u homogeneity ⁴	0.000016		0.000010		0.000011		0.027		2.2E-05		2.2E-05		0.00022		0.013	
Certified value ⁵			0.064		0.023				0.0007				0.028		11.95	
Expanded uncertainty ⁶			0.007		0.003				0.0003				0.010		0.14	

Analysis	Ti	*	W	*	Zr	*	Re	*
1	1.33	7	4.01	5	0.0024	7	0.015	7
2	1.34	7	4.03	7	0.0026	7		
3	1.35	1	4.05		0.0032	6		
4	1.35	1	4.05	5	0.0033	5		
5	1.351	5	4.0880	7	0.0033	5		
6	1.353	5	4.089	7	0.0034	6		
7	1.36	1	4.104	7	0.0038	1		
8	1.371	7	4.12	1	0.0043	7		
9	1.395	7	4.13	1	0.005	7		
10	1.41	7	4.150	7	0.005	11		
11	1.46	7			0.006	1		
12					0.007	1		
Average ¹	1.359		4.0821		0.0039			
SD ²	0.018		0.0458		0.0011			
u characterization ³	0.00680		0.01823		0.00040			
u homogeneity ⁴	0.00094		0.005		0.000015			
Certified value ⁵	1.36		4.08		0.004			
Expanded uncertainty ⁶	0.01		0.04		0.001			

*- analytical method used
** informative value

All values are based on recommendations of the ISO GUIDE 35:2017(E) standard:

1. Average is calculated according to Algorithm A (Guide clause A.2.3.4: Robust statistics);
2. Standard deviation is calculated according to Algorithm A (Guide clause A.2.3.4: Robust statistics);
3. Uncertainty of material characterization is based on the data obtained from the analysis performed by network of competent labs (Guide clause 9.5) and calculated according to Guide clause B.5.2.
4. Uncertainty associated with homogeneity of material is calculated in agreement with Guide clause 7.11 (Uncertainty evaluation from homogeneity studies)
5. Certified value is the average value rounded to one or two significant digits of expanded uncertainty. Expanded uncertainty is a geometric average of u characterization and u homogeneity multiplied by coverage factor k = 2.

Certification Process: Both preparation of this Reference Material and certification process were prepared according to requirements PN-EN 17034 and ISO GUIDE 35:2017(E).

Chemical Analysis: Chemical analyses were carried out on chips prepared by milling and also for bulk samples. Single values in the above table are the means obtained by individual laboratories. The following methods were used for analysis:

- 1 – wavelength dispersive x-ray fluorescence spectrometry,
- 2 – high frequency infra red absorption,
- 5 – spark atomic emission spectrometry,
- 6 – inductive coupled plasma mass spectrometry,
- 7 – inductive coupled plasma atomic emission spectrometry,
- 10 – titrimetry,
- 11 – glow discharge mass spectrometry.

The laboratories participating in certification analysis:

- Consolidated Precision Products, Rzeszów, Poland, accreditation Nadcap no. 15554182566;
- Dirats Laboratories, Westfield, MA USA, accreditation ANAB, ISO/IEC 17025, no. AT-1546;
- Genitest Inc Montreal, Canada, accreditation P RI 123077;
- Inco Test Ltd Hereford, England, accreditation UKAS 0281;
- Institute for Ferrous Metallurgy, Gliwice, Poland; accreditation PCA 17025 - AB554;
- Laboratory Testing Inc., Hatfield, PA. USA, accreditation A2LA, ISO/IEC 17025, no. 0117.05;
- Lithea, Ltd. Czech Republic.

Homogeneity: The homogeneity of this Reference Material was evaluated in accordance with guidelines of ISO GUIDE 35:2017(E). Optical emission spectrometry with spark excitation method was used.

Traceability: This Reference Material was found traceable to the following CRMs: BS 200A, BS 625 E, IMŽ 180, IMŽ 185, IMŽ 187 and IMŽ 202, IPT 37C, ICPMS-71A, ICPMS-71B, ICPMS-p71D.

Production of melt: This material was manufactured by Canon Muskegon, USA.

Available form: 1/4 section of 88 mm cylinder and 20 mm high.

Intended use: This Reference Material is intended for use in optical emission and X-ray spectrometric methods.

Validity of certification: The certification of IMŽ 206 is valid indefinitely within the uncertainty specified provided this Reference Material is stored in dry place and in environment free from chemical or other aggressive vapours. Periodic recertification is not required. The certification is nullified if this Reference Material is damaged, contaminated or otherwise modified.

Storage: This Reference Material should be stored in dry place and in environment free from chemical or other aggressive vapours.

Safety: This Reference Material and packing do not contain substances which can directly influence health.

Inquiries regarding this Reference Material should be directed to:
rm@git.lukasiewicz.gov.pl

Approved by
Director of the Institute

Prof. Dr. Hab. Eng. Adam Zieliński

Certificate issue date: 29 July 2024

Certificate revision history:

29 July 2024 (editorial changes)

19 May 2020 (change of information regarding validity of certification, informative value for sulphur corrected, editorial changes);

6 May 2019 (Original certificate date).