

CERTIFICATE OF ANALYSIS

IMZ 207

CERTIFIED REFERENCE MATERIAL NICKEL ALLOY

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

	Certified value	Expanded Uncertainty		Certified value	Expanded Uncertainty
Al	5.69	± 0.07	P	0.0023	± 0.0006
C	0.040	± 0.002	Pt	0.012	± 0.004
Co	10.00	± 0.14	Re	3.04	± 0.03
Cr	4.95	± 0.09	Si	0.033	± 0.007
Fe	0.022	± 0.004	Ta	8.71	± 0.11
Hf	0.094	± 0.008	W	5.91	± 0.03
Mo	1.90	± 0.03	Zr	0.0043	± 0.0007

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

Analysis	Al	*	B**	*	C	*	Co	*	Cr	*	Cu**	*	Fe	*	Hf	*
1	5,58	1	0.0001	19	0.0346	5	9.83	1	4,7455	10	0,0010	7	0,0167	7	0,086	1
2	5,593	5	0.0009	5	0.0387	2	9.833	7	4,863	5	0,0075	7	0,0169	7	0,0863	7
3	5,627	7	0.0019	5	0.0391	2	9.855	5	4,90	1	0,0097	7	0,017	1	0,09	1
4	5,648	7	< 0.0001	7	0.0396	2	9.889	7	4,94	1	0,0133	5	0,02	1	0,0964	7
5	5,7015	7	< 0.00011	7	0.040	2	9.99	1	4,942	7	< 0,0001	6	0,0220	7	0,1010	7
6	5,71	1	< 0.0010	5	0.0413	2	10.0478	7	4,96	1	< 0,01	1	0,0248	7	0,103	5
7	5,7296	7	< 0.002	7	0.0417	2	10.126	7	5,024	7			0,0259	5		
8	5,762	7			0.042	5	10.18	1	5,0411	7			0,027	1		
9	6,17	1					10.2220	7	5,07	7			0,0310	7		
Wart.śr Huber	5.6861				0.0400		9.9970		4.9489				0.0224		0.0938	
SD Huber	0.0808				0.0017		0.1541		0.0874				0.0051		0.0074	
u charakteryzacji	0.03377				0.0007		0.06437		0.03648				0.00214		0.00379	
u jednorodność	0.0058		0.00019		0.00053		0.021		0.030		0.00002		0.00065		0.00006	
Wartośćatestowana	5.69				0.040		10.00		4.95				0.022		0.094	
niepewność	0.07				0.002		0.14		0.09				0.004		0.008	

Analysis	Mn**	*	Mo	*	Nb**	*	Ni**	*	P	*	S	*	Si	*	Ta	*
1	0,0005	6	1.843	7	0.005	1	59.30	5	0.0018	5	0.00003	19	0,02	1	8.428	7
2	0,0018	7	1.847	7	0.0060	6	59.56	1	0.0020	1	0.00006	2	0,0242	5	8.55	1
3	0,0030	7	1.88	1	0.0063	7	59.79	7	0.0021	7	0.0003	2	0,03	5	8.661	7
4	0,0034	7	1.89	1	0.0085	7			0.0030	7	0.0003	2	0,0327	7	8.69	1
5	0,0096	7	1.898	5	0.011	1			0.0030	5	0.00035	7	0,0336	7	8.6951	7
6	0,0123	5	1.90	1	0.0158	7			< 0.002	7	0.00055	2	0,0357	7	8.7211	7
7	0.017	1	1.9268	7	0.0287	5			< 0.005	1	< 0.0001	2	0,041	1	8.778	5
8	< 0.01	5	1.9300	7									0,0550	7	9.01	1
9	< 0.01	1	2.01	7											9.125	7
Average ¹			1.8974				59.5500		0.0023		0.0003		0.0329		8.7072	
SD ²			0.0387				0.2452		0.0005		0.0002		0.0081		0.1277	
u characterization ³			0.01616						0.00029				0.00358		0.05334	
u homogeneity ⁴	0.00002		0.0024		0.0023		0.042		0.00003		0.00003		0.00017		0.0077	
Certified value ⁵			1.90						0.0023				0.033		8.71	
Expanded uncertainty ⁶			0.03						0.0006				0.007		0.11	

Analysis	Ti**	*	W	*	Zr	*	Ag**	*	Bi**	*	Mg**	*	N**	*	O**	*
1	0.0076	1	5.828	7	0.0036	7	0.000003	19	0.00005	6	0.0029	19	0.0001	3	0.0003	3
2	0.01	1	5.88	1	0.0040	1	0.000027	7	< 0.00001	19	0.0042	7	0.0002	3	0.0032	3
3	0.0160	7	5.885	5	0.004	1	< 0.0001	6	< 0.00001	6	0.0138	5				
4	0.016	7	5.8863	7	0.0040	7	< 0.0001	19	< 0.00003	19						
5	0.0170	7	5.9027	7	0.0044	6	< 0.0001	6	< 0.00011	7						
6	0.0193	5	5.914	7	0.0045	7										
7	0.0202	7	5.93	1	0.0048	5										
8			6.07	1	0.0055	7										
9			6.098	7												
Average ¹	0.0153		5.9063		0.0043											
SD ²	0.0044		0.0345		0.0004											
u characterization ³			0.01440		0.0002											
u homogeneity ⁴	0.010		0.0041		0.00032											
Certified value ⁵			5.91		0.0043											
Expanded uncertainty ⁶			0.03		0.0007											

Analysis	Pb**	*	Pd**	*	Pt	*	Re	*	Se**	*	Te**	*	Tl**	*	V**	*
1	0.000001	19	0.0064	7	0.0096	7	3.00	1	0.0005	6	0.0003	6	0.00001	6	0.00077	7
2	0.00003	6	< 0.0001	7	0.0100	5	3.01	7	0.0005	6	< 0.00001	19	< 0.00001	19	0.0012	7
3	0.00003	7	< 0.01	19	0.0137	7	3.02	1	0.00084	7	< 0.00001	7	< 0.00001	6	0.0018	6
4	< 0.00005	6	< 0.01	7	0.0174	7	3.022	7	< 0.0001	19	< 0.00005	6	< 0.00001	7	0.0036	7
5	< 0.0001	19			< 0.01	7	3.0416	7							0.004	1
6							3.0614	7							0.0264	5
7							3.09	7							< 0.0001	7
8							3.120	5								
Average ¹					0.0124		3.0418									
SD ²					0.0033		0.0368									
u characterization ³					0.0020		0.01628									
u homogeneity ⁴							0.00004								0.00010	
Certified value ⁵					0.012		3.04									
Expanded uncertainty ⁶					0.004		0.03									

Analysis	Sn**	*	Zn**	*
1	0.00004	19	0.0000013	19
2				
Average ¹				
SD ²				
u characterization ³				
u homogeneity ⁴				
Certified value ⁵				
Expanded uncertainty ⁶				

* - 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 performer 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;
6. **Expanded uncertainty** is an 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,
- 19 – 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, UK, accreditation UKAS 0281;
- Sieć Badawcza Łukasiewicz Instytut Metalurgii Żelaza – Gliwice, Poland; accred. PCA 17025 - AB554;
- Laboratory Testing Inc., Hatfield, PA. USA, accreditation A2LA, ISO/IEC 17025, no. 0117.05;
- Lithea, Ltd., Brno, The 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: Alpha Aesar 708917409, Alpha Aesar 911A, Alpha AR 882, Alpha AR 654, IARM 190a, IARM 332a, IARM 333A, IMZ180, IMZ181, IMZ183, IMZ 187, IMZ202, IMZ 205, IMZ 206, MBH 1867a, MS CalA 070920, MS CalB 070920, Cald 070920, NiCoTa+TR1 051520, NiCoTa 042120, Ni10Co9Ta 100720, SRM 3156, SRM 3165A, , SRM 3138, SRM 3140, pure standards from SCP Science and VHGlabs.

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

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

Validity of certification: The certification of IMZ 207 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.

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

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

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: 10 March 2021

Certificate revision history:

13 June 2023 (Editorial changes)

10 March 2021 (Original certificate date)