

CERTIFICATE OF ANALYSIS

IMZ 188

CERTIFIED REFERENCE MATERIAL COBALT ALLOY

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

	Certified value	Uncertainty		Certified value	Uncertainty
B	0.0009	± 0.0004	Mo	0.42	± 0.005
C	0.526	± 0.006	Ni	10.76	± 0.12
Co	51.64	± 0.26	Nb	0.045	± 0.005
Cr	26.44	± 0.24	P	0.011	± 0.001
Cu	0.025	± 0.003	Si	0.69	± 0.02
Fe	1.14	± 0.04	W	7.46	± 0.13
Mn	0.68	± 0.01			

the uncertainty bases on 95% confidence limit and material inhomogeneity

Values in brackets are informative:

Al	(0.005)	Ti	(0.007)
S	(0.0002)	V	(0.011)
Ta	(0.011)	Zr	(0.0004)

Certificate Number: IMZ188-11072024

Certificate revision history on page 4

Analysis	C	**	Si	**	Mn	**	P	**	S*	**	Al*	**	B	**	Co	**
1	0.51	5	0.66	1	0.656	7	0.0087	7	0.00000	2	0.004	7	0.0005	5	51.39	7
2	0.520	2	0.663	5	0.670	7	0.0088	1	0.0001	2	0.0043	7	0.0006	7	51.48	7
3	0.526	2	0.67	7	0.67	5	0.011	7	0.0001	1	0.005	1	0.0009	12	51.66	1
4	0.527	2	0.673	1	0.680	5	0.012	5	0.0001	1	0.0064	7	0.001	5	51.74	1
5	0.529	2	0.68	1	0.68	1	0.012	1	0.0001	2	0.0070	7	0.0011	7	51.91	1
6	0.53	2	0.70	5	0.68	1	0.012	1	0.0003	2			0.0015	7		
7	0.531	2	0.727	7	0.69	7	0.010	7	0.00032	2						
8	0.534	2	0.74	8	0.70	1										
9					0.68	7										
Average	0.526		0.689		0.678		0.0106		0.00015		0.0053		0.0009		51.64	
SD	0.008		0.030		0.013		0.0015		0.00012		0.0013		0.0004		0.21	
Certified	0.526		0.69		0.68		0.011						0.0009		51.64	
C(95%)	0.006		0.025		0.010		0.001						0.0004		0.26	

Analysis	Cr	**	Cu	**	Fe	**	Ni	**	Mo	**	Nb	**	Ta*	**	Ti*	**
1	26.10	7	0.02	5	1.03	5	10.52	1	0.403	7	0.04	5	0.007	7	0.005	7
2	26.11	10	0.022	1	1.074	7	10.53	5	0.410	7	0.040	7	0.009	7	0.0056	6
3	26.18	5	0.022	7	1.10	7	10.72	1	0.412	7	0.044	7	0.010	7	0.0059	1
4	26.42	1	0.023	5	1.15	7	10.74	7	0.420	5	0.046	1	0.010	1	0.0060	7
5	26.45	7	0.026	7	1.15	7	10.819	1	0.420	1	0.046	7	0.018	1	0.007	5
6	26.47	1	0.027	7	1.16	5	10.82	5	0.42	1	0.054	1			0.0079	7
7	26.56	5	0.029	6	1.17	1	10.83	10	0.422	7					0.0097	1
8	26.795	1	0.029	1	1.18	1	10.914	1	0.428	1						
9	26.828	1			1.20	1	10.93	7								
Average	26.435		0.025		1.135		10.758		0.417		0.045		0.011		0.0067	
SD	0.270		0.003		0.055		0.149		0.005		0.01		0.004		0.0016	
Certified	26.44		0.025		1.14		10.76		0.42		0.045					
C(95%)	0.21		0.003		0.043		0.11		0.004		0.005					

Analysis	W	**	Zr*	**	V*	**	Hf	**
1	7.30	5	0.0001	7	0.010	1	0.0016	7
2	7.34	1	0.0002	6	0.010	7		
3	7.38	5	0.0003	1	0.011	7		
4	7.41	1	0.0006	7	0.013	1		
5	7.420	7	0.0008	7				
6	7.424	1						
7	7.44	1						
8	7.54	7						
9	7.87	8						
Average	7.458		0.0004		0.011			
SD	0.168		0.0003		0.001			
Certified	7.46							
C(95%)	0.13							

* - informative values
** analytical method

$C(95\%) = (t \cdot SD) / \sqrt{n - 1}$ - The half-width confidence interval. calculated for the 95 % confidence level. where t is the appropriate Student's t value. SD is the interlaboratory standard deviation and n is the number of acceptable mean values. For further information regarding the confidence interval for the certified value see ISO Guide 35:1989 section 4.

Certification Process: Both preparation of this Reference Material and certification process were carried out in accordance with requirements of ISO Guide 31. ISO Guide 34 and ISO Guide 35. This Reference Material is in agreement with ISO Guide 30.

Chemical Analysis: Chemical analyses were carried out on chips prepared by milling of the certified portion of the bars and on bulk samples. Single values in the above table are the means obtained by individual laboratories. Some laboratories performed analysis with the use of more than one analytical technique. The following methods (the numbers correspond to the numbers in the table at the previous page) 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,
- 8 – gravimetry,
- 10 – titrimetry,
- 12 – inductive coupled plasma atomic emission spectrometry after pyrohydrolysis.

The laboratories participating in the certification analysis:

- ATI Allvac, Monroe, NC, USA; Analysis performed by Senior Analytical Chemist, Brent Wilson; and Tech. Kate Gentry; Nadcap/ISO-IEC17025 no. 128735;
- Brammer Standards, Houston, Texas, USA - A2LA-ISO17025;
- DIRATS Laboratories, Westfield, MA, USA - Nadcap-17025;
- Institute for Ferrous Metallurgy - Gliwice. Poland; PCA 17025 - AB554;
- LECO Corporation, St. Joseph, Michigan, USA - BSI, FM 24045;
- Mieczel, Czelabinskij mietalurgiczkieskij kombinat, Czelabinsk, Russia - RU.0001.511673;
- WSK PZL Rzeszów, Poland.

Homogeneity: The homogeneity of this Reference Material was evaluated in agreement to ASTM E826-85 (R-1990) with the use of X-ray fluorescence spectrometry and optical emission spectrometry with spark excitation.

Traceability: This Reference Material was tested with the use X-ray fluorescence spectrometry and glow discharge optical emission spectrometry and was found compatible to the following CRMs and RMs:

NIST: 1242. **Brammer:** 170B. 171B. 172B. 173; **IARM:** 95B; **MBH:** 119x81601. 119xCOB1. 119xST3. 113x401. 113x402. 112x14943. 112x14942. 112x14936. 111x12670. 111x12673. 111x12672; **IMZ:** IMZ 186.

Material origin: This material was produced by Cannon Muskegon Corp. USA.

Available form: 1/4 section of 75 mm cylinder and 20 mm high.

Intended use: This Reference Material is intended for use in X-ray spectrometric methods and optical emission spectrometry with spark and glow discharge excitation.

Validity of certification: The certification of IMZ 188 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 do 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: 11 July 2024

Certificate revision history:

11. July 2024 (editorial changes)

18 May 2020 (change of information regarding validity of certification and informative values, editorial changes, material origin added);

November 2011 (Original certificate date)