

CERTIFICATE OF ANALYSIS

IMZ 153A

CERTIFIED REFERENCE MATERIAL STAINLESS STEEL

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

	Certified value	Uncertainty		Certified value	Uncertainty
C	0.037	± 0.001	Co	0.015	± 0.001
Si	0.73	± 0.01	V	0.020	± 0.002
Mn	1.49	± 0.01	Ti	0.036	± 0.001
P	0.021	± 0.001	Cu	0.102	± 0.002
S	0.0073	± 0.0005	Al	0.036	± 0.003
Cr	16.45	± 0.06	Nb	0.034	± 0.002
Ni	13.57	± 0.12	N	0.107	± 0.004
Mo	2.61	± 0.03			

the uncertainty bases on 95% confidence limit and material inhomogeneity

Informative values:

B	(0.0005)	As	(0.003)
W	(0.01)	Sb	(0.003)
Sn	(0.003)	Pb	(0.002)

Certificate Number: IMZ153A-15072024
Certificate revision history on page 4

Analysis	C	*	Si	*	Mn	*	P	*	S	*	Cr	*	Ni	*	Mo	*
1	0.0348	5	0.69	1	1.45	1	0.0192	7	0.0061	2	16.3	12	13.2	6	2.49	5
2	0.0355	2	0.71	1	1.45	5	0.020	5	0.0062	2	16.30	7	13.37	5	2.52	7
3	0.036	2	0.71	7	1.45	1	0.020	5	0.0065	2	16.31	9	13.4	7	2.55	1
4	0.036	2	0.72	5	1.459	5	0.020	1	0.0066	2	16.35	10	13.4	1	2.561	7
5	0.0368	2	0.720	1	1.46	5	0.020	12	0.0067	2	16.35	9	13.42	9	2.58	6
6	0.037	5	0.72	6	1.4640	1	0.020	1	0.007	5	16.38	1	13.44	5	2.584	5
7	0.037	5	0.729	1	1.47	5	0.0201	1	0.007	5	16.4	5	13.49	7	2.5860	1
8	0.0370	2	0.73	5	1.47	5	0.021	5	0.0071	2	16.40	17	13.5	7	2.59	5
9	0.037	5	0.730	1	1.47	7	0.021	5	0.0076	2	16.42	5	13.5086	7	2.59	5
10	0.037	2	0.73	5	1.4708	7	0.021	7	0.0076	5	16.430	7	13.51	5	2.60	1
11	0.038	2	0.732	8	1.475	1	0.021	1	0.00786	7	16.44	9	13.56	1	2.610	7
12	0.038	2	0.736	12	1.48	5	0.021	5	0.008	5	16.45	1	13.58	7	2.627	1
13	0.038	5	0.740	7	1.482	7	0.021	6	0.008	2	16.46	5	13.5881	7	2.63	5
14	0.038	5	0.74	12	1.488	7	0.0211	1	0.008	5	16.4982	7	13.5940	1	2.6317	7
15	0.0397	2	0.74	5	1.50	1	0.022	7	0.008	2	16.50	5	13.6	5	2.6371	7
16			0.7420	1	1.50	1	0.022	18	0.008	5	16.50	5	13.64	5	2.64	5
17			0.7433	7	1.502	12	0.023	5	0.008	2	16.5	1	13.65	14	2.65	1
18			0.750	5	1.51	6	0.0254	7			16.50	1	13.67	1	2.65	17
19			0.76	8	1.517	9					16.52	10	13.68	5	2.66	7
20			0.762	7	1.5173	7					16.5210	1	13.68	12	2.68	12
21			0.7674	7	1.52	12					16.58	7	13.7	1	2.68	12
22					1.529	7					16.61	1	13.7	17	2.71	1
23					1.54	17					16.67	5	13.73	1		
24													13.77	8		
25													13.78	10		
Average	0.0371		0.7334		1.4858		0.0210		0.0073		16.4517		13.5664		2.6117	
Standard deviation	0.0012		0.0185		0.0270		0.0014		0.0007		0.0975		0.1419		0.0534	
Certified value	0.037		0.73		1.49		0.021		0.0073		16.45		13.57		2.61	
C(95%)	0.0007		0.0084		0.0117		0.0007		0.0004		0.0422		0.0586		0.0237	
Standard deviation of homogeneity	0.001		0.006		0.004		0.0005		0.0003		0.04		0.10		0.02	
Uncertainty	0.001		0.01		0.01		0.001		0.0005		0.06		0.12		0.03	

Analysis	Co	*	V	*	W**	*	Ti	*	Cu	*	Al	*	Nb	*	N	*
1	0.011	5	0.016	1	0.0007	7	0.031	6	0.095	6	0.027	7	0.028	1	0.100	3
2	0.0129	7	0.0169	7	0.0039	7	0.033	7	0.099	1	0.0316	7	0.031	5	0.1010	5
3	0.0135	1	0.0170	1	0.0041	7	0.0334	7	0.0999	7	0.033	6	0.031	5	0.105	3
4	0.014	5	0.018	1	0.0044	7	0.034	5	0.100	7	0.034	7	0.031	1	0.107	3
5	0.0144	6	0.0181	7	0.0046	6	0.034	1	0.10	5	0.034	5	0.0319	7	0.110	3
6	0.015	5	0.0184	6	0.0078	1	0.034	1	0.100	7	0.035	5	0.032	5	0.110	3
7	0.0153	7	0.019	5	0.0090	1	0.0347	7	0.1003	7	0.035	5	0.0338	7	0.1116	3
8	0.0155	7	0.0197	7	0.010	5	0.035	5	0.101	5	0.035	5	0.034	5	0.113	3
9	0.0156	7	0.02	5	0.011	5	0.035	1	0.102	1	0.036	5	0.034	1		
10	0.016	7	0.0209	7	0.014	5	0.0356	1	0.103	1	0.038	7	0.0347	1		
11	0.017	7	0.021	7	0.018	5	0.0357	1	0.103	1	0.038	1	0.035	6		
12	0.0170	1	0.022	5	0.018	1	0.036	5	0.103	7	0.043	5	0.035	1		
13	0.018	5	0.023	5	0.02	5	0.036	5	0.11	5	0.0439	7	0.0352	7		
14	0.018	1	0.023	7			0.037	5	0.105	5			0.036	7		
15			0.023	5			0.038	5	0.1060	1			0.037	5		
16			0.023	1			0.039	7	0.11	5			0.039	1		
17			0.028	5			0.0395	7								
18							0.041	1								
Average	0.0152		0.0204		0.0097		0.0357		0.1020		0.0357		0.0337		0.1072	
Standard deviation	0.0020		0.0030		0.0062		0.0025		0.0035		0.0045		0.0027		0.0048	
Certified value	0.015		0.020				0.036		0.102		0.036		0.034		0.107	
C(95%)	0.0011		0.0016				0.0012		0.0018		0.0027		0.0015		0.0040	
Standard deviation of homogeneity	0.0007		0.0002				0.0003		0.001		0.0005		0.0009		0.001	
Uncertainty	0.001		0.002				0.001		0.002		0.003		0.002		0.004	

Analysis	Sn**	*	As**	*	Sb**	*	Pb**	*	B**	*
1	0.0002	7	0.0002	7	0.0002	4	< 0.00001	6	0.00005	7
2	0.00061	6	0.0010	1	0.00023	6	< 0.0001	4	0.0001	5
3	0.0019	4	0.0016	7	0.0009	4	0.0004	4	0.00018	6
4	0.00193	7	0.003	5	0.001	5	0.0005	5	0.0005	5
5	0.002	5	0.0041	6	0.0018	5	0.0007	5	0.0005	5
6	0.002	5	0.00493	7	0.00595	7	0.001	5	0.001	5
7	0.003	5	0.0050	4	0.006	5	0.003	7	0.0012	7
8	0.004	5	0.005	5	0.0088	7	0.00356	7	< 0.0010	5
9	0.004	1	< 0.001	5						
10	0.0043	7								
11	0.005	5								
12	0.009	5								
Average	0.00316		0.00310		0.00311		0.00153		0.00050	
Standard deviation	0.00236		0.00195		0.00331		0.00139		0.00044	
Certified value										
C(95%)										
Standard deviation of homogeneity										
Uncertainty										

* - analytical method used

** informative value

$C(95\%) = (t \cdot sd) / \sqrt{n - 1}$ - 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

Certification Process: Both preparation of this reference material and certification process were prepared according to 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 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,
- 3 – high temperature extraction,
- 4 – graphite furnace atomic absorption spectrometry,
- 5 – spark atomic emission spectrometry,
- 6 – inductive coupled plasma mass spectrometry,
- 7 – inductive coupled plasma atomic emission spectrometry,
- 8 – gravimetry,
- 9 – potentiometric titration,
- 10 – titrimetry,
- 11 – glow discharge atomic emission spectrometry ,
- 12 – spectrophotometry,
- 14 – flame atomic emission spectrometry,
- 17 – energy dispersive x-ray fluorescence spectrometry,,
- 18 – visual colorimetry

The laboratories participating in certification analysis:

- ArcelorMittal Eisenhüttenstadt, Forschungs- und Qualitätszentrum GmbH, Germany - accreditation DakkS D-PL-17148-01-00, DIN EN ISO/IEC 17025;
- Deutsche Edelstahlwerke GmbH; Abteilung PP-CH, Witten, Germany - accreditation DakkS D-PL-19654-01-00, DIN EN ISO/IEC 17025;
- Enviform a.s., Třinec, Czech Republic; Testing laboratory Nr. 1371; Accreditation Certificate No. 219/2016 by the Czech Accreditation Institute; ČSN EN ISO/IEC 17025:2005;
- Huta Stali Jakościowych Stalowa Wola, Zakładowe Laboratorium Badawczo-Doświadczalne; UDT LB-032/22-16;
- Institute for Certified Reference Materials, Jekaterinburg, Russia, accreditation RU.0001.510008;
- Institute for Ferrous Metallurgy – Gliwice, Poland; PCA 17025 - AB554;
- Lithea, Ltd. Czech Republic;
- OnderzoekCentrum voor de Aanwending van Staal, Zelzate, Belgium;
- PJSC “Electrometallurgical works “Dnepropetsstal”, Zaporozhye, Ukraine;
- U.S. Steel Košice - Labortest, s.r.o., Slovakia, Slovenská národná akreditačná služba ISO/IEC 17025:2005, Reg. No. 026/S-010 and 026/S-011;
- ŽĎAS. a.s. Žďár nad Sázavou. Czech Republic.

Homogeneity: The homogeneity of this Reference Material was evaluated with the use of ASTM E826-81 standard. Optical emission spectrometry with spark excitation method was used.

Traceability: This Reference Material was tested with the use of optical emission spectrometry with spark excitation and was found compatible to the following CRMs: 29C2-1, 29C5, C47-4, 2C2-1, AR1653, AR645, B2404, BCS405, BS316C, BS316-2, BS317L, BS85D, BS90F, BSS62, C37-5, C39-4, CARTECH13-8M (834), EURONORM 379-1, EURONORM281-1, EURONORM-ZRM Nr 284-3, EZRM Nr 085-1, EZRM Nr 231-2, EZRM Nr 284-1, IARM3C, IARM7B, IMZ.1.23, IMZ1.12/1, IMZ1.73, IMZ1.74, BCS342, IMZ1.85, IMZ 153, IMZ154, IMZ165, IMZ171, IMZ1-N4, LECO 501-675, LECO 501-676, MBH 13X 12853, MBH 13X12540, MBH 13X15059P, MBH 13X32100, MBH 13X43100, MBH 18004A, MBH 316, MBH 321, MW14, MW19, MW28, MW29, MW30, MW36, NBS121d, SPL RM 2014, SPL RM 2005, SPL RM 2006, SS261/1, SS465/1, SS474, SS66.

Production of melt: This material was manufactured by Institute for Ferrous Metallurgy, Gliwice, Poland.

Available form: Discs 38 mm in diameter and 20 mm high.

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

Note: In optical emission spectrometry with spark excitation it is recommended to avoid using the central part of the surface (diameter approx. 5 mm) due to possible segregation of material.

Validity of certification: The certification of IMZ 153A 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: 15 July 2024

Certificate revision history:

15 July 2024 (editorial changes)

19 May 2020 (change of information regarding validity of certification, editorial changes);

December 2017 (Original certificate date)