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CERTIFICATE OF ANALYSIS

IMZ 198

CERTIFIED REFERENCE MATERIAL
HIGH MANGANESE STEEL

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

	Certified value	Uncertainty*		Certified value	Uncertainty*
C	0.44	± 0.01	Al	2.80	± 0.04
Si	0.423	± 0.008	Cr	0.30	± 0.01
Mn	16.10	± 0.11	Ni	0.058	± 0.004
P	0.031	± 0.001	Cu	0.104	± 0.005
S	0.0094	± 0.0004			

* - the uncertainty bases on 95% confidence limit and material inhomogeneity

Informative values:

Mo	(0.008)	Ti	(0.005)

Certificate Number: IMZ 198-290724

Certificate revision history on page 4

Analysis	C	Si	Mn	P	S	Ni	Cr	Cu
1	0.400	0.397	15.67	0.0280	0.0081	0.050	0.2765	0.090
2	0.404	0.410	15.77	0.0280	0.0089	0.051	0.2700	0.09
3	0.419	0.411	15.91	0.030	0.0090	0.053	0.2760	0.0940
4	0.423	0.415	15.91	0.0300	0.0090	0.055	0.277	0.095
5	0.430	0.42	15.94	0.0300	0.0090	0.055	0.280	0.098
6	0.432	0.420	15.96	0.0304	0.0090	0.055	0.290	0.0990
7	0.432	0.420	15.98	0.0304	0.0090	0.055	0.292	0.099
8	0.433	0.420	15.98	0.0310	0.0091	0.0576	0.295	0.10
9	0.437	0.420	16.01	0.0310	0.0092	0.0598	0.30	0.100
10	0.439	0.420	16.04	0.0313	0.0095	0.060	0.3000	0.100
11	0.440	0.424	16.05	0.0319	0.0096	0.062	0.300	0.101
12	0.440	0.428	16.06	0.0320	0.0099	0.064	0.300	0.103
13	0.441	0.430	16.11	0.0325	0.0100	0.067	0.303	0.103
14	0.442	0.434	16.11	0.0326	0.0106	0.067	0.307	0.106
15	0.446	0.434	16.12	0.0327	0.0106		0.310	0.110
16	0.450	0.440	16.14	0.0330			0.310	0.110
17	0.451	0.449	16.18	0.0331			0.310	0.111
18	0.460		16.22	0.0340			0.319	0.115
19	0.460		16.28	0.0340			0.328	0.115
20	0.469		16.31				0.329	0.120
21	0.473		16.39				0.330	0.126
22			16.41				0.340	
23			16.64					
Average	0.439	0.423	16.10	0.0314	0.0094	0.0580	0.3019	0.104
SD	0.019	0.012	0.216	0.0018	0.0007	0.0055	0.0194	0.010
Certified	**0.44**	**0.423**	**16.10**	**0.031**	**0.0094**	**0.058**	**0.30**	**0.104**
C(95%)	0.009	0.006	0.094	0.0009	0.0004	0.0036	0.0086	0.0044

Analysis	Al	Mo*	Ti*	V	Nb	B	Sn
1	2.72	0.0048	0.0036	0.007	< 0.0010	< 0.0005	0.001
2	2.78	0.007	0.005	0.0076	< 0.001	0.001	0.0036
3	2.81	0.0077	0.0053	0.0079	0.0023	0.0019	
4	2.81	0.0085	0.0063	0.022	0.0023		
5	2.82	0.0094		0.032	0.007		
6	2.84						
7							
Average	2.80	0.0075	0.0051				
SD	0.042	0.0017	0.0011				
Certified	**2.80**						
C(95%)	0.036						

* 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. 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 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:

C - coulometric, high frequency infra-red absorption (HFIR), AES spark;
Si - ICP-AES, gravimetric; photometric, AES spark, X-ray fluorescence spectrometry;
Mn - ICP-AES, flame AAS, titrimetric, AES spark, X-ray fluorescence spectrometry;
P - ICP-AES, photometric, AES spark, X-ray fluorescence spectrometry;
S - coulometric, high frequency infra-red absorption (HFIR), AES spark, X-ray fluorescence spectrometry;
Al - ICP-AES, flame AAS, AES spark, X-ray fluorescence spectrometry;
Cr - ICP-AES, flame AAS, photometric, AES spark, X-ray fluorescence spectrometry;
Mo - - ICP-AES, flame AAS, photometric, AES spark, X-ray fluorescence spectrometry;
Ni - ICP-AES, flame AAS, photometric, AES spark, X-ray fluorescence spectrometry;
Cu - ICP-AES, flame AAS, AES spark, X-ray fluorescence spectrometry;
Ti - ICP-AES, flame AAS, AES spark, X-ray fluorescence spectrometry;
V - - ICP-AES, flame AAS, X-ray fluorescence spectrometry;
Nb - ICP-AES, flame AAS, X-ray fluorescence spectrometry;
B - ICP-AES, AES spark;
Sn - ICP-AES, flame AAS.

The laboratories participating in certification analysis:

- Brammer Standards, Houston, Texas, USA - A2LA-ISO17025
- Federal Institute for Materials Research and Testing (BAM), Germany
- CJSC “KZGO” Mountain Equipment Works, Krivoj Rog, Ukraine
- Kerch Switch Plant Ltd., Ukraine
- Exova (UK) Ltd, Middlesbrough, United Kingdom; UKAS 0239
- Institute for Ferrous Metallurgy – Gliwice, Poland; PCA 17025 - AB554
- OJSC Dneprospetsstal, Zaporozhye, Ukraine
- OJSC Ilyich Iron and Steel Works, Mariupol, Ukraine
- OJSC “Dnepropetrovsk Pointer Factory”, Ukraine
- OJSC “MECHEL”, Russia, RU.0001.511673
- OJSC “UralSteel”, Metalloinvest, Russia
- OJSC “Alchevsk Iron & Steel Works”, Ukraine
- OJSC “REGOM”, Ukraine
- SPL-Bohumin”, Czech Republic
- State enterprise “Ukrainian Special Steels Institute”
- Universal Scientific Laboratory PTY LTD, Revesby Australia, NATA No.492 ISO/IEC 17025

Homogeneity: The homogeneity of this Reference Material was evaluated according to ISO Guide 35:2006 (7.7 Evaluating a homogeneity study) and DSTU GOST 8.531:2002 “Reference materials of composition of solid and disperse materials. Ways of homogeneity assessment”.

Traceability: This Reference Material was tested with the use of optical emission spectrometry with spark excitation and was found compatible to the following CRMs: ICRM CRM C51g, BAM ECRM 235-1, BAS SS491/2, BAS SS493/2, BAS SS494/2, BAS SS495/3, BAS SS495/4, MBH CRM 14XMN1 – 14XMN5, BS18A.

Production of melt: This material was manufactured by State enterprise “Ukrainian Special Steels Institute” in cooperation with Joint-Stock Company “Metal and Quality”, Zaporozhye, Ukraine.

Available form: Discs 56 mm in diameter and 15 mm high.

Intended use: This Reference Material is intended for use in spark atomic 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 198 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: 29 July 2024

Certificate revision history:
29 July 2024 (editorial changes)
28 January 2021 (change of information regarding validity of certification, correction of S certified value, editorial changes);
November 2012 (Original certificate date)