

CERTIFICATE OF ANALYSIS

IMZ 178

REFERENCE MATERIAL OF STEEL

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

C	0.29	Cu	0.140
Si	0.28	N	0.0160
Mn	0.65	Sn	0.011
P	0.016	Al	0.051
S	0.0034	V	0.011
Cr	1.26	Co	0.015
Ni	2.09	Nb	0.105
Mo	0.20	W	0.017

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Analysis	C	Si	Mn	P	S	Cr	Ni	Mo
1	0.279	0.260	0.632	0.0140	0.0024	1.231	2.020	0.192
2	0.280	0.270	0.640	0.0140	0.0027	1.235	2.033	0.195
3	0.282	0.270	0.647	0.0144	0.0030	1.246	2.033	0.197
4	0.285	0.270	0.647	0.0145	0.0030	1.250	2.045	0.197
5	0.285	0.272	0.648	0.0148	0.0030	1.250	2.050	0.199
6	0.286	0.274	0.648	0.0151	0.0030	1.250	2.053	0.200
7	0.287	0.276	0.650	0.0160	0.0032	1.260	2.063	0.200
8	0.288	0.279	0.650	0.0170	0.0035	1.263	2.078	0.200
9	0.290	0.280	0.654	0.0170	0.0035	1.267	2.080	0.200
10	0.290	0.283	0.654	0.0179	0.0035	1.280	2.080	0.200
11	0.292	0.288	0.655	0.0180	0.0040	1.280	2.080	0.201
12	0.293	0.289	0.660	0.0180	0.0040	1.280	2.098	0.201
13	0.295	0.290	0.661		0.0040		2.140	0.202
14	0.296	0.290	0.670		0.0041		2.153	0.203
15	0.297						2.183	0.215
16	0.300						2.190	
Average	0.289	0.278	0.651	0.0159	0.0034	1.258	2.086	0.200
SD	0.006	0.009	0.009	0.0016	0.0005	0.017	0.053	0.005
Certified	0.29	0.28	0.65	0.016	0.0034	1.26	2.09	0.20
C(95%)	0.003	0.005	0.006	0.0011	0.0003	0.011	0.029	0.003
Analysis	Cu	Al	V	Sn	W	N	Nb	Co
1	0.129	0.0477	0.0085	0.0094	0.0140	0.0149	0.0959	0.0140
2	0.130	0.0480	0.0088	0.0101	0.0160	0.0157	0.1000	0.0142
3	0.133	0.0490	0.0099	0.0101	0.0170	0.0158	0.1023	0.0157
4	0.136	0.0510	0.0100	0.0104	0.0172	0.0162	0.1038	0.0162
5	0.137	0.0527	0.0100	0.0120	0.0176	0.0162	0.1074	
6	0.140	0.0527	0.0100	0.0120	0.0190	0.0166	0.1083	
7	0.140	0.0543	0.0115	0.0120		0.0168	0.1100	
8	0.141		0.0117	0.0122			0.1100	
9	0.142		0.0120	0.0127				
10	0.142		0.0120					
11	0.143		0.0124					
12	0.143							
13	0.150							
14	0.150							
Average	0.140	0.0508	0.0106	0.0112	0.0168	0.0160	0.1047	0.0150
SD	0.006	0.0026	0.0014	0.0012	0.0017	0.0006	0.0051	0.0011
Certified	0.140	0.051	0.011	0.011	0.017	0.0160	0.105	0.015
C(95%)	0.004	0.0026	0.0010	0.0010	0.0019	0.00063	0.0046	0.0020
Analysis	Pb	As	Sb	Ti	Al(sol)	Bi		
1	0.0008	0.0058	0.0021	0.0010	0.040	0.0005		
2	0.0019	0.0064		0.0010	0.044			
Average								
SD								

$C(95\%) = (t \cdot SD) / \sqrt{n-1}$ - 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 of the certified portion of the bars and also for some solid samples. Single values in the above table are the means obtained by individual laboratories. The following methods were used for analysis:

C and S	-	high frequency infra-red absorption (HFIR), AES spark;
Mn	-	flame AAS, AES spark, XRF, ICP-AES, photometric, titrimetric;
Si	-	ICP-AES, AES spark, XRF, ICP-AES, photometric, gravimetric;
P	-	ICP-AES, AES spark, XRF, photometric, titrimetric;
Cr	-	flame AAS, AES spark, XRF, ICP-AES, photometric, titrimetric;
Ni	-	flame AAS, AES spark, XRF, ICP-AES, photometric, gravimetric;
Cu, Mo	-	flame AAS, AES spark, XRF, ICP-AES, photometric;
V, W	-	flame AAS, AES spark, XRF, ICP-AES, photometric;
Ti	-	GF AAS, AES spark, ICP-AES;
Al	-	flame AAS, AES spark, ICP-AES, photometric;
Co, Nb	-	flame AAS, AES spark, XRF, ICP-AES;
As, Sn	-	GF AAS, AES spark, ICP-AES;
N	-	high temperature extraction;
Al (soluble)	-	ICP-AES, AES spark;
Pb, Sb, Bi	-	GF AAS.

The laboratories participating in the testing of this Reference Material were:

- Alstom Power, Elbląg, Poland
- Ferrostal, Gliwice, Poland
- Huta Lucchini, Warszawa, Poland
- Huta Małapanew, Ozimek, Poland
- Huta Trzyniec, Czech Republic
- Instytut Metalurgii Żelaza, Gliwice, Poland
- ISH Ołomuniec, Czech Republic
- Laboratorium Aplikacyjne firmy GNR, Italy
- Laboratorium Aplikacyjne firmy LECO, Praga, Czech Republic
- Laboratorium Aplikacyjne firmy Thermo-ARL, Switzerland
- Magnesyt Baildon, Katowice, Poland
- Mittal Steel Poland, Oddział Dąbrowa Górnicza, Poland
- Mittal Steel Poland, Oddział Kraków, Poland
- US Steel - Labortest, Koszyce, Slovakia

Homogeneity: The homogeneity of this reference material was evaluated with the use of statistic parameters obtained during interlaboratory tests in 1996 and found acceptable. 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: CKD 180-180A, BCS 406/1 - 410/1 and IMŽ 51/1-58/1.

Production of melt: This material was produced by Huta Baildon, Katowice. The melt was made in an open induction furnace.

Available form: Discs: 40 mm in diameter and 40 mm thick; chips: bottles 100g.

Intended use: This Reference Material is intended for use in optical emission and X-ray spectrometric methods (bulks sample) and also in classical wet methods, UV-Vis spectrometry, AAS, ICP-AES, C,S- and N- analyzers and other wet methods (chips).

Caution: In optical emission spectrometry with spark excitation the central part of the surface of discs (approximately 5 mm) should be avoided because of possible segregation of the material.

Validity of certification: The certification of IMZ 178 is valid indefinitely 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.

Chips: if the contents of the bottle becomes changed (for example oxidized) or contaminated, the whole contents of bottle should be discarded.

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: 08 October 2024

Certificate revision history:

08 October 2024 (editorial changes)

21 January 2021 (change of information regarding validity of certification, correction for S value, editorial changes);

November 2003 (Original certificate date)