



INSTYTUT METALURGII ŻELAZA

istnieje od 1945 roku
founded in 1945
ul. Karola Miarki 12-14
44-100 Gliwice
www.imz.gliwice.pl

im. Stanisława Staszica
INSTITUTE FOR FERROUS METALLURGY
tel. +48 (32) 2345-200, 7777-200
fax +48 (32) 2345-300, 2345-301
e-mail:imz@imz.gliwice.pl

CERTIFICATE OF ANALYSIS

IMŻ-196

SPECTROMETRIC REFERENCE MATERIAL

VM12 grade steel

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

C	0.179	Cu	0.080
Si	0.46	Al	0.029
Mn	0.42	V	0.34
P	0.018	B	0.065
S	0.012	W	1.54
Cr	11.04	N	0.058
Ni	0.44	Co	1.55
Mo	0.65	Nb	0.073

Certificate Number ...

See the following pages for more information

Analysis	C	Si	Mn	P	S	Cr	Ni	Mo	Cu
1	0.167	0.437	0.403	0.0146	0.0096	10.767	0.417	0.617	0.0750
2	0.167	0.450	0.409	0.0157	0.0108	10.800	0.420	0.621	0.0760
3	0.168	0.454	0.409	0.0158	0.0109	10.870	0.420	0.630	0.0764
4	0.169	0.460	0.410	0.0164	0.0110	10.960	0.424	0.640	0.0770
5	0.171	0.466	0.410	0.0164	0.0111	11.002	0.430	0.644	0.0770
6	0.173	0.467	0.415	0.0170	0.0114	11.033	0.431	0.648	0.0787
7	0.175	0.470	0.416	0.0174	0.0114	11.050	0.436	0.649	0.0792
8	0.176	0.470	0.420	0.0180	0.0115	11.050	0.438	0.650	0.0792
9	0.177	0.471	0.420	0.0188	0.0115	11.052	0.439	0.650	0.0797
10	0.177	0.476	0.420	0.0193	0.0116	11.056	0.440	0.656	0.0800
11	0.179	0.477	0.420	0.0198	0.0117	11.077	0.441	0.658	0.0804
12	0.181	0.480	0.421	0.0200	0.0123	11.082	0.443	0.660	0.0810
13	0.182	0.484	0.430	0.0200	0.0128	11.086	0.443	0.662	0.0817
14	0.188		0.430		0.0130	11.150	0.445	0.666	0.0818
15	0.190		0.431		0.0130	11.160	0.466	0.668	0.0850
16	0.192		0.437		0.0142	11.200			0.0863
17	0.193		0.439		0.0144				0.0870
18	0.194		0.442						0.0870
19			0.464						
Average	0.179	0.466	0.421	0.018	0.012	11.037	0.436	0.648	0.080
Std. Dev.	0.009	0.013	0.011	0.002	0.001	0.125	0.013	0.013	0.004
Certified	0.179	0.46	0.42	0.018	0.012	11.04	0.44	0.65	0.080
C(95%)	0.005	0.008	0.006	0.001	0.001	0.069	0.007	0.007	0.002

Analysis	Al	V	B	W	N	Co	Nb	Ti	Sn
1	0.0259	0.317	0.0586	1.470	0.0526	1.476	0.0700	0.0030	0.0047
2	0.0263	0.322	0.0630	1.476	0.0528	1.482	0.0704	0.0046	0.0055
3	0.0264	0.326	0.0633	1.480	0.0560	1.485	0.0711	0.0050	0.0064
4	0.0266	0.328	0.0644	1.486	0.0572	1.500	0.0715	0.0050	0.0110
5	0.0270	0.330	0.0671	1.490	0.0585	1.500	0.0723	0.0054	
6	0.0275	0.334	0.0682	1.531	0.0596	1.560	0.0739	0.0063	
7	0.0290	0.336	0.0698	1.566	0.0598	1.576	0.0746		
8	0.0298	0.341		1.570	0.0598	1.600	0.0750		
9	0.0300	0.343		1.577	0.0600	1.605	0.0790		
10	0.0301	0.347		1.579	0.0608	1.653	0.0820		
11	0.0305	0.348		1.580		1.658			
12	0.0310	0.350		1.591					
13	0.0311	0.350		1.625					
14		0.353							
15		0.360							
16		0.360							
17		0.366							
Average	0.029	0.342	0.065	1.540	0.0577	1.554	0.074	0.005	0.007
Std. Dev.	0.002	0.014	0.004	0.053	0.0030	0.069	0.004	0.001	0.003
Certified	0.029	0.34	0.065	1.54	0.058	1.55	0.074		
C(95%)	0.001	0.008	0.004	0.034	0.0023	0.049	0.003		

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

IMZ 196

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 bulk samples. Single values in the above table are the means obtained by individual laboratories. The following methods were used for analysis:

C	- high frequency infra-red absorption (HFIR), AES spark;
S	- high frequency infra-red absorption (HFIR), AES spark; X-ray fluorescence spectrometry;
Mn	- ICP-AES, AES spark; X-ray fluorescence spectrometry;
Si	- ICP-AES, spectrophotometric, gravimetric; AES spark; X-ray fluorescence spectrometry;
P	- ICP-AES, AES spark; X-ray fluorescence spectrometry;
Cr	- titrimetric, ICP-AES, AES spark; X-ray fluorescence spectrometry;
Ni	- ICP-AES, AES spark; X-ray fluorescence spectrometry, spectrophotometric;
Cu	- spectrophotometric, ICP-AES, AES spark; X-ray fluorescence spectrometry;
N	- high temperature extraction, distillation / acidimetry, AES spark;
Mo	- ICP-AES, AES spark; X-ray fluorescence spectrometry, spectrophotometric;
Al	- ICP-AES, AES spark; X-ray fluorescence spectrometry, spectrophotometric;
Ti	- AES spark, ICP-AES;
V	- ICP-AES, AES spark; X-ray fluorescence spectrometry;
Nb	- ICP-AES, AES spark; X-ray fluorescence spectrometry, spectrophotometric;
W	- ICP-AES, AES spark; X-ray fluorescence spectrometry, spectrophotometric;
Co	- ICP-AES, AES spark; X-ray fluorescence spectrometry, spectrophotometric;
B	- ICP-AES, AES spark; spectrophotometric;
Sn	- ICP-AES, AES spark; X-ray fluorescence spectrometry.

The laboratories participating in certification analysis:

ALSTOM Power, Elbląg, Poland
ArcelorMittal, Ostrava, Czech Republic
ArcelorMittal, Warszawa, Poland
EnviChem, Elbląg, Poland
Ferrostal Łabędy, Gliwice, Poland
Huta MałaPanew, Ozimek, Poland
ICO, Yekaterinburg, Russia
Instytut Metalurgii Żelaza, Gliwice, Poland
SEROV, Sverdlovsk, Russia
Třinecké Železárny, a.s., Třinec, Czech Republic.
Vitkovice Testing Center, Ostrava, Czech Republic
ŽDAS, a.s. Žďár nad Sázavou, Czech Republic

IMZ 196

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.

Pewność (traceability): This Reference Material was tested with the use of optical emission spectrometry with spark excitation and was found compatible to the following CRMs: BCS SS483, BCS SS422, BCS SS423, BCS SS69, IMŽ 157, IMŽ 171, IMŽ 119, IMŽ 1.18/5, IMŽ 1.14/1, IMŽ 1.8/4, MW 13A, BS 99-5, ECRM296-1, AR646, AR 872

Production of melt: This material was manufactured by SPL Bohumin, Czechy

Available form: Discs 37 mm in diameter and 30 mm thick or as chips.

Intended use: This Reference Material is intended for use in optical emission and X-ray spectrometric methods and also in wet methods (chips).

Storage: This Reference Material should be stored in dry place and in environment free from chemical or other aggressive vapours. Proper storage of this Reference Material guarantees the stability of the chemical composition for more than 20 years.

Chips: Proper storage of this Reference Material guarantees the stability of the chemical composition for not less than 15 years. After opening the bottle, the material should be stored no longer than 3 years.

Director of the Institute

Dr inż. Adam Schwedler

December 2010