

CERTIFICATE OF ANALYSIS

PI 3.31

REFERENCE MATERIAL OF IRON ORE KOSTOMUKSZA PELLETS

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

Fe	63.05	Pb	0.002
FeO	1.55	Cu	0.0016
SiO₂	5.11	Ni	0.002
CaO	3.78	Ba	0.0025
Mn	0.028	Cr	0.0051
Al₂O₃	0.24	Sn	0.0011
TiO₂	0.017	Zn	0.003
MgO	0.21	Co	0.001
P	0.015	V	0.003
S	0.107	As	(0.0004)
K₂O	0.092	GOI	0.22
Na₂O	0.037		

Value in brackets is informative

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Analysis	Fe	FeO	SiO ₂	CaO	Mn	Al ₂ O ₃	TiO ₂	MgO
1	62.895	1.507	5.003	3.721	0.0262	0.213	0.016	0.206
2	62.900	1.516	5.035	3.728	0.0267	0.217	0.016	0.208
3	62.919	1.527	5.069	3.786	0.0269	0.238	0.016	0.210
4	62.970	1.532	5.077	3.804	0.0281	0.246	0.017	0.213
5	62.973	1.590	5.138	3.807	0.0285	0.250	0.018	0.217
6	63.000	1.603	5.144	3.819	0.0290	0.260	0.019	0.223
7	63.040	1.605	5.179	3.826	0.0300	0.261		0.224
8	63.070		5.231			0.265		
9	63.073							
10	63.687							
Average	63.053	1.554	5.110	3.784	0.0279	0.244	0.017	0.214
Std. Dev.	0.232	0.043	0.077	0.0429	0.0014	0.02	0.0013	0.007
Certified	63.05	1.55	5.11	3.78	0.028	0.24	0.017	0.21
C(95%)	0.17	0.043	0.069	0.043	0.0014	0.017	0.001	0.007

Analysis	P	S	K ₂ O	Na ₂ O	Pb	Cu	Ni	Ba
1	0.0125	0.103	0.0817	0.0320	0.0014	0.0011	0.0006	0.0021
2	0.0135	0.104	0.0915	0.0327	0.0016	0.0014	0.0019	0.0022
3	0.0139	0.105	0.0931	0.0359	0.0017	0.0014	0.0028	0.0026
4	0.0140	0.107	0.0933	0.0366	0.0020	0.0017	0.0032	0.0031
5	0.0166	0.109	0.0940	0.0420	0.0023	0.0025	0.0038	
6	0.0170	0.110	0.0957	0.0433	0.0028			
7		0.112						
Average	0.0146	0.107	0.0916	0.0371	0.0020	0.0016	0.0025	0.0025
Std. Dev.	0.0018	0.0033	0.0050	0.0047	0.0005	0.0005	0.0012	0.0005
Certified	0.015	0.107	0.092	0.037	0.002	0.0016	0.002	0.0025
C(95%)	0.0019	0.0031	0.0053	0.0049	0.0005	0.0007	0.0016	0.0007

Analysis	Cr	Sn	Zn	Co	V	As	GOI
1	0.0042	0.0007	0.0017	0.0004	0.0023	0.0002	0.200
2	0.0044	0.0010	0.0025	0.0008	0.0029	0.0005	0.210
3	0.0049	0.0012	0.0027	0.0009	0.0036	0.0006	0.230
4	0.0049	0.0015	0.0039	0.0014	0.0044		0.250
5	0.0053						
6	0.0059						
7	0.0059						
Average	0.0051	0.0011	0.003	0.001	0.003	0.0004	0.223
Std. Dev.	0.0007	0.0003	0.0009	0.0004	0.0009	0.0002	0.022
Certified	0.0051	0.0011	0.003	0.001	0.003		0.22
C(95%)	0.0008	0.0005	0.0013	0.0006	0.0013		0.03

$C(95\%) = (t \cdot sd) / \sqrt{n - 1}$ - 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 dried at 105°C powder samples. Single values in the above table are the means obtained by individual laboratories. The following methods were used for analysis:

Fe - titrimetric, XRF;
FeO - titrimetric;
SiO₂ - gravimetric, photometric as silicon-molybdenum blue, XRF;
CaO - titrimetric, ICP-AES, XRF;
Mn - flame AAS, ICP-AES, XRF;
Al₂O₃ - flame AAS, ICP-AES, XRF;
TiO₂ - flame AAS, ICP-AES, XRF;
MgO - ICP-AES, XRF;
S - high frequency infra-red absorption (HFIR), XRF;
P - ICP-AES, photometric as molybdenum blue, XRF;
K₂O - AAS, ICP-AES, XRF;
Na₂O - AAS, ICP-AES, XRF;
GOI - gravimetric;
V, Cr, Co, Ni, Cu, Zn, As, Sn, Pb, Ba - ICP-AES, GF-AAS.

The laboratories participating in the testing of this Reference Material:

Mittal Steel Poland S.A. Kraków, Poland
Mittal Steel Poland S.A. Dąbrowa Górnicza, Poland
Mittal Steel Ostrava, Czech Republic
Huta Trzyniec, Czech Republic
U.S. Steel, Koszyce, Slovakia
Polcargos – Medyka, Poland
Instytut Metalurgii Żelaza, Poland

Homogeneity: The homogeneity of this Reference Material was evaluated with the use of X-ray fluorescence spectrometry and found acceptable.

Traceability: This Reference Material was tested with the use of UV-Vis spectrometry, AAS, ICP-AES and C,S-analyzers and was found compatible to the following CRMs:

ECRM 676-1, CSMU 1-1-23, CSMU 1-1-25, CSMU 1-1-26, CSMU 1-1-27, JSS 805, JSS 812, JSS 850, JK 30, SARM 11 and Dillinger 1132.

Origin of the material: Russia

Basic mineralogical composition:

Main component: hematite α - Fe₂O₃

Other components: magnetite Fe₃O₄, quartz SiO₂, syderite (Fe,Mg)CO₃, rutile TiO₂

Available form: 100 g of powder sample, grain size less than 0.1 mm.

Intended use: This Reference Material is intended for use in determination of chemical composition of iron ores by x-ray fluorescence spectrometry, UV-Vis spectrometry, AAS, ICP-AES and C,S-analyzers and other wet methods. Chemical analyses should be carried out on samples dried at 105°C.

Validity of certification: The certification of PI 3.31 is valid for 15 years - until February 2035, within the uncertainty specified provided this Reference Material is stored in accordance with the instructions given in this certificate (see Storage). The certification is nullified if this Reference Material is damaged, contaminated or otherwise modified.

Revision: This Reference Material was certified originally in February 2005. Additional tests were performed to prove that the material remains unchanged.

Storage: This Reference Material should be stored in dry place and in environment free from chemical or other aggressive vapours and should be protected against vibration. If the contents become changed (for example oxidized) because of contamination, the whole contents of bottle should be discarded.

Safety: This Reference Material and packing do not contain substances which can directly influence health. Radioactivity less than 0.12 Bq/g equivalent of ^{60}Co

Inquiries regarding this Reference Material should be directed to rm@git.lukasiewicz.gov.pl

Approved by

President of Polcargó Medyka



Marek Drabik, BEng, MSc

Director of the Institute



Prof. Dr. Hab. Eng. Adam Zieliński

Certificate issue date: 08.11.2024

Certificate revision history:

08 November 2024 (editorial changes);

25 February 2020 (change of information regarding validity of certification, editorial changes);

February 2005 (Original certificate date).