

# CERTIFICATE OF ANALYSIS

## PI 3.32

### REFERENCE MATERIAL OF IRON ORE POLTAVA PELLETS

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

<b>Fe</b>	<b>62.10</b>	<b>K<sub>2</sub>O</b>	<b>0.117</b>
<b>FeO</b>	<b>1.61</b>	<b>Na<sub>2</sub>O</b>	<b>0.050</b>
<b>SiO<sub>2</sub></b>	<b>9.63</b>	<b>V</b>	<b>(0.001)</b>
<b>CaO</b>	<b>0.39</b>	<b>Cr</b>	<b>0.005</b>
<b>Mn</b>	<b>0.026</b>	<b>Ni</b>	<b>0.002</b>
<b>Al<sub>2</sub>O<sub>3</sub></b>	<b>0.32</b>	<b>Cu</b>	<b>0.0021</b>
<b>TiO<sub>2</sub></b>	<b>0.027</b>	<b>Zn</b>	<b>0.0023</b>
<b>MgO</b>	<b>0.71</b>	<b>Pb</b>	<b>0.0016</b>
<b>C</b>	<b>0.012</b>	<b>Ba</b>	<b>0.0036</b>
<b>P</b>	<b>0.010</b>	<b>GOI</b>	<b>0.11</b>
<b>S</b>	<b>0.003</b>		

Value in brackets is informative

Certificate Number: PI 3.32-081124  
Certificate revision history on page 4

Analysis	Fe	FeO	SiO <sub>2</sub>	CaO	Mn	Al <sub>2</sub> O <sub>3</sub>	TiO <sub>2</sub>	MgO
1	61.990	1.574	9.437	0.350	0.0236	0.302	0.025	0.667
2	62.012	1.588	9.447	0.378	0.0243	0.319	0.027	0.693
3	62.043	1.599	9.607	0.392	0.0250	0.326	0.027	0.709
4	62.045	1.612	9.647	0.395	0.0260	0.326	0.028	0.713
5	62.083	1.627	9.673	0.396	0.0263	0.326	0.030	0.731
6	62.097	1.670	9.712	0.400	0.0270	0.347		0.760
7	62.143		9.745	0.404	0.0290			
8	62.146		9.800					
9	62.303							
Average	62.096	1.612	9.634	0.388	0.0259	0.324	0.027	0.712
Std. Dev.	0.094	0.034	0.132	0.0186	0.0018	0.01	0.002	0.032
Certified	<b>62.10</b>	<b>1.61</b>	<b>9.63</b>	<b>0.39</b>	<b>0.026</b>	<b>0.32</b>	<b>0.027</b>	<b>0.71</b>
C(95%)	0.08	0.04	0.12	0.019	0.002	0.017	0.003	0.037

Analysis	P	S	K <sub>2</sub> O	Na <sub>2</sub> O	Pb	Cu	Ni	Ba
1	0.0081	0.0013	0.1100	0.0457	0.0017	0.0016	0.0015	0.0032
2	0.0082	0.0017	0.1123	0.0580	0.0020	0.0017	0.0017	0.0035
3	0.0083	0.0022	0.1137	0.0460	0.0011	0.0023	0.0022	0.0037
4	0.0092	0.0027	0.1165	0.0443	0.0010	0.0023	0.0030	0.0039
5	0.0109	0.0030	0.1170	0.0530	0.0020	0.0026		
6	0.0111	0.0050	0.1203	0.0520	0.0018			
7	0.0115		0.1220					
8			0.1230					
Average	0.0096	0.0027	0.1169	0.0498	0.0016	0.0021	0.0021	0.0036
Std. Dev.	0.0015	0.0013	0.0047	0.0054	0.0004	0.0004	0.0007	0.0003
Certified	<b>0.010</b>	<b>0.003</b>	<b>0.117</b>	<b>0.050</b>	<b>0.0016</b>	<b>0.0021</b>	<b>0.002</b>	<b>0.0036</b>
C(95%)	0.0014	0.0014	0.004	0.006	0.0005	0.0005	0.0011	0.0005

Analysis	Cr	C	Zn	Co	V	GOI
1	0.0043	0.0103	0.0021	0.0002	0.0009	0.098
2	0.0046	0.0112	0.0023	0.001	0.0015	0.110
3	0.0050	0.0123	0.0024		0.0011	0.120
4	0.0051	0.0133	0.0024			0.130
5	0.0057	0.0147	0.0025			
Average	0.0049	0.012	0.0023		0.001	0.115
Std. Dev.	0.0005	0.0017	0.0002		0.0003	0.014
Certified	<b>0.005</b>	<b>0.012</b>	<b>0.0023</b>			<b>0.11</b>
C(95%)	0.0007	0.002	0.0002			0.025

$C(95\%) = (t \cdot sd) / \sqrt{n - 1}$  - 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;  
**SiO<sub>2</sub>** - gravimetric, photometric as silicon-molybdenum blue, XRF;  
**CaO** - titrimetric, ICP-AES, XRF;  
**Mn** - flame AAS, ICP-AES, XRF;  
**Al<sub>2</sub>O<sub>3</sub>** - flame AAS, ICP-AES, XRF;  
**TiO<sub>2</sub>** - flame AAS, ICP-AES, XRF;  
**MgO** - ICP-AES, XRF;  
**C,S** - high frequency infra-red absorption (HFIR), XRF;  
**P** - ICP-AES, photometric as molybdenum blue, XRF;  
**K<sub>2</sub>O** - AAS, ICP-AES, XRF;  
**Na<sub>2</sub>O** - AAS, ICP-AES, XRF;  
**GOI** - gravimetric;  
**V, Cr, Co, Ni, Cu, Zn, 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  
Polcarga – 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:** Ukraine

**Basic mineralogical composition:**

Main component: hematite  $\alpha$  - Fe<sub>2</sub>O<sub>3</sub>

Other components: magnetite Fe<sub>3</sub>O<sub>4</sub>, quartz SiO<sub>2</sub>, cristobalite SiO<sub>2</sub>

**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 3.32 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  $^{60}\text{Co}$

Inquiries regarding this Reference Material should be directed to [rm@git.lukasiewicz.gov.pl](mailto:rm@git.lukasiewicz.gov.pl)

Approved by

President of Polcargo 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)