

# CERTIFICATE OF ANALYSIS

## PI 3.12

### REFERENCE MATERIAL OF IRON ORE FOR SINTERING SUCHA BALKA

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

<b>Fe</b>	<b>57.69</b>	<b>K<sub>2</sub>O</b>	<b>0.032</b>
<b>FeO</b>	<b>(0.72)</b>	<b>Na<sub>2</sub>O</b>	<b>0.27</b>
<b>SiO<sub>2</sub></b>	<b>14.67</b>	<b>V</b>	<b>0.0019</b>
<b>CaO</b>	<b>0.057</b>	<b>Cr</b>	<b>0.006</b>
<b>Mn</b>	<b>0.025</b>	<b>Co</b>	<b>0.0003</b>
<b>Al<sub>2</sub>O<sub>3</sub></b>	<b>1.00</b>	<b>Ni</b>	<b>0.0022</b>
<b>TiO<sub>2</sub></b>	<b>0.039</b>	<b>Cu</b>	<b>0.0014</b>
<b>MgO</b>	<b>0.21</b>	<b>Zn</b>	<b>0.0022</b>
<b>C</b>	<b>0.024</b>	<b>As</b>	<b>(0.0007)</b>
<b>P</b>	<b>0.027</b>	<b>Pb</b>	<b>0.0011</b>
<b>S</b>	<b>0.011</b>	<b>Ba</b>	<b>0.0022</b>
<b>Cl</b>	<b>0.31</b>	<b>LOI</b>	<b>1.20</b>

Values in brackets are informative

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Analysis	Fe	FeO	SiO <sub>2</sub>	CaO	Mn	Al <sub>2</sub> O <sub>3</sub>	TiO <sub>2</sub>	MgO
1	57.403	0.627	14.410	0.0532	0.0226	0.931	0.034	0.200
2	57.420	0.643	14.433	0.0542	0.0233	0.945	0.039	0.205
3	57.588	0.716	14.673	0.0569	0.0235	0.980	0.039	0.206
4	57.640	0.763	14.716	0.0577	0.0245	0.999	0.041	0.207
5	57.685	0.837	14.724	0.0580	0.0250	1.001	0.041	0.209
6	57.757		14.849	0.0597	0.0277	1.021	0.043	0.217
7	57.854		14.883		0.0280	1.096		0.243
8	57.860				0.0283			
9	57.963							
Average	57.686	0.717	14.670	0.0566	0.0254	0.996	0.039	0.212
Std. Dev.	0.195	0.087	0.185	0.0025	0.0023	0.05	0.003	0.014
Certified	<b>57.69</b>		<b>14.67</b>	<b>0.057</b>	<b>0.025</b>	<b>1.00</b>	<b>0.039</b>	<b>0.21</b>
C(95%)	0.16		0.19	0.003	0.002	0.05	0.003	0.01

Analysis	P	S	K <sub>2</sub> O	Na <sub>2</sub> O	Pb	Cu	Ni	Ba
1	0.0247	0.0101	0.0301	0.2570	0.0008	0.0009	0.0018	0.0019
2	0.0248	0.0103	0.0303	0.2650	0.0009	0.0012	0.0023	0.0021
3	0.0256	0.0107	0.0320	0.2710	0.0010	0.0014	0.0023	0.0022
4	0.0263	0.0113	0.0323	0.2720	0.0012	0.0015	0.0024	0.0025
5	0.0267	0.0114	0.0327	0.2743	0.0012	0.0015		
6	0.0286	0.0116	0.0343		0.0015	0.0019		
7	0.0292							
Average	0.0266	0.0109	0.0320	0.2679	0.0011	0.0014	0.0022	0.0022
Std. Dev.	0.0018	0.0006	0.0016	0.0070	0.0003	0.0003	0.0003	0.0002
Certified	<b>0.027</b>	<b>0.011</b>	<b>0.032</b>	<b>0.27</b>	<b>0.0011</b>	<b>0.0014</b>	<b>0.0022</b>	<b>0.0022</b>
C(95%)	0.0016	0.0007	0.0016	0.009	0.0003	0.0004	0.0004	0.0004

Analysis	Cr	Cl	C	Zn	Co	V	As	LOI
1	0.0044	0.2870	0.0220	0.0019	0.0001	0.0014	0.0005	1.270
2	0.0046	0.3060	0.0223	0.0021	0.0003	0.0018	0.0007	1.210
3	0.0048	0.3140	0.0240	0.0022	0.0004	0.0019	0.0009	1.196
4	0.0059	0.3170	0.0250	0.0022	0.0004	0.0021		1.170
5	0.0060		0.0256	0.0025	0.0005	0.0024		1.170
6	0.0062							
7	0.0077							
Average	0.0057	0.3060	0.0238	0.0022	0.0003	0.0019	0.0007	1.203
Std. Dev.	0.0012	0.0135	0.0016	0.0002	0.0002	0.0004	0.0002	0.041
Certified	<b>0.006</b>	<b>0.31</b>	<b>0.024</b>	<b>0.0022</b>	<b>0.0003</b>	<b>0.0019</b>		<b>1.20</b>
C(95%)	0.0012	0.025	0.0022	0.0003	0.0002	0.0005		0.06

$C(95\%) = (t \cdot sd) / \sqrt{n-1}$  - 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;  
**LOI** - gravimetric;  
**Cl** - spectrophotometric;  
**V, Cr, Co, Ni, Cu, Zn, As, 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: CSMU 1-1-21, CSMU 1-1-24, ECRM 680, ASCRAM 4, BCS 175B, IPT 23, Dillinger 1131, Dillinger 1133.

**Origin of the material:** Ukraine

**Basic mineralogical composition:**

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

Other components: quartz SiO<sub>2</sub>, siderite (Fe,Mg)CO<sub>3</sub>, kaolinite

**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 3.12 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 Polcargó Medyka



Marek Drabik, BEng,MSc

Director of the Institute



Prof. Dr. Hab. Eng. Adam Zieliński

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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)