Łukasiewicz Research Network
– Upper Silesian Institute of Technology

44-100 Gliwice, ul. Karola Miarki 12-14, POLAND
Tel.: +48 32 23 45 251
E-mail: rm@git.lukasiewicz.gov.pl

CERTIFICATE OF ANALYSIS

IMŻ 3.43

REFERENCE MATERIAL OF SINTER

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

	Certified value	Uncertainty		Certified value	Uncertainty
Fe	55.09	±0.17	Mn	0.020	±0.004
FeO	6.37	±0.23	S	0.021	±0.002
SiO_2	9.31	±0.17	Zn	0.005	±0.001
CaO	10.93	±0.17	P	0.030	±0.003
Al_2O_3	0.74	±0.03	K_2O	0.037	±0.005
MgO	1.21	±0.04	Cr	0.004	±0.003
TiO_2	0.032	±0.003	Na_2O	(0.040)	

The uncertainty bases on 95% confidence limit and material inhomogeneity

Value in brackets is informative

Certificate Number: IMZ3.43-081024
Certificate revision history on page 4

Analysis	Fe	*	FeO	*	SiO_2	*	CaO	*	Al_2O_3	*	MgO	*	TiO_2	*	C	*	S	*
1	54.60	5	6.18	5	8.97	3	10.54	1	0.683	1	1.12	2	0.028	2	0.052	2	0.018	2
2	55.02	5	6.27	5	9.06	3	10.56	5	0.699	2	1.13	2	0.030	2	0.057	4	0.020	2
3	55.04	5	6.27	5	9.13	2	10.90	2	0.720	6	1.17	6	0.030	2	0.082	7	0.021	4
4	55.10	5	6.56	5	9.23	3	10.90	2	0.734	2	1.21	6	0.031	1			0.021	1
5	55.14	1	6.57	5	9.33	1	10.94	6	0.758	3	1.21	1	0.032	2			0.022	4
6	55.17	5			9.43	3	10.94	1	0.758	2	1.21	2	0.035	2			0.023	4
7	55.18	1			9.45	3	10.97	2	0.760	2	1.22	2	0.036	3			0.023	4
8	55.20	2			9.56	1	11.00	2	0.760	1	1.23	2						
9	55.35	5			9.61	2	11.12	2	0.770	2	1.23	1						
10							11.38	6			1.25	2						
11											1.23	3						
Average	55.089		6.370		9.308		10.925		0.738		1.207		0.0317				0.0211	
Sd	0.207		0.182		0.224		0.244		0.031		0.051		0.0028				0.0019	
Certified	**55.09**		**6.37**		**9.31**		**10.93**		**0.74**		**1.21**		**0.032**				**0.021**	
C(95%)	0.16		0.23		0.17		0.17		0.03		0.03		0.003				0.002	

Analysis	Mn	*	P	*	K_2O	*	Na_2O	*	Cr	*	Cu	*	V	*	Zn	*	GOI	*
1	0.014	1	0.027	2	0.030	6	0.037	1	0.0022	1	0.002	1	0.0016	2	0.0045	1	0.43	3
2	0.016	2	0.028	1	0.037	2	0.038	6	0.003	1	0.002	1	0.002	2	0.0048	6	0.36	3
3	0.018	1	0.029	2	0.037	1	0.040	2	0.005	2					0.005	2	0.14	3
4	0.022	2	0.030	2	0.039	6	0.043	6	0.0051	2					0.0056	1		
5	0.022	2	0.032	2	0.040	2			0.0065	2					0.0057	2		
6	0.023	6	0.032	1											0.006	6		
7	0.025	2	0.033	3											0.0065	2		
Average	0.0200		0.0301		0.0366		(0.040)		0.0044						0.0054			
Sd	0.0040		0.0022		0.0039				0.0017						0.0007			
Certified	**0.020**		**0.030**		**0.037**				**0.004**						**0.005**			
C(95%)	0.004		0.002		0.005				0.002						0.001			

* - analytical method used

Value in brackets is informative

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

1 - wavelength dispersive x-ray fluorescence spectrometry (WD XRF),
2 - inductive coupled plasma atomic emission spectrometry (ICP OES),
3 - gravimetry,
4 - high frequency infrared absorption (HFIR),
5 - titrimetry,
6 - flame atomic absorption spectrometry (FA AAS),
7 - coulometry,

The laboratories participating in the testing of this Reference Material:

- Lithea, Ltd., Brno, Czech Republic ,
- Dniprovsky Iron and Steel Integrated Works n.a.Dzerzhynsky, PJSC, Common (DMKD), Ukraine,
- Institute for Certified Reference Materials, Jekatierinburg, Russia,
- ENVIFORM a.s., Třinec, Czech Republic,
- ArcelorMittal, Kraków, Poland,
- ArcelorMittal, Dąbrowa Górnicza, Poland,
- Instytut Metalurgii Żelaza, Gliwice, 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: BCS 377, JSS 851-2, BCS 378,

Origin of the material: Material manufactured by Instytut Metalurgii Żelaza, Gliwice, Poland

Basic mineralogical composition:

Main component: hematite Hematite α-Fe_2O_3 , Magnetite Fe_3O_4, Quartz SiO_2
Other components: Wistyt FeO, Larnite Ca_2SiO_4,
Wollastonite-1A $CaSiO_3$, $CaSi_2O_5$, $MgSiO_3$

Available form: 100g 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 $105^{O}C$.

Validity of certification: The certification of IMZ3.43 is valid for 15 years - until May 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 November 2014. 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 60Co

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)
: 30th April 2020 (change of information regarding validity of certification, editorial changes; November 2014 (Original certificate date)