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CERTIFICATE OF CHEMICAL ANALYSIS No 15 – 22

BLAST FURNANCE SLAG for X-Ray Fluorescence spectrometries and wet-way analysis, S on combustion analysers by IR absorption

SPL S-1A (PT 30/9A)

CERTIFIED VALUES – Mass content in %wt.

Element	Value [%wt.]	Uncertainty [%wt.]
Fe	0.929	0.060
SiO₂	39.71	0.35
Al₂O₃	7.05	0.15
MnO	0.405	0.007
CaO	40.66	0.17
MgO	9.00	0.25
S	0.478	0.027
TiO₂	0.270	0.003
K₂O	0.248	0.002
Na₂O	0.309	0.030
Cr₂O₃	0.0162	0.0044

PARTICIPATING LABORATORIES:

ARCELORMITTAL Avilés (Asturias), Spain
CASTCO, Hong Kong
COGNOR S.A. - Ferrostal Łabędy, Poland
DUNAFERR Labor Nonprofit, Hungary
ESAB CZ, Czech Republic
HORN & CO. ANALYTICS, Germany
INSTITUT PRO TEST. A CERTIF., Czech Republic

LIBERTY Ostrava, Czech Republic
SSAB EMEA, Sweden
TATA STEEL IJMUIDEN, Netherlands
TÜV NORD Czech, Czech Republic
U. S. STEEL Košice, Slovakia
VÍTKOVICE TESTING CENTER, Czech Republic
VOESTALPINE STAHL, Germany

S-1A - ANALYTICAL DATA:

Method	Fe	Method	SiO ₂	Method	Al ₂ O ₃	Method	MnO	Method	CaO	Method	MgO
XRF	0,588										
XRF	0,675	ICP	16,19*	ICP	3,14*	ICP	0,277*			ICP	4,58*
XRF	0,679	XRF	31,59*	XRF	6,47	XRF	0,377	ICP	25,05*	XRF	8,05
ICP	0,812	XRF	31,63*	XRF	6,66	XRF	0,379	XRF	36,65*	XRF	8,49
AAS	0,853	ICP	38,35	XRF	6,76	XRF	0,381	XRF	36,67*	XRF	8,54
XRF	0,882	XRF	38,59	XRF	6,80	XRF	0,391	XRF	39,98	XRF	8,59
ICP	0,887	ICP	38,68	XRF	6,85	XRF	0,397	ICP	40,27	ICP	8,69
XRF	0,890	XRF	38,89	XRF	6,87	XRF	0,399	XRF	40,32	XRF	8,71
XRF	0,890	Gravim.	39,10	XRF	6,88	ICP	0,400	Titrimetric	40,48	XRF	8,77
XRF	0,908	XRF	39,32	XRF	6,88	XRF	0,402	XRF	40,53	XRF	8,82
XRF	0,944	XRF	39,47	XRF	6,90	XRF	0,403	ICP	40,58	XRF	8,84
XRF	0,967	XRF	39,56	XRF	6,93	XRF	0,403	XRF	40,61	XRF	8,84
ICP	0,973	XRF	39,77	XRF	6,95	XRF	0,406	XRF	40,64	XRF	8,92
XRF	0,988	Gravim.	39,82	XRF	6,95	AAS	0,407	XRF	40,66	XRF	9,05
Titrimetric	0,988	Gravim.	39,98	XRF	7,09	ICP	0,409	XRF	40,76	XRF	9,08
ICP	0,997	XRF	40,03	XRF	7,14	ICP	0,409	XRF	40,78	XRF	9,25
XRF	0,998	XRF	40,07	ICP	7,17	XRF	0,416	XRF	40,80	ICP	9,28
XRF	1,022	XRF	40,28	ICP	7,23	XRF	0,418	XRF	40,81	ICP	9,43
XRF	1,033	XRF	40,41	AAS	7,25	XRF	0,420	XRF	40,93	XRF	9,58
XRF	1,073	XRF	40,44	ICP	7,25	XRF	0,421	XRF	41,15	Titrimetric	9,73
XRF	1,077	XRF	40,45	XRF	7,53	XRF	0,424	XRF	41,27	XRF	10,32
XRF	1,114	XRF	40,48	XRF	7,56	XRF	0,442	XRF	41,32*	XRF	11,20*
XRF	1,129	XRF	40,73	XRF	7,83	XRF	0,678*	ICP	43,68*	XRF	11,20*
	Fe		SiO₂		Al₂O₃		MnO		CaO		MgO
Value	0,929		39,71		7,05		0,405		40,66		9,00
S _M	0,139		0,72		0,32		0,016		0,32		0,52
U	0,060		0,35		0,15		0,007		0,17		0,25

Method	S	Method	TiO ₂	Method	K ₂ O	Method	Na ₂ O	Method	Cr ₂ O ₃
XRF	0,354	ICP	0,136*						
ICP	0,367	XRF	0,260						
XRF	0,431	XRF	0,263						
XRF	0,454	XRF	0,264						
IR	0,460	XRF	0,265	XRF	0,181*				
XRF	0,467	XRF	0,267	XRF	0,202*				
XRF	0,468	XRF	0,267	XRF	0,241				
IR	0,471	XRF	0,269	XRF	0,244	XRF	0,246		
IR	0,473	XRF	0,271	XRF	0,245	ICP	0,257	XRF	0,0086
IR	0,477	XRF	0,271	XRF	0,245	XRF	0,268	ICP	0,0103
IR	0,480	XRF	0,271	AAS	0,247	XRF	0,270	XRF	0,0103
XRF	0,481	XRF	0,273	XRF	0,248	XRF	0,271	ICP	0,0119
IR	0,492	ICP	0,274	ICP	0,248	XRF	0,276	AAS	0,0133
IR	0,497	XRF	0,275	ICP	0,249	XRF	0,324	XRF	0,0137
ICP	0,525	XRF	0,276	XRF	0,249	XRF	0,331	ICP	0,0184
XRF	0,526	ICP	0,277	XRF	0,250	ICP	0,358	XRF	0,0188
XRF	0,529	XRF	0,292*	XRF	0,252	AAS	0,363	XRF	0,0204
IR	0,535	XRF	0,293*	XRF	0,253	XRF	0,364	XRF	0,0228
XRF	0,593	ICP	0,313*	ICP	0,268*	ICP	0,375	XRF	0,0300
	S		TiO₂		K₂O		Na₂O		Cr₂O₃
Value	0,478		0,270		0,248		0,309		0,0162
S _M	0,055		0,005		0,003		0,048		0,0065
U	0,027		0,003		0,002		0,030		0,0044

Comments:

Value – reference value, s_M – standard deviation of intralaboratory means (* - result excluded as outlier)

U – Uncertainty of the reference value $U \geq \pm \frac{t_{5;0,05}}{\sqrt{n}} \cdot s_M$ in the sense of the ISO Guide to the Expression of the Uncertainty of Measurement (1993), dependent on the standard deviation of the laboratory results.

Certified fully compliant with the ISO 17034 definition of Reference Material – with the characterization for determining the property values and their associated uncertainties.

Intended for calibration, matrix-match verification and statistical process control of low alloy steel spectrometric analysis from a plane of solid sample. They may not substitute CRM in a statement of metrological traceability, method validation. A single analysis area of at least 4 mm in diameter defines the minimum sample intake. They may be used for combustion and wet-way methods too.

Manufactured by casting to a special ingot with discarding of the parts, which have been suspected inhomogenous and the rest has been machined to the samples of the ultimate size.

Supplied as 100g bottle.

Homogeneity (random and trend, within- and between- samples) was tested by various analytical techniques of adequate repeatability. Its uncertainty contribution, when statistically significant, was combined to the ultimate uncertainty statement. The RM are stable by a nature of material.

Characterised by results from SPL proficiency test **PT 30/9A** – X-Ray Fluorescence spectrometries and wet-way analysis, S on combustion analysers by IR absorption with measurements metrological traceable to adequate CRM. Identity of PT participating laboratories is confidential.

Certified values in % m/m, tabulated below in bold, are robust means of a minimum five accepted laboratory means. They are rounded to the same digit as their uncertainty statement.

Uncertainty is expressed as a \pm half width interval combined from the standard uncertainty, expanded by the coverage factor $k = 2$ (corresponding to 95% level of confidence). It does not exceed 1,5 multiple of the typical uncertainty of the matching CRM.

Non-certified values in regular without the uncertainty statement do not meet the requirements for certification and are intended for the matrix information.

User instruction: the surface of the specimens and RM should be prepared in a similar manner in accordance with manufacturer's instructions of spectrometers.

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