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CERTIFICATE OF CHEMICAL ANALYSIS No 04 – 21

MANGANESE STEEL for solid sample spectrometry, combustion and wet-way methods

SPL SP-2D (PT 29/6)

CERTIFIED VALUES – Mass content in %wt.

Element	Value [%wt.]	Uncertainty [%wt.]
C	1.369	0.009
Mn	26.90	0.32
Si	0.558	0.012
P	0.0725	0.0018
S	0.0031	0.0009
Cu	0.106	0.005
Cr	1.507	0.008
Ni	0.388	0.007
Al	0.0043	0.0013
Mo	0.391	0.009

Element	Value [%wt.]	Uncertainty [%wt.]
W	0.083	0.007
V	0.178	0.004
Ti	0.0213	0.0012
Co	0.0432	0.0019
As	<i>0.0031</i>	
Sn	<i>0.0026</i>	
B	<i>0.0008</i>	
Ca		
Nb	0.0163	0.0014
N	0.0203	0.0009

PARTICIPATING LABORATORIES:

BWZ Köln, Germany
BRITISH STEEL, United Kingdom
COGNOR S.A., Poland
COMTES, Czech Republic
DAIMLER TRUCK AG, Germany
DUNAFERR Labor Nonprofit, Hungary
ENVIFORM, Czech Republic
FERONA, Czech Republic

INSTYTUT METALURGII ŻELAZA, Poland
LIBERTY Ostrava, Czech Republic
MM VÝZKUM, Czech Republic
MS UTILITIES & SERVICES, Czech Republic
OCAS NV, Belgium
VÍTKOVICE TESTING CENTER, Czech Republic
ZPS - SLÉVÁRNA, Czech Republic
ŽĐAS, Czech Republic

SP-2D - ANALYTICAL DATA:

Method	C	Method	Mn	Method	Si	Method	P	Method	S	Method	Cu	Method	Cr	Method	Ni	Method	Al	Method	Mo
IR	1,326																		
AES	1,353																		
IR	1,356	XRF	25,55	ICP	0,471*	ICP	0,0565*	AES	0,0002										
AES	1,356	ICP	25,94	Gravim.	0,521	AES-m.	0,0576*	IR	0,0017	ICP	0,090	AES	1,356*	ICP	0,355				AES
IR	1,357	ICP	26,37	AES-m.	0,522	AES	0,0666	IR	0,0016	ICP	0,097	XRF	1,374*	ICP	0,367				AES
AES	1,357	ICP	26,50	XRF	0,539	AES	0,0672	IR	0,0017	ICP	0,097	AES	1,415*	AES	0,368				ICP
IR	1,360	AES	26,51	ICP	0,544	ICP	0,0688	IR	0,0018	AES	0,099	AES-m.	1,418*	ICP	0,371				AES-m.
AES	1,360	AES	26,55	Gravim.	0,545	AES	0,0702	IR	0,0021	ICP	0,100	XRF	1,480	ICP	0,375				Photom.
IR	1,363	AES	26,56	AES	0,546	AES	0,0706	IR	0,0022	XRF-m.	0,101	ICP	1,489	XRF	0,379				ICP
AES	1,364	ICP	26,77	AES	0,551	ICP	0,0707	IR	0,0024	ICP	0,102	AES	1,492	AES	0,381				AES
IR	1,366	XRF	26,87	AES	0,554	AES	0,0707	IR	0,0026	AES	0,103	XRF	1,501	AES	0,382				AES
IR	1,368	AES	26,89	AES	0,558	XRF	0,0723	XRF	0,0029	AES-m.	0,107	ICP	1,501	AES	0,385				ICP
AES	1,370	AES	26,93	AES	0,562	AES	0,0726	AES	0,0029	AES	0,108	ICP	1,507	XRF	0,387	AES	0,0014	AES	0,387
IR	1,371	XRF	27,01	AES	0,563	AES	0,0728	AES	0,0031	AES	0,108	AES	1,510	ICP	0,387	AES	0,0026	AES	0,389
AES	1,371	AES	27,10	XRF	0,564	AES	0,0736	AES	0,0031	XRF	0,109	Titrimetric	1,511	XRF	0,397	AES	0,0029	AES	0,393
IR	1,375	XRF-m.	27,12	AES	0,566	XRF	0,0738	AES	0,0035	XRF	0,111	XRF	1,512	ICP	0,401	AES-m.	0,0040	AES	0,393
IR	1,380	AES	27,44	XRF	0,567	Photom.	0,0749	IR	0,0039	XRF-m.	0,111	AES	1,512	AES	0,401	AES	0,0040	XRF	0,397
IR	1,382	XRF-m.	27,63	Gravim.	0,567	AES	0,0752	AES-m.	0,0042	XRF-m.	0,113	AES	1,513	AES	0,401	AES	0,0048	XRF-m.	0,400
IR	1,393	AES	27,64	AES	0,578	XRF	0,0772	IR	0,0046	AES	0,115	XRF-m.	1,514	XRF-m.	0,402	AES	0,0048	XRF	0,400
AES	1,404	XRF	27,82	AES	0,587	Photom.	0,0773	IR	0,0046	XRF	0,115	XRF-m.	1,523	XRF	0,404	AES	0,0054	XRF	0,413
IR	1,410	AES-m.	27,85	AES	0,614	AES	0,0775	ICP	0,0062	XRF	0,115	XRF-m.	1,529	AES	0,410	AES	0,0059	XRF-m.	0,418
									0,0066	AES	0,120	AES	1,532	AES-m.	0,420	AES	0,0085	XRF	0,436

	C	Mn	Si	P	S	Cu	Cr	Ni	Al	Mo
Value	1,369	26,90	0,558	0,0725	0,0031	0,106	1,507	0,388	0,0043	0,391
s _M	0,018	0,62	0,022	0,0034	0,0016	0,008	0,015	0,016	0,0019	0,019
U	0,009	0,32	0,012	0,0018	0,0009	0,005	0,008	0,007	0,0013	0,009

Method	W	Method	V	Method	Ti	Method	Co	Method	As	Method	Sn	Method	B	Method	Ca	Method	Nb	Method	N
			0,164																
			0,172																
			0,173																
			0,173																
			0,174	AES	0,0188														
AES	0,060	ICP	0,174	AES	0,0189	AES	0,0380												
XRF	0,070	ICP	0,176	XRF	0,0190	AES	0,0387								ICP	0,007*	AES	0,0133*	
AES	0,074	AES	0,177	ICP	0,0194	AES	0,0394								AES	0,0075*	TCM	0,0182	
AES	0,076	AES	0,178	AES	0,0194	AES	0,0407								XRF	0,0123	AES	0,0188	
AES	0,078	AES	0,178	ICP	0,0202	AES	0,0418								XRF	0,0135	TCM	0,0192	
AES	0,081	XRF	0,180	AES	0,0204	AES-m.	0,0420								AES	0,0140	AES	0,0194	
AES	0,081	AES	0,181	ICP	0,0206	AES	0,0435								AES	0,0142	TCM	0,0194	
ICP	0,083	Titrimetric	0,182	AES	0,0207	ICP	0,0442								XRF-m.	0,0152	TCM	0,0194	
XRF	0,083	AES	0,182	AES	0,0218	XRF	0,0442								ICP	0,0160	TCM	0,0201	
ICP	0,084	XRF	0,188	AES	0,0230	AES	0,0451	AES	0,0030	ICP	0,0016				AES	0,0166	TCM	0,0203	
XRF	0,084	AES	0,192	ICP	0,0232	AES	0,0460	AES	0,0030	AES	0,0022	AES	0,0005		AES	0,0166	TCM	0,0206	
AES	0,089	AES	0,198*	AES	0,0241	ICP	0,0462	ICP	0,0031	XRF	0,0024	AES	0,0006		AES	0,0179	TCM	0,0214	
XRF	0,092	AES	0,203*	XRF	0,0243	ICP	0,0503	XRF	0,0032	ICP	0,0029	AES	0,0007	AES	0,0004	AES	0,0184	TCM	0,0221
ICP	0,098	AES	0,217*	AES-m.	0,0252	ICP	0,0577*	AES	0,0032	AES	0,0037	AES	0,0009	AES	0,0004	AES	0,0194	AES	0,0225
AES	0,110	XRF	0,223*	XRF	0,0296*	AES	0,058*	AES	0,0038*	AES	0,0037	AES	0,0011	AES	0,0006	ICP	0,0196	AES-m.	0,0226

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 machining from bar.

Supplied as discs 37 mm in diameter and 25 mm of standard height.

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 29/6** - laboratories by various spectrometric methods (AES spark, glow discharge, XRF) and alternative methods (combustion, thermoevolution, wet-way) standard methods, with measurements metrological traceable to adequate CRM (CZ 2001, 2003 - 2008, 2015-2024, BAS, Brammer Standard). 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. It is recommended to storage of RM in dry and non-corrosive conditions.

Produced by: SPL-LABMAT s.r.o.

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