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CERTIFICATE OF CHEMICAL ANALYSIS No 07 – 19

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

SPL CM-2B

CERTIFIED VALUES – mass content in %wt.

Element	*Value* [%wt.]	*Uncertainty* [%wt.]
C	**0.247**	0.004
Mn	**0.894**	0.007
Si	**1.950**	0.040
P	**0.082**	0.002
S	**0.0114**	0.0007
Cu	**0.994**	0.019
Cr	**1.538**	0.015
Ni	**1.205**	0.014
Al	**0.0464**	0.0011
Mo	**0.332**	0.011
W	**0.223**	0.013

Element	*Value* [%wt.]	*Uncertainty* [%wt.]
V	**0.109**	0.005
Ti	**0.342**	0.008
Co	**0.454**	0.022
As	**0.120**	0.017
Sn	**0.091**	0.003
B	**0.0010**	0.0001
Nb	*0.58*	
Pb	**0.087**	0.008
Sb	**0.020**	0.004
Zr	**0.013**	0.002
N	**0.0062**	0.0007

PARTICIPATING LABORATORIES:

***ARCELORMITTAL**, Ostrava, Czech Republic*
DUNAFERR LABOR NONPROFIT, Dunaújváros, Hungary
***ENVIFORM**, Třinec, Czech Republic*
***GO STEEL**, Frýdek-Místek, Czech Republic*
***INSTITUTE FOR CRM (ICRM)**, Yekaterinburg, Russia*
***SES INSPEKT**, Tlmače, Slovakia*
***ŠKODA AUTO**, Mladá Boleslav, Czech Republic*
***U. S. STEEL KOŠICE – LABORTEST**, Košice, Slovakia*
***VÍTKOVICE TESTING CENTER**, Ostrava, Czech Republic*
***VOESTALPINE STAHL DONAWITZ**, Leoben-Donawitz, Austria*
***ŽĎAS**, Žďár nad Sázavou, Czech Republic*

CM-2B - ANALYTICAL DATA:

Method	C	Method	Mn	Method	Si	Method	P	Method	S	Method	Cu	Method	Cr	Method	Ni	Method	Al
AES	0,235							AES	0,0090								
AES	0,235							AES	0,0091								
AES	0,236							IR+TCM	0,0096								
AES	0,237							IR+TCM	0,0103								
IR+TCM	0,238							IR+TCM	0,0103								
AES	0,238							AES	0,0104								
AES	0,244							IR+TCM	0,0111								
AES	0,244	AES	0,870	AES	1,869	AES	0,077*	IR+TCM	0,0112			AES	1,505	AES	1,172	AES	0,0444
IR+TCM	0,246	AES	0,890	ICP	1,898	ICP	0,081	AES	0,0113			AES	1,507	AES	1,175	AES	0,0446
IR+TCM	0,247	AES	0,890	AES	1,910	AES	0,081	IR	0,0116			AES	1,526	AES	1,186	AES	0,0446
AES	0,247	AES	0,890	AES	1,915	AES	0,082	IR+TCM	0,0116			ICP	1,529	AES	1,200	AES	0,0447
IR+TCM	0,247	AES	0,890	AES	1,929	AES	0,082	AES	0,0120	AES	0,968	AES	1,530	AES	1,206	ICP	0,0459
AES	0,248	AES	0,891	AES	1,932	AES	0,082	AES	0,0121	AES	0,970	AES	1,536	AES	1,206	AES	0,0462
IR+TCM	0,248	AES	0,893	AES	1,939	AES	0,082	AES	0,0124	AES	0,980	AES	1,542	AES	1,208	AES	0,0466
IR+TCM	0,254	AES	0,894	AES	1,964	AES	0,082	IR+TCM	0,0126	ICP	0,985	AES	1,545	AES	1,210	AES	0,0470
IR+TCM	0,256	AES	0,895	AES	1,971	AES	0,085	AES	0,0126	AES	0,994	AES	1,547	AES	1,210	AES	0,0475
IR+TCM	0,256	AES	0,905	AES	2,016	AES	0,091*	AES	0,0130	AES	1,013	AES	1,547	AES	1,214	AES	0,0477
AES	0,257	AES	0,905	AES	2,020	AES	0,094*	IR+TCM	0,0135	AES	1,017	AES	1,555	AES	1,231	AES	0,0478
IR+TCM	0,258	ICP	0,912	AES	2,040	AES	0,094*	AES	0,0136	AES	1,024	AES	1,591	ICP	1,237	AES	0,0492

	C	Mn	Si	P	S	Cu	Cr	Ni	Al
Value	0,247	0,894	1,950	0,082	0,0114	0,994	1,538	1,205	0,0464
s_M	0,008	0,011	0,053	0,006	0,0014	0,022	0,023	0,020	0,0016
U	0,004	0,007	0,040	0,002	0,0007	0,019	0,015	0,014	0,0011

Method	Mo	Method	W	Method	V	Method	Ti	Method	Co	Method	As	Method	Sn	Method	B	Method	Nb
ICP	0,304			AES	0,100												
AES	0,320			AES	0,100												
AES	0,320			AES	0,100												
AES	0,320			AES	0,107	AES	0,329					ICP	0,087				
AES	0,322	AES	0,207	AES	0,108	AES	0,335					AES	0,089	AES	0,0008		
AES	0,327	AES	0,210	ICP	0,109	AES	0,339	AES	0,423			AES	0,089	AES	0,0009	AES	0,150*
AES	0,328	AES	0,214	AES	0,110	AES	0,342	AES	0,441	AES	0,100	AES	0,090	AES	0,0009	ICP	0,482
AES	0,333	AES	0,220	AES	0,111	AES	0,346	ICP	0,444	AES	0,106	AES	0,090	AES	0,0009	AES	0,572
AES	0,337	AES	0,221	AES	0,112	AES	0,346	AES	0,450	AES	0,118	AES	0,090	AES	0,0009	AES	0,591
AES	0,355	AES	0,224	AES	0,116	AES	0,354	AES	0,479	AES	0,128	AES	0,092	AES	0,0010	AES	0,592
AES	0,356	AES	0,234	AES	0,119	AES	0,373*	AES	0,486	AES	0,131	AES	0,095	AES	0,0012	AES	0,596
AES	0,361	AES	0,255	AES	0,120	AES	0,394*	AES	0,542*	ICP	0,137	AES	0,096	AES	0,0012	AES	0,663*

	Mo	W	V	Ti	Co	As	Sn	B	Nb
Value	0,332	0,223	0,109	0,342	0,454	0,120	0,091	0,0010	*0,58*
s_M	0,017	0,015	0,007	0,008	0,024	0,015	0,003	0,0001	
U	0,011	0,013	0,005	0,008	0,022	0,017	0,003	0,0001	

Method	Pb	Method	Sb	Method	Zr	Method	N
						IR+TCM	0,0057
						IR+TCM	0,0058
						AES	0,0059
		ICP	0,014			IR+TCM	0,0061
AES	0,080	AES	0,015	ICP	0,004*	AES	0,0062
AES	0,081	AES	0,020	AES	0,012	IR+TCM	0,0064
AES	0,086	AES	0,021	AES	0,013	IR+TCM	0,0068
AES	0,086	AES	0,021	AES	0,013	AES	0,0075
AES	0,093	AES	0,023	AES	0,014	AES	0,0076
AES	0,097	AES	0,025	AES	0,014	AES	0,0087

	Pb	Sb	Zr	N
Value	0,087	0,020	0,013	0,0062
s_M	0,007	0,004	0,001	0,0010
U	0,008	0,004	0,002	0,0007

Value – reference value

s_M – standard deviation of intralaboratory means (* - result excluded as outlier)

U – Uncertainty of the reference value $U = \pm \frac{t_{5;0,05}}{\sqrt{n}} \cdot s_M$ 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 Guide 35 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 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 inter-laboratory study of the expert laboratories listed below by spectrometric methods and alternative methods (combustion, thermoevolution, wet-way) standard methods, with measurements metrological **traceabled** to adequate CRMs.

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 ± 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.

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