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CERTIFICATE OF CHEMICAL ANALYSIS No 11 – 19

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

SPL LA-4D

CERTIFIED VALUES – Mass content in %wt.

Element	<i>Value</i> [%wt.]	<i>Uncertainty</i> [%wt.]
C	1.143	0.005
Mn	1.266	0.009
Si	0.181	0.005
P	0.0289	0.0011
S	0.0091	0.0002
Cu	0.066	0.004
Cr	1.831	0.021
Ni	0.367	0.007
Al	0.067	0.002
Mo	0.136	0.004

Element	<i>Value</i> [%wt.]	<i>Uncertainty</i> [%wt.]
W	0.0251	0.0025
V	0.103	0.002
Ti	0.0154	0.0007
Co	0.0370	0.0013
As	0.0104	0.0016
Sn	0.0142	0.0010
Nb	0.0046	0.0009
Pb	0.0401	0.0035
N	0.0064	0.0005

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
ŽDAS, Žďár nad Sázavou, Czech Republic

LA-4D - ANALYTICAL DATA:

Method	C	Method	Mn	Method	Si	Method	P	Method	S	Method	Cu	Method	Cr
IR+TCM	1,123							AES	0,0067*				
IR+TCM	1,134							IR+TCM	0,0082				
AES	1,134							AES	0,0086				
AES	1,136							AES	0,0087				
IR+TCM	1,137							AES	0,0088				
AES	1,138							IR+TCM	0,0088				
AES	1,138							AES	0,0090				
IR+TCM	1,143	AES	1,252	AES	0,145*	AES	0,0254	IR+TCM	0,0090	AES	0,055	AES	1,770
AES	1,145	AES	1,252	AES	0,169	AES	0,0272	IR+TCM	0,0090	AES	0,059	AES	1,804
IR+TCM	1,146	AES	1,255	AES	0,173	AES	0,0278	AES	0,0090	AES	0,061	AES	1,805
AES	1,146	AES	1,256	AES	0,176	AES	0,0288	AES	0,0090	AES	0,065	AES	1,818
IR+TCM	1,150	AES	1,257	AES	0,181	AES	0,0292	IR+TCM	0,0093	AES	0,067	AES	1,825
IR+TCM	1,151	AES	1,265	AES	0,182	AES	0,0293	IR	0,0094	AES	0,067	AES	1,830
AES	1,153	AES	1,266	AES	0,184	AES	0,0294	AES	0,0096	AES	0,068	AES	1,844
AES	1,154	AES	1,275	AES	0,185	AES	0,0298	IR+TCM	0,0097	AES	0,068	AES	1,853
IR	1,154	AES	1,280	AES	0,186	AES	0,0300	AES	0,0097	AES	0,069	AES	1,857
AES	1,180*	AES	1,285	AES	0,187	AES	0,0302	IR+TCM	0,0097	AES	0,070	AES	1,858
IR+TCM	1,182*	AES	1,286	AES	0,190	AES	0,0309	IR+TCM	0,0106*	AES	0,072	AES	1,878
C		Mn		Si		P		S		Cu		Cr	
Value	1,143		1,266		0,181		0,0289		0,0091		0,066		1,831
s _M	0,009		0,013		0,007		0,0016		0,0004		0,005		0,031
U	0,005		0,009		0,005		0,0011		0,0002		0,004		0,021

Method	Ni	Method	Al	Method	Mo	Method	W	Method	V	Method	Ti	Method	Co
AES	0,346	AES	0,064	AES	0,130			AES	0,092*				
AES	0,356	AES	0,065	AES	0,130			AES	0,096*	AES	0,0142		
AES	0,362	AES	0,066	AES	0,131			AES	0,099	AES	0,0144		
AES	0,362	AES	0,066	AES	0,134	AES	0,0196	AES	0,101	AES	0,0147	AES	0,0346
AES	0,364	AES	0,066	AES	0,134	AES	0,0222	AES	0,102	AES	0,0151	AES	0,0364
AES	0,365	AES	0,067	AES	0,135	AES	0,0252	AES	0,102	AES	0,0152	AES	0,0366
AES	0,373	AES	0,067	AES	0,138	AES	0,0252	AES	0,103	AES	0,0154	AES	0,0369
AES	0,374	AES	0,069	AES	0,139	AES	0,0253	AES	0,104	AES	0,0156	AES	0,0370
AES	0,376	AES	0,070	AES	0,141	AES	0,0271	AES	0,104	AES	0,0162	AES	0,0374
AES	0,378	AES	0,070	AES	0,141	AES	0,0280	AES	0,105	AES	0,0166	AES	0,0374
AES	0,380	AES	0,072	AES	0,147	AES	0,0284	AES	0,106	AES	0,0170	AES	0,0400
Ni		Al		Mo		W		V		Ti		Co	
Value	0,367		0,067		0,136		0,0251		0,103		0,0154		0,0370
s _M	0,010		0,002		0,005		0,0030		0,002		0,0009		0,0015
U	0,007		0,002		0,004		0,0025		0,002		0,0007		0,0013

Method	As	Method	Sn	Method	Nb	Method	Pb	Method	N
								IR+TCM	0,0056
AES	0,0089							AES	0,0057
AES	0,0092	AES	0,0126	AES	0,0027			IR+TCM	0,0058
AES	0,0092	AES	0,0134	AES	0,0038			IR+TCM	0,0060
AES	0,0093	AES	0,0140	AES	0,0046	AES	0,0374	AES	0,0062
AES	0,0112	AES	0,0140	AES	0,0049	AES	0,0376	IR+TCM	0,0063
AES	0,0124	AES	0,0146	AES	0,0050	AES	0,0400	AES	0,0069
AES	0,0128	AES	0,0154	AES	0,0052	AES	0,0417	AES	0,0074
AES	0,0218*	AES	0,0157	AES	0,0058	AES	0,0440	IR+TCM	0,0077
As		Sn		Nb		Pb		N	
Value	0,0104		0,0142		0,0046		0,0401		0,0064
s _M	0,0017		0,0011		0,0010		0,0028		0,0007
U	0,0016		0,0010		0,0009		0,0035		0,0005

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 $\pm$ 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.

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