SPL-LABMAT s.r.o.

CERTIFICATE OF CHEMICAL ANALYSIS No 05 – 24

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

SPL SST-4B (PT 32/1C)

CERTIFIED VALUES – Mass content in %wt.

Element	Value [%wt.]	Uncertainty [%wt.]	Element	Value [%wt.]	Uncertainty [%wt.]
C	0.125	0.003	V	0.037	0.001
Mn	0.506	0.004	Ti	0.061	0.002
Si	5.02	0.06	Co	0.0127	0.0003
P	0.040	0.001	As	0.0064	0.0005
S	0.0235	0.0007	Sn	0.0270	0.0013
Cu	0.135	0.002	B	0.0076	0.0003
Cr	0.118	0.002	Pb	0.0081	0.0006
Ni	0.099	0.002	Zr	0.0121	0.0004
Al	0.223	0.004	Bi	0.0072	0.0005
Mo	0.0236	0.0008	N	0.0101	0.0008
W	0.021	0.002			

PARTICIPATING LABORATORIES:

COGNOR S.A. - Ferrostal Łabędy, Poland
DAIMLER TRUCK AG, Germany
DUNAFERR Labor Nonprofit, Hungary
ENVIFORM, Czech Republic
ENVIROLAB MIKE, Greece
ESAB CZ, Czech Republic
FERONA, Czech Republic
IT Łukasiewicz, Poland

OCAS NV, Belgium
PRECIOSA, Czech Republic
SSAB, Sweden
ŠKODA AUTO, Czech Republic
TATA STEEL IJMUIDEN, Netherlands
VOESTALPINE STAHL, Austria
ZPS - SLÉVÁRNA, Czech Republic

SST-4B - ANALYTICAL DATA:

Method	C	Method	Mn	Method	Si	Method	P	Method	S	Method	Cu	Method	Cr
								ICP	0,0193				
AES	0,114							AES	0,0202				
IR	0,120							AES	0,0204				
AES	0,121							AES	0,0209				
IR	0,121							AES	0,0214				
IR	0,121	XRF	0,474*					AES	0,0220			ICP	0,114
IR	0,121	ICP	0,490					AES	0,0221	ICP	0,127	ICP	0,114
IR	0,122	AES	0,495			ICP	0,035	AES	0,0224	AES	0,131	AES	0,115
AES	0,122	AES	0,495			AES	0,036	AES	0,0225	XRF	0,131	AES	0,116
AES	0,122	XRF	0,496			ICP	0,036	AES	0,0226	ICP	0,131	AES	0,116
AES	0,123	AES	0,496	AES	4,82	AES	0,037	IR	0,0227	AES	0,131	XRF	0,117
AES	0,123	ICP	0,496	ICP	4,85	AES	0,037	IR	0,0229	ICP	0,132	AES	0,117
AES	0,123	AES	0,502	AES	4,87	AES	0,038	AES	0,0230	AES	0,133	AES	0,118
AES	0,124	AES	0,504	AES	4,88	AES	0,039	IR	0,0230	AES	0,133	AES	0,118
AES	0,124	ICP	0,504	ICP	4,89	AES	0,039	IR	0,0230	XRF	0,133	AES	0,118
IR	0,124	AES	0,505	Gravim.	4,89	AES	0,039	IR	0,0237	AES	0,133	ICP	0,118
AES	0,125	AES	0,506	AES	4,97	AES	0,039	AES	0,0239	AES	0,134	AES	0,118
IR	0,125	ICP	0,507	AES	5,02	AES	0,040	IR	0,0240	AES	0,134	ICP	0,119
IR	0,125	AES	0,508	XRF	5,02	AES	0,040	AES	0,0241	AES	0,136	AES	0,119
IR	0,125	AES	0,508	AES	5,03	AES	0,040	IR	0,0241	AES	0,136	AES	0,119
AES	0,125	ICP	0,511	AES	5,04	AES	0,040	IR	0,0242	AES	0,137	AES	0,120
IR	0,127	AES	0,511	Gravim.	5,06	AES	0,041	IR	0,0243	AES	0,138	AES	0,120
AES	0,127	AES	0,511	AES	5,07	ICP	0,041	IR	0,0244	AES	0,138	AES	0,121
AES	0,128	ICP	0,512	AES	5,07	AES	0,042	IR	0,0247	AES	0,139	AES	0,121
AES	0,130	AES	0,514	AES	5,08	ICP	0,042	AES	0,0248	AES	0,139	AES	0,122
IR	0,130	AES	0,514	AES	5,13	AES	0,042	IR	0,0254	AES	0,139	AES	0,125
IR	0,130	AES	0,516	XRF	5,16	XRF	0,043	AES	0,0269	ICP	0,140	ICP	0,126*
IR	0,131	ICP	0,523	AES	5,22	ICP	0,045	XRF	0,0283	ICP	0,142	ICP	0,129*
AES	0,134	XRF	0,524	AES	5,33	AES	0,045	ICP	0,0306*	AES	0,145	XRF	0,165*

	C		Mn		Si		P		S		Cu		Cr
Value	0,125		0,506		5,02		0,040		0,0235		0,135		0,118
s_M	0,004		0,009		0,13		0,003		0,0019		0,004		0,003
U	0,003		0,004		0,06		0,001		0,0007		0,002		0,002

Method	Ni	Method	Al	Method	Mo	Method	W	Method	V	Method	Ti	Method	Co
ICP	0,092												
ICP	0,094												
XRF	0,095			AES	0,0167*			ICP	0,033*				
ICP	0,095	AES	0,209	ICP	0,0208			XRF	0,035	AES	0,054		
AES	0,096	ICP	0,211	AES	0,0221			AES	0,036	AES	0,058		
AES	0,097	ICP	0,213	AES	0,0222	XRF	0,007*	AES	0,036	ICP	0,059	AES	0,0113
AES	0,097	ICP	0,214	AES	0,0222	ICP	0,015	AES	0,036	AES	0,059	AES	0,0119
AES	0,098	AES	0,216	AES	0,0223	AES	0,015	AES	0,036	AES	0,059	ICP	0,0119
AES	0,099	ICP	0,217	XRF	0,0224	ICP	0,017	AES	0,036	AES	0,059	ICP	0,0121
ICP	0,100	AES	0,219	ICP	0,0227	AES	0,018	ICP	0,036	AES	0,060	ICP	0,0122
AES	0,100	AES	0,221	AES	0,0228	AES	0,018	ICP	0,037	AES	0,060	AES	0,0122
AES	0,100	AES	0,223	ICP	0,0228	AES	0,019	AES	0,037	ICP	0,060	XRF	0,0123
AES	0,100	AES	0,224	AES	0,0229	ICP	0,020	AES	0,037	ICP	0,060	AES	0,0124
AES	0,100	XRF	0,225	AES	0,0230	AES	0,020	AES	0,037	ICP	0,060	AES	0,0126
AES	0,100	ICP	0,225	AES	0,0236	AES	0,021	ICP	0,037	ICP	0,061	AES	0,0128
AES	0,101	AES	0,226	AES	0,0237	AES	0,021	AES	0,037	AES	0,061	AES	0,0129
AES	0,101	AES	0,226	AES	0,0237	AES	0,022	AES	0,038	AES	0,061	AES	0,0129
AES	0,102	AES	0,226	ICP	0,0238	ICP	0,023	AES	0,038	AES	0,062	AES	0,0130
AES	0,102	AES	0,228	ICP	0,0241	AES	0,023	AES	0,038	AES	0,063	AES	0,0132
AES	0,104	AES	0,231	AES	0,0244	AES	0,023	AES	0,038	XRF	0,064	AES	0,0133
AES	0,107	AES	0,232	AES	0,0246	AES	0,024	AES	0,038	AES	0,064	AES	0,0136
ICP	0,108	ICP	0,234	ICP	0,0269	ICP	0,024	AES	0,038	AES	0,065	AES	0,0140
ICP	0,114*	AES	0,234	AES	0,0273	AES	0,028	AES	0,038	AES	0,065	ICP	0,0140
XRF	0,124*	AES	0,235	AES	0,0278	AES	0,029	XRF	0,075*	AES	0,065	AES	0,0159*

	Ni		Al		Mo		W		V		Ti		Co
Value	0,099		0,223		0,0236		0,021		0,037		0,061		0,0127
s_M	0,004		0,008		0,0018		0,004		0,001		0,003		0,0007
U	0,002		0,004		0,0008		0,002		0,001		0,002		0,0003

Method	As	Method	Sn	Method	B	Method	Pb	Method	Zr	Method	Bi	Method	N
		XRF	0,0214										
		ICP	0,0225										
		AES	0,0242										
		AES	0,0243									AES	0,0061
		AES	0,0247	AES	0,0059*							AES	0,0081
ICP	0,0050	ICP	0,0248	AES	0,0068	AES	0,0063					AES	0,0084
AES	0,0051	AES	0,0249	AES	0,0069	AES	0,0067	ICP	0,0073*			AES	0,0084
AES	0,0052	AES	0,0252	AES	0,0073	ICP	0,0071	AES	0,0110			AES	0,0086
ICP	0,0054	AES	0,0266	XRF	0,0073	AES	0,0071	AES	0,0110			AES	0,0086
ICP	0,0058	ICP	0,0266	AES	0,0073	XRF	0,0073	AES	0,0116			AES	0,0095
AES	0,0060	AES	0,0268	ICP	0,0074	AES	0,0074	AES	0,0117			AES	0,0100
AES	0,0060	ICP	0,0268	AES	0,0074	AES	0,0077	AES	0,0120	AES	0,0059	TCM	0,0101
AES	0,0064	AES	0,0269	AES	0,0076	AES	0,0080	AES	0,0121	AES	0,0066	TCM	0,0101
AES	0,0064	ICP	0,0279	AES	0,0076	ICP	0,0081	AES	0,0121	AES	0,0069	TCM	0,0101
AES	0,0065	AES	0,0280	AES	0,0077	AES	0,0085	AES	0,0121	AES	0,0070	TCM	0,0102
AES	0,0066	AES	0,0281	AES	0,0077	AES	0,0086	AES	0,0123	AES	0,0070	TCM	0,0102
AES	0,0066	AES	0,0289	AES	0,0078	AES	0,0087	AES	0,0124	AES	0,0074	TCM	0,0107
AES	0,0068	AES	0,0297	AES	0,0079	ICP	0,0088	AES	0,0126	AES	0,0074	TCM	0,0109
AES	0,0068	AES	0,0301	AES	0,0079	AES	0,0088	AES	0,0131	AES	0,0078	TCM	0,0112
AES	0,0073	AES	0,0308	AES	0,0081	AES	0,0090	AES	0,0132	AES	0,0085	TCM	0,0117
XRF	0,0081	AES	0,0311	AES	0,0087	ICP	0,0095	AES	0,0146*	ICP	0,0102*	AES	0,0132
AES	0,0085	AES	0,0343	ICP	0,0107*	ICP	0,0102	ICP	0,0147*	AES	0,0112*	AES	0,0133

	As		Sn		B		Pb		Zr		Bi		N
Value	0,0064		0,0270		0,0076		0,0081		0,0121		0,0072		0,0101
s_M	0,0010		0,0030		0,0005		0,0010		0,0007		0,0007		0,0017
U	0,0005		0,0013		0,0003		0,0006		0,0004		0,0005		0,0008

COMMENTS:

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

U – Uncertainty of the reference value $U \geq \pm \dfrac{t_{5;0,05}}{\sqrt{n}} \cdot s_M$ 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 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 32/1C** - laboratories by various spectrometric methods (AES spark, glow discharge, XRF) and alternative methods (combustion, thermoevolution, wet-way) standard methods, with measurements metrological traceabled 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 ± 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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