

Certificate No 01-18, Reference materials of cast iron CI-SPL-17

for solid sample spectrometry

Intended for calibration, matrix-match verification and statistical process control of cast iron spectrometric analysis from a plane of solid sample: Atomic Emission Spectrometry with spark, glow-discharge or laser excitation, and X-ray Fluorescence Spectrometry. They may not substitute CRM in a statement of metrological traceability, method validation.

User instructions A single analysis area of at least 4 mm in diameter defines the minimum sample intake. A mean of at least three independent measurements is required for every metrological operation. Storage of the RM in dry and non-corrosive environment is recommended. There are no safety hazards in the storage and proper use of RM.

Supplied in a set or as individual discs 40 mm in diameter and approximately 18 mm thick. The reference values and/or approximative reference values are valid for both plan-parallel sides (working surfaces) into depth of 6mm.. The discs are marked on the side by the RM batch code and the limits to which reference and/or approximative reference values apply. **When used to both limits, the remainder, which may contain minor structure defects, should be discarded.**

Characterised by inter-laboratory study of the expert laboratories listed below 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, CZ02033, CZ 20034, ČKD 241-249, Brammer Standard).

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.

Reference 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.

Indicative values in regular without the uncertainty statement are intended for the matrix information.

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Participating laboratories

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Best Materia Co, Tokyo, Japan
Brammer Standard Company, Houston, USA
Enviform, Třinec, Czech Republic
Institute for CRM, Yekaterinburg, Russia
Lithea, Brno, Czech Republic
MS Utilities and services, Bohumín, Czech Republic
OBLF, Witten, Germany

SES Inspekt, Tlmače, Slovakia
SPECTRO Analytical Instruments, Kleve, Germany
US Steel Košice – Labortest, Slovakia
Viadrus, Bohumín, Czech Republic
Vítkovice Testing Center, Ostrava, Czech Republic
Well Group, Beijing, China
ZPS Slévárna, Zlín, Czech Republic
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CI-SPL-17 Reference Materials

31A - 41A - VALUES IN wt. %

Reference values in bold, with ± uncertainty interval below in regular.

Indicative values in regular, without uncertainty statement.

Empty boxes indicate values at or below limit of determination

	C	Mn	Si	P	S	Cr	Ni	Cu	Mo	Mg	Ce	V
31A	3.54	0.041	2.10	0.025	0.006	0.019	0.538	0.005	0.004	0.070	<i>0.004</i>	0.008
(ID-0A)	0.04	0.002	0.02	0.001	0.001	0.001	0.004	0.001	0.001	0.003		0.001
32A	3.39	0.288	2.74	0.037	0.007	0.060	0.015	0.306	0.116	0.024	<i>0.004</i>	0.005
(ID-1B)	0.02	0.003	0.03	0.002	0.001	0.002	0.001	0.005	0.002	0.002		0.001
33A	2.75	0.710	3.10	0.060	0.007	0.239	0.389	0.730	0.220	0.021	0.026	0.356
(ID-3B)	0.02	0.006	0.03	0.002	0.001	0.002	0.004	0.010	0.003	0.002	0.003	0.004
34A	3.48	0.980	2.29	0.105	0.008	0.102	0.493	0.230	0.072	0.026	0.008	0.073
(ID-5B)	0.03	0.010	0.02	0.003	0.001	0.002	0.004	0.004	0.002	0.002	0.002	0.002
35A	4.55	0.096	0.078	0.024	0.011	0.022	0.024	0.004	0.003			0.009
(IP-1B)	0.04	0.003	0.004	0.001	0.001	0.002	0.002	0.001	0.001			0.001
36A	3.02	0.057	2.13	0.026	0.010	0.014	0.011	0.007	0.004	0.012	0.007	0.021
(IG-0A)	0.02	0.002	0.02	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002
37A	3.07	0.211	3.30	0.025	0.023	0.328	0.106	0.149	0.325			0.122
(IG-1B)	0.02	0.003	0.03	0.001	0.001	0.002	0.002	0.003	0.004			0.003
38A	3.39	0.401	2.37	0.067	0.036	0.141	0.306	0.510	0.101			0.061
(IG-2B)	0.03	0.004	0.02	0.002	0.002	0.002	0.003	0.006	0.002			0.002
39A	3.70	0.812	1.90	0.160	0.045	0.488	0.032	0.298	0.203			0.232
(IG-3B)	0.03	0.011	0.02	0.003	0.002	0.003	0.001	0.005	0.003			0.004
40A	3.38	0.042	1.98	0.021	0.0035	0.031	0.045	0.010	0.005	0.007	0.012	0.014
(IG-4A)	0.02	0.002	0.02	0.002	0.0005	0.001	0.001	0.001	0.001	0.001	0.002	0.001
41A	3.41	0.512	1.92	0.199	0.068	0.125	0.104	0.151	0.041			0.011
(IG-5B)	0.03	0.004	0.02	0.004	0.002	0.002	0.002	0.003	0.003			0.001

	Ti	Al	Sn	Sb	Bi	B	Zn	Pb	W	Co	Nb	N
31A	0.007	0.005	<i>0.003</i>			<i>0.0004</i>			<i>0.005</i>	0.022		0.0042
(ID-0A)	0.001	0.001								0.001		0.0003
32A	0.044	0.029	<i>0.012</i>	0.023	<i>0.007</i>	<i>0.0005</i>	0.011	0.022	<i>0.008</i>	<i>0.002</i>		0.0042
(ID-1B)	0.001	0.001		0.002			0.001	0.002				0.0003
33A	0.130	0.054	0.039	0.019	<i>0.002</i>	0.0064	0.009	0.010	0.079	0.015	0.032	0.0043
(ID-3B)	0.005	0.002	0.001	0.002		0.0003	0.001	0.001	0.003	0.001	0.002	0.0003
34A	0.044	0.010	0.051	0.007	<i>0.005</i>	0.0076	0.007	<i>0.006</i>	0.016	0.025	0.014	0.0041
(ID-5B)	0.001	0.001	0.002	0.002		0.0003	0.001		0.002	0.001	0.001	0.0003
35A	<i>0.002</i>	<i>0.002</i>	<i>0.002</i>			<i>0.0002</i>		<i>0.002</i>	<i>0.005</i>	0.023		0.0036
(IP-1B)										0.002		0.0003
36A	0.021	<i>0.003</i>	<i>0.002</i>		<i>0.007</i>	0.022	<i>0.002</i>	0.016		<i>0.004</i>		0.0038
(IG-0A)	0.001					0.002		0.002				0.0003
37A	0.008	0.039	0.073		<i>0.002</i>	0.0124	<i>0.001</i>	<i>0.002</i>	0.026	0.031		0.0089
(IG-1B)	0.001	0.002	0.002			0.0005			0.002	0.001		0.0004
38A	0.012	0.034	0.032	0.018	<i>0.002</i>	0.0027	0.028	<i>0.003</i>	<i>0.005</i>	0.021	0.008	0.0100
(IG-2B)	0.001	0.001	0.001	0.002		0.0002	0.002			0.001	0.002	0.0004
39A	<i>0.074</i>	0.008	<i>0.003</i>	0.037	0.008	0.0195	0.035	0.017		<i>0.002</i>		0.0037
(IG-3B)		0.001		0.002	0.002	0.0006	0.003	0.002				0.0003
40A	0.015	0.096	<i>0.004</i>			0.0008	<i>0.002</i>			0.027		0.0063
(IG-4A)	0.001	0.003				0.0002				0.001		0.0004
41A	0.048	<i>0.003</i>	0.066	0.016	<i>0.007</i>	<i>0.0004</i>	<i>0.001</i>	0.010	0.012	0.031		0.0070
(IG-5B)	0.001		0.002	0.002				0.001	0.002	0.001		0.0003

Further approximative reference values are 0.041% As in 37A, 0.025% As in 32A, 0.016% As in 33A, 0.008% As in 41A, 0.008% Te in 33A, 0.007% Te in 37A and 39A.