BUREAU OF ANALYSED SAMPLES LTD

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BRITISH CHEMICAL STANDARD CERTIFIED REFERENCE MATERIAL

CERTIFICATE OF ANALYSIS
BCS*/SS§-CRM No. 402/2
LOW ALLOY STEEL

Prepared under rigorous laboratory conditions and, AFTER CERTIFICATION ANALYSIS IN GREAT BRITAIN, issued by the Bureau of Analysed Samples Ltd.

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ANALYSES

Mean of 4 values - mass content in %.

Lab No.	C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	N	V
1	**...**	**...**	**...**	…	**...**	0.638	0.150	0.807	0.168	0.298	…	0.190
2	…	…	…	…	…	0.634	0.141	0.822	0.161	0.312	…	0.190
3	1.328	0.115	0.228	0.0160	0.0135	0.661	0.133	0.806	0.157	0.294	…	0.212
4	**...**	0.108	0.235	0.0155	0.0128	…	0.152	0.807	…	0.307	…	0.197
5	1.306	0.121	0.226	0.0154	0.0157	…	…	…	…	…	0.0067	…
6	1.306	0.108	0.223	0.0165	0.0132	…	…	…	…	…	0.0064	…
7	1.291	0.103	0.231	0.0162	0.0130	…	…	…	…	…	0.0082	…
8	1.319	0.114	0.228	0.0176	0.0144	…	…	…	…	…	0.0071	…
9	…	**...**	…	…	…	0.654	0.137	0.800	0.155	0.301	…	0.189
10	1.314	0.108	0.222	0.0152	0.0141	0.658	0.129	0.797	0.164	0.298	0.0063	0.195
11	**...**	…	**...**	…	…	0.668	0.140	0.815	0.159	0.305	…	0.188
M_M	**1.311**	**0.111**	**0.228**	**0.0161**	**0.0138**	**0.652**	**0.140**	**0.808**	**0.161**	**0.302**	**0.0069**	**0.194**
s_M	0.013	0.006	0.005	0.0009	0.0011	0.014	0.009	0.009	0.005	0.007	0.0008	0.009
s_W	0.006	0.005	0.003	0.0006	0.0005	0.005	0.003	0.009	0.003	0.005	0.0002	0.005

The above figures are those which each Analyst has decided upon after careful verification

M_M: Mean of the intralaboratory means. s_M: standard deviation of the intralaboratory means. s_W: intralaboratory standard deviation.
Values given above in small italic type are for information only.

CERTIFIED VALUES (Cv)

mass content in %

	C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	N	V
Cv	**1.311**	**0.111**	**0.228**	**0.0161**	**0.0138**	**0.652**	**0.140**	**0.808**	**0.161**	**0.302**	**0.0069**	**0.194**
C(95%)	0.014	0.006	0.005	0.0008	0.0009	0.014	0.008	0.008	0.005	0.006	0.0010	0.008

The half width confidence interval C(95%) = $\frac{t \times s_M}{\sqrt{n}}$ where "t" is the appropriate Student's t value and "n" is the number of acceptable mean values

For further information regarding the confidence interval for the certified value see ISO Guide 35:1989 section 4.

BCS/SS-CRM No. 402/2
LOW ALLOY STEEL
NOTES ON METHODS USED

CARBON

Analyst No. 3 determined carbon by non-aqueous titration according to the British Standard Carbon Method 4*. Nos. 5, 6, 8, and 10 used high frequency combustion/infrared absorption. No. 7 used the gravimetric method BS 6200:3.8.1:1985.

SILICON

Analysts Nos. 3, 5, 6, 7 and 10 determined silicon by double dehydration with perchloric acid, according to the British Standard Silicon Method 1*. No. 4 determined silicon photometrically as molybdenum blue, using the Standard Method BS 6200:3.26.3:1987. No.8 used Inductively Coupled Plasma – Optical Emission Spectrometry (ICP-OES).

MANGANESE

Analysts Nos. 3, 4, 5 and 7 determined manganese photometrically after oxidation with periodate according to the British Standard Manganese Method 2*. Nos. 6, 8 and 10 used ICP-OES.

PHOSPHORUS

Analysts Nos. 3, 4, 5, 6 and 7 determined phosphorus photometrically as phosphovanadomolybdate. Nos. 3, 5 and 6 used the Standard Method BS 6200:3.24.1:1985. Nos. 8 and 10 used ICP-OES.

SULPHUR

Analyst No. 3 determined sulphur gravimetrically according to the British Standard Sulphur Method 1*. Nos. 4, 5, 6, 8 and 10 used high frequency combustion/infrared absorption. No. 7 determined sulphur titrimetrically with borate after combustion of the sample.

CHROMIUM

Analyst No. 1 determined chromium using Flame Atomic Absorption Spectrometry (FAAS). Nos. 2, 9, 10 and 11 used ICP-OES. No. 3 determined chromium titrimetrically after oxidation with persulphate/silver nitrate using the Standard Method BS 6200:3.10.1:1985.

MOLYBDENUM

Analyst No. 1 determined molybdenum using FAAS. Nos. 2, 9, 10 and 11 used ICP-OES. Nos. 3 and 4 determined molybdenum photometrically as the oxythiocyanate according to the British Standard Molybdenum Method 1*.

NICKEL

Analysts Nos. 1 and 2 determined nickel using FAAS. No. 3 determined nickel titrimetrically according to the Analoid Method No. 62. No. 4 determined nickel photometrically with dimethylglyoxime. Nos. 9, 10 and 11 used ICP-OES.

ALUMINIUM

Analysts Nos. 1 and 3 determined aluminium using FAAS. Nos. 2, 9, 10 and 11 used ICP-OES.

COPPER

Analysts Nos. 1, 2, 3 and 4 determined copper using FAAS. Nos. 9, 10, and 11 used ICP-OES.

NITROGEN

Analyst No. 7 determined nitrogen by acidimetric titration after converting to ammonia and steam distillation. The remaining analysts determined nitrogen using thermal conductivity after fusion of the sample in graphite crucibles.

VANADIUM

Analyst No. 1 determined vanadium using FAAS. Nos. 2, 9, 10 and 11 used ICP-OES. Nos. 3 and 4 determined vanadium titrimetrically, No. 3 according to the Analoid Method No. 34

*Methods for Sampling and Analysis of Iron, Steel and other Ferrous Metals, B.S. Handbook No. 19, published 1970 by the British Standards Institute, London.

DESCRIPTION OF SAMPLE

*British Chemical Standard – bottles of 100g chips graded 1700 – 250µm (10 – 60 mesh) for chemical analysis.

§ Spectroscopic Standard – 38 mm diameter discs for spectroscopic analysis

INTENDED USE & STABILITY

The chip sample, BCS-CRM 402/2, is intended for the verification of analytical methods, such as those used by the participating laboratories, for the calibration of analytical instruments in cases where the calibration with primary substances (pure metals or stoichiometric compounds) is not possible and for establishing values for secondary reference materials.

It will remain stable provided that the bottle remains sealed and is stored in a cool, dry atmosphere. When the bottle has been opened the lid should be secured immediately after use. If the contents should become discoloured (e.g. oxidised) by atmospheric contamination they should be discarded.

The disc sample, SS-CRM 402/2, is intended for establishing and checking the calibration of Optical Emission and X-Ray Spectrometers for the analysis of similar materials. The "as received" working surface of the sample should be linished before use to remove any protective coating. It will remain stable provided that it is not subject to excessive heat (e.g., during preparation of the working surface). An area 6mm in diameter in the centre of the disc should be avoided for optical emission spectrometry

TRACEABILITY

The traceability of this CRM is ensured by the use of either stoichiometric analytical techniques or methods which are calibrated against pure metals or stoichiometric compounds.

This Certified Reference Material has been prepared in accordance with the recommendations specified in ISO Guides 30 to 35, available from the International Standards Organisation in Geneva.

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For BUREAU OF ANALYSED SAMPLES LTD

P.D. RIDSDALE,
Chairman

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