BUREAU OF ANALYSED SAMPLES LTD

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Certificate No. Q3993

BRITISH CHEMICAL STANDARD CERTIFIED REFERENCE MATERIAL

CERTIFICATE OF ANALYSIS
BCS*/SS§-CRM No. 466/2
AUSTENITIC STAINLESS STEEL

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

CO-OPERATING ANALYSTS AND FIRMS

INDEPENDENT ANALYSTS

1 BOUSTEAD, I., *BSc.*
Bodycote Materials Testing Teesside, Middlesbrough.
2 GIBBS, J.S. *CChem, MRSC*
Castings Technology International, Birmingham.
3 HEYWOOD, D.G., *AMet,* Pattinson & Stead, Middlesbrough.
4 PAGE-GIBSON, J.E., *BSc, CChem, MRSC*
Ridsdale & Co. Ltd., Middlesbrough.
5 SUTCLIIFE, T., Alfred H. Knight International, St Helens.

ANALYSTS representing MANUFACTURERS and USERS

6 FOX, G., Corus Testing Solutions, Stocksbridge.
7 WILSON J., Allvac Ltd., Sheffield.
8 RUGG, P., Corus Testing Solutions, Rotherham.

ANALYSES

Mean of 4 values - mass content in %.

Lab No.	C	Si	Mn	P	S	Cr	Mo	Ni	As	B	Co	Cu	N	V	*Total Al*	*Ti*
1	0.0135	0.4849	1.3000	0.0097	0.0071	17.9275	2.7585	10.1673	0.0021	0.0039	…	0.0271	…	0.0335	...	*0.0006*
2	0.0137	0.4840	1.3185	0.0107	0.0069	17.8275	2.7973	10.3025	…	…	0.0197	0.0280	…	0.0348	*0.0014*	*0.0012*
3	0.0148	0.4685	1.2908	0.0111	0.0067	17.7925	2.7975	10.1800	0.0016	0.0034	0.0179	0.0288	0.0514	0.0319	*0.0021*	*0.0039*
4	0.0133	0.4818	1.3101	0.0104	0.0063	17.8425	2.7765	10.1447	0.0019	0.0038	0.0196	0.0287	0.0505	0.0345	*0.0015*	*0.0028*
5	…	0.4873	1.3331	0.0102	0.0076	17.8693	…	10.2355	…	…	0.0187	0.0268	…	0.0372	...	...
6	0.0144	0.4803	1.3103	0.0109	0.0071	17.7945	2.7485	10.1925	0.0022	0.0043	0.0164	0.0274	0.0490	0.0356	*0.0004*	*0.0006*
7	0.0146	0.4706	1.3125	0.0107	0.0066	17.8080	2.7799	10.1860	0.0022	0.0041	0.0181	0.0281	0.0517	0.0345	*0.0020*	*0.0024*
8	…	…	…	…	…	…	…	…	…	…	…	…	0.0514	…	...	...
M_m	**0.0141**	**0.4796**	**1.3108**	**0.0105**	**0.0069**	**17.8374**	**2.7764**	**10.2012**	**0.0020**	**0.0039**	**0.0184**	**0.0278**	**0.0508**	**0.0346**	…	...
s_M	0.0007	0.0073	0.0134	0.0005	0.0005	0.0483	0.0200	0.0525	0.0003	0.0004	0.0013	0.0008	0.0011	0.0017	…	...
s_W	0.0003	0.0041	0.0089	0.0004	0.0003	0.0282	0.0076	0.0326	0.0003	0.0004	0.0003	0.0005	0.0006	0.0013	…	...

(Additional information :- Analyst No. 1:- Nb 0.0010%; Analyst No. 4:- Pb <0.0001%, Sn <0.0010%, W 0.0012%)

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

mass content in %

	C	Si	Mn	P	S	Cr	Mo	Ni	As	B	Co	Cu	N	V
M_m	**0.0141**	**0.480**	**1.311**	**0.0105**	**0.0069**	**17.84**	**2.776**	**10.20**	**0.0020**	**0.0039**	**0.0184**	**0.0278**	**0.0508**	**0.0346**
C(95%)	0.0008	0.007	0.013	0.0005	0.0005	0.05	0.021	0.05	0.0004	0.0005	0.0014	0.0008	0.0014	0.0016

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.

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

BCS/SS-CRM No. 466/2
AUSTENITIC STAINLESS STEEL
NOTES ON METHODS USED

CARBON

All Analysts, except No. 4, determined carbon by high frequency combustion- infrared absorption. Analyst No. 4 determined carbon using non-aqueous titration according to the Standard Method BS 6200:3.8.2:1991.

SILICON

All Analysts, except No. 1, determined silicon gravimetrically after dehydration with perchloric acid according to the Standard Method BS 6200:3.26.5:1985. Analyst No. 1 determined silicon using Inductively Coupled Plasma – Optical Emission Spectrometry (ICP-OES).

MANGANESE

Analysts Nos. 1 and 5 determined manganese using ICP-OES. Analysts Nos. 2 and 3 determined manganese using Flame Atomic Absorption Spectrometry (FAAS). Analysts Nos. 4, 6 and 7 determined manganese photometrically, Nos. 4 and 7 after oxidation with potassium periodate, No. 6 after oxidation with ammonium persulphate.

PHOSPHORUS

Analysts Nos. 1 and 2 determined phosphorus using ICP-OES. Analysts Nos. 3, 4, 5 and 6 determined phosphorus photometrically as phosphovanadomolybdate with extraction according to the Standard Method BS EN 10184. Analyst No. 7 determined phosphorus by acidimetric titration of ammonium phosphomolybdate.

SULPHUR

All Analysts, except No. 4, determined sulphur by high frequency combustion infrared absorption. Analyst No. 4 determined sulphur photometrically as methylene blue after separation as H_2S according to the Standard Method ISO 10701.

CHROMIUM

All Analysts determined chromium titrimetrically after oxidation with ammonium persulphate according to the Standard Method BS EN 24937:1991 (ISO 4937:1986).

MOLYBDENUM

Analyst No. 1 determined molybdenum using ICP-OES. Analysts Nos. 2, 4 and 7 determined molybdenum photometrically with thiocyanate in the presence of Sn (II), Nos. 2 and 4 with extraction. No 3 used FAAS.

NICKEL

Analyst No. 1 determined nickel using ICP-OES. Analyst Nos. 2 and 3 used FAAS. Analysts Nos. 4, 6 and 7 determined nickel titrimetrically, No. 4 with potassium dichromate after separation with dimethylglyoxime, No. 6 using cyanometric titration and No.7 using complexometric titration, all with visual end-points. Analyst No. 5 determined nickel gravimetrically with dimethylglyoxime.

ARSENIC

Analysts Nos. 1 and 3 determined arsenic using atomic absorption spectrometry. No. 1 used electrothermal atomisation and No. 3 separated arsenic as arsine. Analysts No. 4 and 7 determined arsenic photometrically, No. 4 with silver diethyldithiocarbamate after separation as arsine, according to BS EN 10212:1996, and No. 7 as molybdenum blue after halide extraction. No 6 used ICP-OES.

BORON

Analyst No. 1 determined boron using ICP-OES. Analysts Nos. 3, 4, 6, and 7 determined boron photometrically, Nos. 3, 4 and 6 with curcumin, according to BS EN 10200, No. 7 with 1.1dianthramide after distillation of methyl boric acid ester.

COBALT

Analysts Nos. 2, 4, 5 and 6 determined cobalt using ICP-OES. Analysts Nos. 3 and 7 used FAAS

COPPER

Analysts Nos. 1 and 6 determined copper using ICP-OES. Analysts Nos. 2, 3, 4, 5 and 7 used FAAS.

NITROGEN

Analysts Nos. 3 and 4 determined nitrogen using an acidimetric titration after distillation according to the Standard Method BS 6200:3.22.1:1992. Analysts Nos. 6, 7 and 8 used thermal conductivity after decomposition in a graphite crucible.

VANADIUM

Analysts Nos. 1, 2, 4, 5 and 6 determined vanadium using ICP-OES. No. 3 used FAAS and No. 7 used Electrothermal Atomic Absorption Spectrometry (ETAAS).

ALUMINIUM (Total)

Analysts Nos. 2, 4 and 6, determined aluminium using ICP-OES, Nos. 3 and 7 used FAAS.

TITANIUM

Analyst Nos. 1, 2, 4 and 6 determined titanium using ICP-OES. No. 3 used FAAS. No. 7 determined titanium photometrically with diantipyrylmethane according to the Standard Method ISO 10281:1991.

INTENDED USE & STABILITY

The chip sample, BCS 446/2, 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 466/2, 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).

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.
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Preliminary Edition …. February 2003
Main Edition …. December 2004