MAIN EDITION

BUREAU OF ANALYSED SAMPLES LTD

BRITISH CHEMICAL STANDARD CERTIFIED REFERENCE MATERIAL

CERTIFICATE OF ANALYSIS

†BCS-CRM No. 340/‡SS-CRM No. 70

FERRITIC STAINLESS 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 %.

Analyst No.	C	Si	Mn	P	S	Cr	Ni	*Cu*
1	…	…	…	0.022	0.018	…	…	*...*
2	0.18	0.35	0.38	0.024	0.019	16.32	0.39	*0.02*
3	0.18	…	0.37	…	…	16.41	0.41	*...*
4	0.17	0.35	0.38	0.025	0.021	16.36	0.38	*...*
5	…	0.35	0.37	…	…	…	0.39	*...*
6	…	…	…	…	…	16.41	0.39	*...*
7	0.18	0.35	0.37	0.023	0.019	16.34	0.42	*...*
8	…	0.36	0.37	…	…	…	…	*...*
9	…	0.35	…	…	…	…	0.40	*...*
10	…	0.35	0.38	0.023	…	…	…	*...*
11	0.18	…	0.39	0.024	…	16.35	…	*...*
12	…	0.36	…	…	0.020	…	…	*...*
13	0.17	…	…	0.024	0.021	16.38	…	*...*
14	0.17	…	…	0.024	0.021	16.40	…	*...*
15	…	…	…	…	0.018	16.26	…	*...*
M_M	**0.18**	**0.35**	**0.38**	**0.024**	**0.020**	**16.36**	**0.40**	*...*
s_M	0.01	0.01	0.01	0.001	0.002	0.05	0.02	*...*

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

Figures in bold type certified, figures in small italic type only approximate.

M_M: Mean of the intralaboratory means. s_M: standard deviation of the intralaboratory means.

CERTIFIED VALUES (Cv)

mass content in %

	C	Si	Mn	P	S	Cr	Ni
Cv	**0.18**	**0.35**	**0.38**	**0.024**	**0.020**	**16.36**	**0.40**
C(95%)	0.01	0.01	0.01	0.001	0.002	0.04	0.02

The half width confidence interval **C**(95%) = $\frac{t \times s_M}{\sqrt{n}}$ where "t" is the appropriate two sided Student's t value at the 95% confidence level for "n" acceptable mean values.

For further information regarding the confidence interval for the certified value see ISO Guide 35:2006 sections 6.1 and 10.5.2.

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NOTES ON METHODS USED

CARBON

Analysts Nos. 2 and 7 determined carbon by the Standard gravimetric method B.S. 1121: Part 11: 1948. The method was slightly modified in each case; No. 2 used pure tin as flux, No. 7 used a 5g sample. Nos. 3 and 11 determined carbon by electrical conductivity. No. 3 used a microchemical method (Nall & Scholey, Metallurgia, 1961, **64**, 97). No. 11 used a balanced two-cell circuit method. Nos. 4, 13 and 14 used the low-pressure method (Cook & Speight, Analyst, 1956, **81**, 144).

SILICON

All Analysts except No. 5 determined silicon gravimetrically by the Standard method B.S. 1121: Part 10: 1967 in which the silica is dehydrated by double evaporation with perchloric acid. No. 5 used a similar method but dehydrated with a mixture of sulphuric and perchloric acids.

MANGANESE

All Analysts except No. 7 determined manganese photometrically as permanganic acid. Nos. 2, 3, 4, 10 and 11 used the Standard method B.S. 1121: Part 23: 1951 which depends on oxidation with periodate. No. 5 used a similar method. No. 8 oxidized with persulphate/silver nitrate. No. 7 used the Standard titrimetric method B.S. 1121: Part 16: 1951.

Analyst No. 5 also used a photometric method depending upon oxidation with persulphate/silver nitrate and found 0.36%.

PHOSPHORUS

Analysts Nos. 1 and 14 determined phosphorus by the Standard gravimetric method B.S. 1121: Part 9: 1948. The other Analysts determined phosphorus photometrically using the Standard method B.S. 1121: Part 45: 1966 which depends on formation of phosphovanadomolybdic acid and extraction with *iso*butyl methyl ketone. Analyst No. 1 also used two alternative methods (a) a molybdenum-blue photometric method in conjunction with an automatic analyser (b) a phosphovanadomolybdate photometric method; the results obtained were 0 025% and 0.023% respectively. No. 14 also used a phosphovanadomolybdate photometric method and found 0.023%.

SULPHUR

Analysts Nos. 1, 4, 7, 14 and 15 determined sulphur gravimetrically. Nos. 1, 7, 14 and 15 used the Standard method B.S. 1121: Part 1: 1966. No. 4 used a method involving chromatographic separation of the sulphur, as sulphuric acid, on an alumina column (Nydahl, Anal. Chem., 1954, **26**, 580). Nos. 2, 12 and 13 determined sulphur by combustion. No. 2 used a modified IRSID stoichiometric method (Green, B.C.I.R.A. Journ. 1963, **11**, 76) with tin as flux. Nos. 12 and 13 used conventional methods; No. 12 absorbed the sulphur gases in dilute hydrochloric acid and titrated with iodide/iodate solution, No. 13 absorbed in hydrogen peroxide solution and titrated with borate solution.

Analysts Nos. 1 and 14 also determined sulphur by combustion. No. 1 used an electrical conductivity method after IRSID type combustion in oxygen and found 0.017%. No. 14 used a conventional combustion method and found 0.020%.

CHROMIUM

All Analysts determined chromium titrimetrically. No. 2 used the Analoid method No. 37 in which the hexavalent chromium is titrated with ammonium ferrous sulphate. Nos. 4, 7, 13, 14 and 15 used the Standard method B.S. 1121: Part 13: 1954 in which the chromium is titrated with ammonium ferrous sulphate/potassium permanganate. Nos. 6 and 11 used a similar method but titrated with ammonium ferrous sulphate/dichromate. No. 3 used both the Standard method and the modification employing titration with ammonium ferrous sulphate/ dichromate.

Analyst No. 7 also used the ammonium ferrous sulphate/dichromate titration and found 16.32%.

NICKEL

Analysts Nos. 2, 3, 5 and 7 determined nickel photometrically with dimethylglyoxime. No. 2 used the Analoid method No. 44. Nos. 3 and 7 used the Standard photometric method B.S. 1121: Part 6: 1948. Nos. 4 and 6 determined nickel titrimetrically after precipitation with dimethylglyoxime. No. 4 titrated cyanometrically according to the Standard method B.S. 1121: Part 37: 1961 whereas No. 6 titrated with EDTA. No. 9 used a gravimetric method (Claassen and Bastings, Z. anal. Chem. 1959, **165**, 354).

Analyst No. 5 also used a cyanometric method and found 0.39%.

COPPER

Photometric method using bis-cyclohexanone oxalyldihydrazone (Analoid method No. 65).

DESCRIPTION OF SAMPLE

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

‡ Spectroscopic Standard – 44 mm diameter x 13 mm thick discs for spectroscopic analysis.

INTENDED USE & STABILITY

The chip sample, BCS-CRM 340, 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 70, 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). Due to slight segregation of certain elements an area 6mm in diameter in the centre of the disc samples should be avoided for emission spectroscopy.

TRACEABILITY

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

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For BUREAU OF ANALYSED SAMPLES LTD

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