MAIN EDITION

BUREAU OF ANALYSED SAMPLES LTD

SPECTROSCOPIC STANDARD CERTIFIED REFERENCE MATERIAL

CERTIFICATE OF ANALYSIS

SS-CRM No. 604/2

PLAIN CARBON CAST STEEL

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

CO-OPERATING ANALYSTS

INDEPENDENT ANALYST

1 PAGE-GIBSON, J. E., *BSc*, *CChem*, *MRSC*, Ridsdale and Co. Ltd., Middlesbrough.

ANALYSTS representing MANUFACTURERS and USERS

2 AMBROSE, A. D., *BSc*, BSC Technical Centre, Corby.
3 CADZOW, N. G., *BSc*, *CChem*, *FRSC*, Weir Pumps Ltd., Glasgow.
4 CRESSWELL, C., *CChem*, *FRSC*, BICC Cables Ltd., Prescot.
5 CUNNINGHAM, A., *MSc*, *CChem*, *MRSC*, BSC Ravenscraig Works, Motherwell.

ANALYSTS representing MANUFACTURERS and USERS (CONT.)

6 DAVIES, T. D., GKN Technology Ltd., Wolverhampton.
7 DYSON, R. W., BSC Swinden Laboratories, Rotherham.
8 GARNER, J. D., and DAVISON, B., *LRSC*, Rolls-Royce plc (Nuclear Components Division), Hartlepool.
9 GULLAND, W. S., BSC Welsh Laboratory, Port Talbot.
10 HUMPHREYS, D., British Telecommunications plc, Birmingham.
11 JOWITT, R., BSC Teesside Laboratories, Middlesbrough.
12 MORRIS, G. P., Rotherham Engineering Steels, Rotherham.

ANALYSES

Mean of 4 values - mass content in %.

Analyst No.	C	Si	Mn	P	S	Al (Total)	*Al (Acid Sol.)*	*Cr*	*Mo*	*Ni*	*Co*	*Cu*	*V*	*Zr*
1	0.205	0.74	1.90	0.018	0.072	0.010	...	...	...	...	...	...	...	...
2	0.192	0.75	1.91	0.014	0.072	0.007	...	*0.06*	*0.02*	*0.09*	*0.01*	*0.07*	*0.001*	*<0.005*
3	...	0.73	1.87	0.017	...	...	...	...	...	...	...	...	...	...
4	0.204	0.75	1.88	...	...	...	...	...	...	...	...	...	...	...
5	0.198	...	...	...	0.072	0.011	...	...	...	...	...	...	...	...
6	...	0.76	1.88	0.016	...	...	...	...	...	...	...	...	...	...
7	0.202	0.74	...	...	0.071	...	...	...	...	...	...	...	...	...
8	...	0.74	1.91	0.015	...	...	...	...	...	...	...	...	...	...
9	0.194	0.75	1.94	0.016	0.069	0.008	...	...	...	...	...	...	...	...
10	0.202	0.75	1.96	0.014	0.076	...	*0.005*	...	...	...	...	...	...	...
11	...	...	...	...	...	0.005	...	...	...	...	...	...	...	...
12	0.197	...	...	...	0.072	0.009	...	...	...	...	...	...	...	...
M_M	**0.199**	**0.75**	**1.91**	**0.016**	**0.072**	**0.008**	...	...	...	...	...	...	...	...
s_M	0.005	0.01	0.04	0.002	0.003	0.003	...	...	...	...	...	...	...	...

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 laboratory mean values. s_M: standard deviation of the laboratory mean values.

CERTIFIED VALUES (Cv)

mass content in %

	C	Si	Mn	P	S	Al (Total)
Cv	**0.199**	**0.75**	**1.91**	**0.016**	**0.072**	**0.008**
C(95%)	0.004	0.01	0.03	0.002	0.002	0.003

The half width confidence interval **C**(95%) is an expression of the uncertainty of the certified value, where **C**(95%) = $\frac{t \times s_M}{\sqrt{n}}$ and "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.

NB: Although widely accepted within the industry "mass content in %" is neither an SI nor an IUPAC supported quantity.
Multiplication of the certified value (Cv) by 10^4 will yield the value in µg/g.

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(The current edition is available at www.basrid.co.uk)

SS-CRM 604/2 PLAIN CARBON CAST STEEL

NOTES ON METHODS USED

CARBON

Analysts Nos. 1 and 4 determined carbon by non-aqueous titration according to the British Standard Carbon Method 4*. Nos. 2, 5, 7, 10 and 12 used high frequency combustion with infrared absorption. No. 9 determined carbon coulometrically (Boniface and Jenkins, Analyst **96**, 1971, 37).

SILICON

Analysts Nos. 1, 3, 4, 6, 7, 8 and 9 determined silicon gravimetrically by dehydration with perchloric acid according to the British Standard Method BS 6200:3.26.5:1985 (B.S. Handbook No. 19 Silicon Method 1*). Nos. 2 and 10 used Inductively Coupled Plasma - Atomic Emission Spectrometry (ICP-AES).

MANGANESE

Analysts Nos 1, 2, 4, 6, 8 and 9 determined manganese photometrically after oxidation with periodate according to the British Standard Method BS 6200:3.18.2:1985 (B.S. Handbook No. 19 Manganese Method 2*). No. 3 also used a photometric method after oxidation with persulphate. No. 10 used ICP-AES.

PHOSPHORUS

Analysts Nos. 1, 2, 6, 8 and 9 determined phosphorus photometrically as phosphovanadomolybdate according to the British Standard Method BS 6200:3.24.1:1985 (B.S. Handbook No. 19 Phosphorus Method 2*). No. 3 determined phosphorus titrimetrically after precipitation as ammonium phosphomolybdate. No. 10 used ICP-AES.

SULPHUR

Analyst No. 1 determined sulphur gravimetrically as barium sulphate according to the British Standard Sulphur Method 1*. Nos. 2, 5, 7, 10 and 12 used high-frequency combustion with infra-red absorption. No. 9 determined sulphur coulometrically after combustion in air.

ALUMINIUM (Total)

Analysts Nos. 1, 9, 11 and 12 determined aluminium by Flame Atomic Absorption Spectrometry (FAAS) according to the British Standard Method BS 6200:3.1.4:1985. No. 2 used ICP-AES. No. 5 determined aluminium photometrically with eriochrome cyanine after removal of interfering elements according to the British Standard Aluminium Method 3*.

ALUMINIUM (Acid Soluble)

Analyst No. 10 determined acid-soluble aluminium using ICP-AES.

CHROMIUM, MOLYBDENUM, NICKEL, COBALT, COPPER, VANADIUM and ZIRCONIUM

Analyst No. 2 determined the seven above mentioned elements using ICP-AES.

BS 6200: Sampling & Analysis of Iron, Steel and Other Ferrous Metals. Part 3 Methods of Analysis. Published by the British Standards Institution, 2 Park St., London. W1A 2BS.

*Methods for Sampling and Analysis of Iron, Steel and Other Ferrous Metals, B.S. Handbook No. 19, first published 1970 by the British Standards Institution, 2 Park Street, London, W1A 2BS.

DESCRIPTION OF SAMPLE

Spectroscopic Standard, SS-CRM 604/2, is sold as 44 mm diameter x 19 mm thick discs for spectroscopic analysis.

The preparation of representative samples for chemical analysis and certification by co-operative analysis was undertaken by Bureau of Analysed Samples Ltd.

These disc samples have been prepared from chill cast bars which were subjected to extensive spectrographic tests to confirm their homogeneity both radially and longitudinally. Slight porosity may be found in the centre of some of the disc samples but spectrographic examination has proved that this will not adversely affect the use of these samples provided that they are not sparked directly on to the affected area.

INTENDED USE

SS-CRM 604/2 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 should be linished before use to remove any protective coating. An area 6mm in diameter in the centre of the disc should be avoided for optical emission spectroscopy.

STABILITY

SS-CRM 604/2 will remain stable provided that it is not subjected to excessive heat (e.g. during preparation of the working surfaces).

TRACEABILITY

The characterisation of this material has been achieved by chemical analysis involving inter-laboratory study, each laboratory using the method of their choice, details of which are given above.

Most of the analytical methods used in the characterisation of this CRM were either international or national standard methods or methods which are technically equivalent. All laboratories used either stoichiometric analytical techniques or methods which were calibrated predominantly against pure metals or stoichiometric compounds, ensuring traceability of the individual results to the SI.

MEASUREMENT UNCERTAINTY

The uncertainty of each of the certified values of SS-CRM 604/2 has been established by multiplying the standard error arising from the chemical analysis by the appropriate two sided Student's t value at the 95% confidence level for the number of results. Homogeneity has been assessed to be acceptable. It has not, therefore, been included in the calculated measurement uncertainty. The stability of this CRM and its transportation also make negligible contributions to the overall uncertainty of the certified values.

COMMUTABILITY

It has been established that, when using optical emission spectrometers, materials of similar composition from different sources may respond differently. The user should be aware that the metallurgical history of this SS-CRM may not accurately reflect the metallurgical history of the user's own materials.

Further information and advice on this or other Certified Reference Materials or Reference Materials produced by Bureau of Analysed Samples Ltd may be obtained from the address below.

NEWHAM HALL, NEWBY,
MIDDLESBROUGH, ENGLAND, TS8 9EA
Email: enquiries@basrid.co.uk
Website: www.basrid.co.uk

For BUREAU OF ANALYSED SAMPLES LTD

R.P. MEERES,
Managing Director

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