MAIN EDITION

BUREAU OF ANALYSED SAMPLES LTD

BRITISH CHEMICAL STANDARD CERTIFIED REFERENCE MATERIAL

CERTIFICATE OF ANALYSIS
BCS/SS-CRM No. 433/2
PLAIN CARBON STEEL

Prepared under rigorous laboratory conditions and, AFTER CERTIFICATION ANALYSIS IN GREAT BRITAIN and SWEDEN, 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	Nb	*Co*	*Mo*
1	0.0947	0.0067	1.1987	0.0124	0.0085	0.0261	0.0370	0.0602	...	...
2	0.0983	...	...	...	0.0084	0.0280	0.0340	...	*0.007*	...
3	0.0935	0.0089	1.1915	0.0103	0.0078	0.0273	0.0381	0.0576	*0.005*	*0.004*
4	...	...	1.1890	...	...	0.0245	0.0395	...	...	...
5	...	0.0061	1.1671	...	...	0.0280	0.0396	...	...	*0.003*
6	...	0.0068	1.1804	0.0108	...	...	...	0.0595	...	...
7	...	...	1.1880	0.0126	...	0.0258	0.0383	0.0598	...	...
8	0.0957	...	1.1963	...	0.0081	0.0245	0.0358	...	...	...
9	0.0975	0.0071	1.1895	0.0099	0.0085	0.0252	0.0361	0.0580	...	...
M_M	**0.0959**	**0.0071**	**1.1876**	**0.0112**	**0.0083**	**0.0262**	**0.0373**	**0.0590**	...	...
s_M	0.0020	0.0011	0.0100	0.0013	0.0004	0.0015	0.0020	0.0012	...	...
s_W	0.0006	0.0006	0.0046	0.0004	0.0003	0.0007	0.0007	0.0007	...	...

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, s_W: average within laboratory standard deviation.

The following additional information was supplied by Analyst No. 3: Cu *0.025*%, V *0.001*%, W *0.003*%

CERTIFIED VALUES (Cv)

mass content in %

	C	Si	Mn	P	S	Cr	Ni	Nb
Cv	**0.096**	**0.0071**	**1.188**	**0.011**	**0.0083**	**0.0262**	**0.037**	**0.0590**
C(95%)	0.003	0.0014	0.008	0.002	0.0004	0.0013	0.002	0.0015

The half width confidence interval, **C**(95%), is an expression of the uncertainty of the certified value.

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.

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)

BCS/SS-CRM 433/2 PLAIN CARBON STEEL

NOTES ON METHODS USED

CARBON

Analysts Nos. 1, 2, 8 and 9 determined total carbon by high frequency combustion and infrared absorption. No. 3 by non-aqueous titration according to BS 6200:3.8.2:1991.

SILICON

Analysts Nos. 1, 3, 5 and 9 determined silicon using the reduced molybdosilicate spectrophotometric method, BS EN 24829-2:1990. Analyst No. 6 used Inductively Coupled Plasma-Optical Emission Spectrometry.

MANGANESE

Analysts Nos. 1, 3, 6 and 8 determined manganese photometrically after oxidation with potassium periodate according to BS 6200:3.18.2:1985. Nos. 4, 5 and 9 used Flame Atomic Absorption Spectrometry and No. 7 used Inductively Coupled Plasma-Optical Emission Spectrometry.

PHOSPHORUS

Analysts Nos. 1, 3, 6 and 9 determined phosphorus photometrically as the phosphovanadomolybdate complex according to BS. EN 10184:1992. No. 7 used Inductively Coupled Plasma-Optical Emission Spectrometry.

SULPHUR

Analysts Nos. 1, 2, 8 and 9 determined sulphur by high frequency combustion and infrared absorption. No. 3 determined sulphur photometrically after evolution as hydrogen sulphide.

CHROMIUM

Analysts Nos. 1, 2, 3, 4, 5 and 8 determined chromium using Flame Atomic Absorption Spectrometry. Nos. 7 and 9 used Inductively Coupled Plasma-Optical Emission Spectrometry.

NICKEL

Analysts Nos. 1, 2, 3, 4, 5 and 8 determined nickel using Flame Atomic Absorption Spectrometry according to BS EN 10136:1991. Nos. 7 and 9 used Inductively Coupled Plasma-Optical Emission Spectrometry.

NIOBIUM

Analysts Nos. 1 and 3 determined niobium photometrically using 4-(2-pyridylazo) resorcinol, No. 1 after separation by ion exchange. No. 3 used the procedure according to BS EN 10178:1989. Nos. 6, 7 and 9 used Inductively Coupled Plasma-Optical Emission Spectrometry.

COBALT

Analysts Nos. 2 and 3 determined cobalt using Flame Atomic Absorption Spectrometry.

MOLYBDENUM

Analyst No. 3 determined molybdenum photometrically according to BS 6200:3.19.1:1985. No. 5 used Flame Atomic Absorption Spectrometry.

DESCRIPTION OF SAMPLE

British Chemical Standard, BCS-CRM 433/2, is sold in bottles containing 100g chips graded 1700 - 250µm (10 - 60 mesh) for chemical analysis.

Spectroscopic Standard, SS-CRM 433/2, is sold as 38 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.

INTENDED USE

BCS-CRM 433/2 is intended for uses such as the verification of the accuracy and repeatability of analytical methods, such as those used by the participating laboratories, for the calibration of analytical instruments, for establishing values for secondary reference materials and for training purposes. The sample should be mixed thoroughly before each use.

SS-CRM 433/2 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. N.B. Due to slight segregation of certain elements an area 6mm in diameter in the centre of the disc sample should be avoided for emission spectrometry. Users of optical emission spectrometry should also be aware that a minimum of three sparks should be made before calculating mean values.

STABILITY

BCS-CRM 433/2 will remain stable provided that the bottle remains sealed and is stored in a dry atmosphere. When the bottle has been opened the lid should be secured immediately after use. SS-CRM 433/2 will remain stable provided that it is not subjected to excessive heat (e.g. during preparation of the working surfaces).

TRACEABILITY

The characterisation of BCS-CRM 433/2 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 BCS/SS-CRM 433/2 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 in accordance with ASTM E826 – 85 and found to be acceptable. Homogeneity 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

BCS-CRM 433/2 is intended to be used in the same physical form as that used by the participating Analysts and therefore commutability is not of relevance in respect of this CRM.

In the case of SS-CRM 433/2 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.

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For BUREAU OF ANALYSED SAMPLES LTD

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