



BUREAU OF ANALYSED SAMPLES LTD

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4004

BRITISH CHEMICAL STANDARD CERTIFIED REFERENCE MATERIAL

CERTIFICATE OF ANALYSIS

BCS-CRM No. 111

LOW CARBON STEEL

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

CO-OPERATING ANALYSTS

ANALYSTS representing MANUFACTURERS and USERS

- | | |
|------------------------------------|--|
| 1. Crook D. and Symonds, J., | Corus Strip Products, Llanwern. |
| 2. O'Sullivan, P., | Corus Strip Products Port Talbot. |
| 3. Raw, M. and Snowden, Miss Y.A., | Corus Construction and Industrial, Scunthorpe. |
| 4. Fox, G., | Corus Engineering Steels, Stocksbridge. |
| 5. Raw, M and Richmond, Mrs H., | Corus Construction and Industrial, Teesside. |

INDEPENDENT ANALYST

- | | |
|---|-------------------------------------|
| 6. Page-Gibson, J.E., BSc, CChem, MRSC, | Ridsdale & Co. Ltd., Middlesbrough. |
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ANALYSES

Mean of 4 values - mass content in %.

Lab No.	C	Si	Mn	P	S	Cr	Mo	Ni	Al	As	Co	Cu	N	Sn	Ti	V	Nb	Ca
1	0.0269	0.0260	0.1498	0.0035	0.0055	0.0193	0.0010	0.0394	0.0351	0.0021	0.0146	0.0170	0.0035	...	0.0005	...	0.0009	<0.0005
2	0.0261	0.0245	0.1534	0.0027	0.0055	0.0200	0.0008	0.0393	0.0323	0.0011	0.0142	0.0170	0.0033	0.0016	0.0005	0.0011	0.0004	...
3	0.0248	0.0264	0.1547	0.0038	...	0.0193	...	0.0392	0.0359	...	0.0148	0.0166	...	0.0014	...	0.0008	...	...
4	0.0257	0.0246	0.1568	0.0036	0.0057	0.0202	0.0006	0.0402	0.0348	0.0016	0.0146	0.0172	0.0036	0.0012	0.0003	0.0010	0.0003	0.0001
5	0.0247	0.0241	0.1562	0.0030	0.0050	0.0195	0.0010	0.0370	0.0343	0.0020	0.0132	0.0178	0.0034	0.0016	...	...	...	...
6	0.0264	0.0262	0.1602	0.0033	0.0051	0.0200	0.0008	0.0370	0.0364	0.0015	0.0152	0.0168	0.0030	0.0016	0.0004	0.0008	0.0003	0.0001
M_M	0.0258	0.0253	0.1552	0.0033	0.0054	0.0197	0.0008	0.0387	0.0348	0.0017	0.0144	0.0171	0.0034	0.0015	0.0004	0.0009	...	...
<i>s_M</i>	0.0009	0.0010	0.0035	0.0004	0.0003	0.0004	0.0002	0.0014	0.0014	0.0004	0.0007	0.0004	0.0002	0.0002	0.0001	0.0002	...	...
<i>s_w</i>	0.0004	0.0014	0.0006	0.0002	0.0002	0.0007	0.0001	0.0004	0.0004	0.0001	0.0002	0.0002	0.0002	0.0002	0.0001	0.0001	...	...

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.

Additional Information: B, Pb, Zr and Sb were determined by one or more analysts and found to be present at concentrations of <10µg/g

CERTIFIED VALUES

mass content in %

	C	Si	Mn	P	S	Cr	Mo	Ni	Al	As	Co	Cu	N	Sn	Ti	V
M_M	0.0258	0.0253	0.155	0.0033	0.0054	0.0197	0.0008	0.0387	0.0348	0.0017	0.0144	0.0171	0.0034	0.0015	0.0004	0.0009
C(95%)	0.0010	0.0011	0.004	0.0004	0.0004	0.0005	0.0003	0.0015	0.0015	0.0005	0.0008	0.0005	0.0002	0.0002	0.0001	0.0003

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.

DESCRIPTION OF SAMPLE

Bottles of 100g chips graded 1700 – 250µm (10 – 60 mesh) for chemical analysis.

This material is also available in disc form as SS-CRM 111 and SS-CRM 111A

BCS-CRM No. 111

LOW CARBON STEEL

NOTES ON METHODS USED

CARBON

Analysts Nos. 1, 2, 4 and 5 determined carbon by high frequency combustion and infrared absorption. Analysts Nos. 3 and 6 determined carbon using non-aqueous titration according to the Standard Method BS 6200:3.8.2:1991.

SILICON

Analyst No. 1 determined silicon photometrically as silicophosphomolybdate without extraction. Nos. 2 and 6 determined silicon gravimetrically, according to BS 6200:3.26.1:1995. Nos. 3, 4 and 5 used inductively coupled plasma optical emission spectrometry (ICP-OES).

MANGANESE

Analysts Nos. 1, 2, 4 and 5 used ICP-OES. Nos. 3 and 6 determined manganese photometrically after oxidation with potassium periodate according to BS 6200:3.18.2:1995

PHOSPHORUS

Analysts No 1, 2, 4 and 5 use ICP-OES. Nos. 3 and 6 determined phosphorus photometrically as phosphovanadomolybdate according to BS EN 10184:1992.

SULPHUR

Analyst Nos.1, 2, 4 and 5 determined sulphur using high frequency combustion and infrared absorption. Analyst No. 6 determined sulphur using oxidation/reduction titration after combustion.

CHROMIUM

Analysts Nos. 1, 2, 3, 4 and 5 determined chromium using ICP-OES. Analyst No.6 used flame atomic absorption spectrometry (FAAS).

MOLYBDENUM

Analysts Nos. 1, 2, 4 and 5 determined molybdenum using ICP-OES. Analyst No. 6 used FAAS

NICKEL

Analysts Nos. 1, 2, 3, 4 and 5 determined nickel using ICP-OES. Analyst No.6 used FAAS.

ALUMINIUM

Analysts Nos. 1, 2, 3, 4 and 5 determined aluminium using ICP-OES. Analyst No.6 used FAAS, according to BS6200: 3.1.4:1990.

ARSENIC

Analysts Nos. 1, 2, 4 and 5 determined arsenic using ICP-OES. Analyst No.6 determined As photometrically with silver diethyldithiocarbamate after separation as arsine

COBALT

All Analysts determined cobalt by ICP-OES.

COPPER

Analysts Nos. 1, 2, 3, 4 and 5 determined copper using ICP-OES. Analyst No.6 used FAAS according to BS EN 24943:1990.

NITROGEN

Analysts Nos. 1, 2, 4 and 5 determined nitrogen using thermal conductivity. Analyst No.6 determined nitrogen titrimetrically after distillation as ammonia according to the Standard Method BS 6200:3.22.1:1992.

TIN

All analysts determined tin using ICP-OES.

TITANIUM

All Analysts determined titanium using ICP-OES.

VANADIUM

All Analysts determined vanadium by ICP-OES.

NIOBIUM

All Analysts determined niobium using ICP-OES.

CALCIUM

Analyst No. 1 determined calcium using ICP-OES. Analysts Nos. 4 and 6 used FAAS.

INTENDED USE & STABILITY

This 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.

In order to ensure that a fully representative sample is taken users should take a minimum sub-sample size of 1.0g. Users of this material should be aware that the use of a smaller sub-sample size will invalidate the certified values and the associated 95% confidence limits. Provided that the material is stored in a suitable environment there will be no contribution to the uncertainty from the long term stability of this CRM.

TRACEABILITY

The traceability of BCS 111 has been established in accordance with principles of ISO Guides 30 – 35 and the International vocabulary of basic and general terms in metrology.

The characterisation of this material has been achieved by inter-laboratory study, each laboratory using the method of their choice, details of which are given above. These methods are either stoichiometric analytical techniques or methods which are calibrated against pure metals or stoichiometric compounds. Most methods used were either international or national standard methods or methods which are technically equivalent.

Bureau of Analysed Samples Ltd is a UKAS Accredited Reference Material Producer No 4004.

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.
R P MEERES,
MANAGING DIRECTOR

Preliminary Edition.... .. March 2001
Main Edition July 2004
Main Edition (revised with corrected values for (C95%) for P and S) November 2004
Main Edition issued under ISO Guide 34 Accreditation November 2010