MAIN EDITION

BUREAU OF ANALYSED SAMPLES LTD

Directors:-
R. P. MEERES, *BA (Oxon)*, *MRSC* (Managing)
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J. C. MEERES
M. S. TAYLOR, *PhD*, *CChem*, *MRSC*

BRITISH CHEMICAL STANDARD CERTIFIED REFERENCE MATERIAL

CERTIFICATE OF ANALYSIS
BCS-CRM No. 216/3
5% COPPER ALUMINIUM ALLOY

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

CO-OPERATING ANALYSTS

INDEPENDENT ANALYSTS

1 HAGGAN, F., AMTAC Laboratories Ltd., Altrincham.

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

ANALYSTS representing MANUFACTURERS and USERS

3 EVANS, M.R.J., Sterling Metals Ltd., Nuneaton.

4 FAULKS, J.E., Rolls Royce plc, Derby.

5 HUGHES, P.V., *LRSC*, Anglesey Aluminium Metal Ltd., Holyhead.

ANALYSTS representing MANUFACTURERS and USERS (cont.)

6 KIMMERLE, F.M., *BSc*, *PhD*, and CHOQUETTE, D., *BSc*, *MSc*, Alcan International Ltd.,Research and Development Centre, Arvida, Canada.

7 PILGRIM, W.E., Reynolds Metals Company,Richmond, Virginia, USA.

8 ROGERS, G.A., Alcan Enfield Alloys Ltd., Bradford.

ANALYSES

Mean of 4 values - mass content in %.

Analyst No.	Si	Fe	Cu	Mn	Mg	Cr	Zn	Ti	Pb	Sn	Ni	Zr	*Sb*	*V*
1	0.74	0.75	5.44	0.75	0.74	0.111	0.214	0.19	0.047	0.055	0.23	0.084	*0.009*	...
2	0.75	0.76	5.42	0.76	0.76	0.114	0.209	0.20	0.054	0.050	0.23	0.082	*0.015*	...
3	0.71	0.77	5.44	0.78	0.75	0.100	0.210	0.22	0.057	0.048	0.25	0.078	*0.012*	...
4	0.73	0.78	5.48	0.76	0.77	0.112	0.213	0.20	0.053	0.051	0.24	0.089	...	...
5	0.76	0.79	5.44	0.76	0.76	0.110	0.212	0.20	0.055	...	0.24	...	...	...
6	0.74	0.76	5.45	0.77	0.79	0.112	0.220	0.19	0.053	0.056	0.23	0.085	*0.009*	*0.018*
7	0.74	0.75	5.45	0.75	0.76	0.106	0.215	0.20	0.049	0.049	0.22	0.085	...	*0.015*
8	0.76	0.77	...	0.75	0.75	0.100	0.215	0.22	0.050	...	0.24	...	...	...
M_M	**0.74**	**0.77**	**5.45**	**0.76**	**0.76**	**0.108**	**0.214**	**0.20**	**0.052**	**0.052**	**0.24**	**0.084**	...	...
s_M	0.02	0.02	0.02	0.02	0.02	0.006	0.004	0.02	0.004	0.004	0.01	0.004	...	...

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.

The following additional information was supplied by Analyst No. 6:-

Be *<0.001%*, Cd *<0.0001%*, Co *0.0007%*, Sr *<0.001%*

CERTIFIED VALUES (Cv)

mass content in %

	Si	Fe	Cu	Mn	Mg	Cr	Zn	Ti	Pb	Sn	Ni	Zr
Cv	**0.74**	**0.77**	**5.45**	**0.76**	**0.76**	**0.108**	**0.214**	**0.20**	**0.052**	**0.052**	**0.24**	**0.084**
C(95%)	0.02	0.02	0.02	0.01	0.02	0.005	0.003	0.01	0.003	0.004	0.01	0.004

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

SILICON

Analysts Nos. 1, 3 and 6 determined silicon photometrically, No. 1 as silicomolybdate and Nos. 3 and 6 as molybdenum blue. Nos. 2, 4, 5, 7 and 8 used gravimetric methods involving decomposition of the sample in sodium hydroxide solution followed by acidification and evaporation. Nos. 2, 5 and 7 acidified with perchloric acid and carried out a double dehydration, Nos. 2 and 5 according to the Standard Method BS 1728: Part 11:1960 and No. 7 according to the Standard Method ASTM E34-85. Nos. 4 and 8 acidified with sulphuric acid and flocculated the silicic acid with gelatin (British Aluminium Co., Ltd., Publication No. 405, 1961 p. 125).

IRON

Analysts Nos. 1, 2, 3 and 5 determined iron photometrically, Nos. 1, 2 and 5 with 1, 10-phenanthroline according to the Standard Method BS 1728: Part 8: 1957, No. 3 with potassium thiocyanate. No. 4 reduced with copper powder and titrated with potassium dichromate. No. 6 used ICP-AES. Nos. 7 and 8 used atomic absorption spectrometry, No. 7 according to the Standard Method ASTM E34-85.

Analyst No. 4 also used a photometric method with potassium thiocyanate and obtained a mean value of 0.77%. Analyst No. 6 also used a photometric method and obtained a mean value of 0.74%. Analyst No. 7 also used ICP-AES and obtained a value of 0.74%.

COPPER

Analyst No. 1 determined copper gravimetrically by electrodeposition. Nos. 2 and 4 used iodometric titration following separation of copper as copper sulphide according to the Standard Method BS 1728: Part 1: 1957. No. 3 used a photometric method with tetraethylene pentamine. Nos. 5, 6 and 7 used atomic absorption spectrometry, No. 5 according to the Standard Method BS 1728: Part 23: 1976 and No. 7 according to the Standard Method ASTM E34-85.

Analyst No. 7 also used ICP-AES and obtained a value of 5.45%.

MANGANESE

Analysts Nos. 1, 2, and 3 determined manganese photometrically after oxidation with periodate according to the Standard Method BS 1728: Part 10: 1957. Nos. 4 and 5 determined manganese titrimetrically with arsenite/nitrite after oxidation to permanganic acid according to the Standard Method BS 1728: Part 9. 1957. No. 6 used ICP-AES. Nos. 7 and 8 used atomic absorption spectrometry, No. 7 according to the Standard Method ASTM E34-85.

Analyst No. 4 also determined manganese photometrically after oxidation with periodate and obtained a mean value of 0.75%. No. 6 also used atomic absorption spectrometry and obtained a mean value of 0.73%. No. 7 also used ICP-AES and obtained a value of 0.75%.

MAGNESIUM

Analysts Nos. 1, 2, 3, 5, 7 and 8 determined magnesium by atomic absorption spectrometry. Nos. 1, 2, 3 and 5 used the Standard Method BS 1728: Part 19: 1971, No. 7 the Standard Method ASTM E34-85. No. 4 used a titrimetric method in which magnesium was separated using zinc oxide and titrated with EDTA. No. 6 used ICP-AES.

Analyst No. 6 also used atomic absorption spectrometry and obtained a mean value of 0.80%. No. 7 also used ICP-AES and obtained a value of 0.77%.

CHROMIUM

Analysts Nos. 1, 2 and 4 determined chromium titrimetrically after oxidation with persulphate/silver nitrate according to the Standard Method BS 1728: Part 17: 1968. Nos. 3, 7 and 8 used atomic absorption spectrometry, No. 7 according to the Standard Method ASTM E34-85. No. 5 used a photometric method with diphenylcarbazide according to the Standard Method BS 1728: Part 16: 1968. No. 6 used ICP-AES.

Analyst No. 2 also used atomic absorption spectrometry and obtained a mean value of 0.11%. No. 6 also used a photometric method and obtained a mean value of 0.10%. No. 7 also used ICP-AES and obtained a value of 0.11%.

ZINC

Analysts Nos. 1, 2, 3, 5, 7 and 8 determined zinc by atomic absorption spectrometry. Nos. 1, 2, 3 and 5 used the Standard Method BS 1728: Part 21: 1973 and No. 7 the Standard Method ASTM E34-85. No. 4 determined zinc gravimetrically as zinc mercury thiocyanate after ion-exchange separation. (British Aluminium Co. Ltd., Publication No. 405, 1961 p. 147). No. 6 used ICP-AES.

Analyst No. 6 also used atomic absorption spectrometry and obtained a mean value of 0.22%. No. 7 also used ICP-AES and obtained a value of 0.21%.

TITANIUM

Analysts Nos. 1, 2, 3, 4, 5 and 8 determined titanium photometrically, Nos. 1, 3, 4 and 8 with hydrogen peroxide, No. 2 with diantipyrylmethane according to the Standard Method ASTM E34-85, No. 5 with chromotropic acid according to the Standard Method BS 1728: Part 13: 1964. Nos. 6 and 7 used ICP-AES.

Analyst No. 6 also used a photometric method and obtained a mean value of 0.20%.

LEAD

Analysts Nos. 1, 2, 3, 5, 6, 7 and 8 determined lead by atomic absorption spectrometry. Nos. 1, 2, 3, 5 and 8 used the Standard Method BS 1728: Part 20: 1971, No. 7 used the Standard Method ASTM E34-85. No. 4 determined lead photometrically as the sulphide after separation as lead sulphate.

Analyst No. 7 also used ICP-AES and obtained a value of 0.052%.

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NOTES ON METHODS USED (continued)

TIN

Analyst No. 1 determined tin by atomic absorption spectrometry. Nos. 2, 3 and 4 used titrimetric methods with potassium iodate after reduction of tin to stannous chloride. No. 2 used the Standard Method ASTM E34-85, Nos. 3 and 4 followed the procedure in the British Aluminium Co. Ltd., Publication No. 405, 1961, p. 138. No. 6 used a photometric method and No. 7 used ICP-AES.

Analyst No. 2 also used atomic absorption spectrometry and obtained a mean value of 0.048%.

NICKEL

Analysts Nos. 1, 2, 3, 5, 7 and 8 determined nickel by atomic absorption spectrometry. Nos. 1, 2, 3, 5 and 8 used the Standard Method BS 1728: Part 14: 1976 and No. 7 the Standard Method ASTM E34-85. No. 4 precipitated copper as the sulphide, separated nickel with dimethylglyoxime and titrated nickel cyanometrically. No. 6 used ICP-AES.

Analyst No. 6 also determined nickel by atomic absorption spectrometry and obtained a mean value of 0.25%. No. 7 also used ICP-AES and found 0.22%.

ZIRCONIUM

Analysts Nos. 1, 2, 3 and 4 determined zirconium photometrically, Nos. 1, 3 and 4 with Alizarin Red S, No. 2 with Arsenazo III according to the Standard Method ASTM E34-85. Nos. 6 and 7 used ICP-AES.

ANTIMONY

Analysts Nos. 1, 2 and 6 determined antimony by atomic absorption spectrometry. No. 3 used a photometric method with potassium iodide.

VANADIUM

Analysts Nos. 6 and 7 determined vanadium by ICP-AES.

Abbreviations:
ICP-AES : Inductively Coupled Plasma - Atomic Emission Spectrometry.

DESCRIPTION OF SAMPLE

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

INTENDED USE & STABILITY

The sample 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.

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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