MAIN EDITION

British Chemical Standards

issued by

Bureau of Analysed Samples, Ltd.

Directors (1962-66) :—
P. D. Ridsdale, *B.Sc., A.I.M.* (Managing).
B. Bagshawe, *A.Met., F.I.M., M.Inst.F.*
C. Gildon, *F.C.A.*

Certificate of Analyses

B.C.S. No. 321 (S.S. No. 51)
MILD STEEL (Second Residual Series)

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

The standard bars were specially prepared by Edgar Allen and Co. Ltd., Sheffield.

ANALYSES

Analyst No.	Ni %	Cr %	Mo %	W %	Ti %	As %	Sn %	C %	Si %	S %	P %	Mn %	Al (Total) %	V %	Sb %
1	..	..	..	..	..	0·003	..	*0·38*	*0·13*	*0·009*	*0·017*	*0·13*	..	..	..
2	..	0·108	..	..	..	..	..	..	..	..	..	..	..	..	..
3	0·096	0·109	0·066	0·068	0·127	0·002	0·015	*0·38*	*0·12*	*0·011*	*0·019*	*0·13*	*0·12*	*0·004*	*0·003*
4	..	..	0·070	..	0·130	..	..	..	..	..	..	..	..	..	..
5	..	..	0·064	0·072	0·13–	0·003	..	..	..	..	..	..	..	..	..
6	..	0·105	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	0·098	..	..	..	..	..	..	..	..	..	..	..	..	..
8	0·096	..	..	..	..	..	0·015	..	..	..	..	..	..	..	..
9	0·096	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10	..	0·099	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	0·070	0·134	0·003	..	*0·37*	*0·12*	*0·010*	*0·018*	*0·12*	..	..	..
12	..	0·110	..	0·086	..	..	..	..	..	..	..	..	..	..	..
13	..	..	0·064	0·08–	..	0·003	0·013	..	..	..	..	..	..	..	..
14	..	..	0·072	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	0·082	..	0·002	0·013	..	..	..	..	..	..	..	..
16	0·098	..	..	..	..	..	..	..	..	..	..	..	..	..	..
17	..	..	0·070	..	0·139	..	..	..	..	..	..	..	..	..	..
18	..	0·110	..	..	..	..	..	..	..	..	..	..	..	..	..
19	0·105	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	..	..	0·002	0·013	..	..	..	..	..	..	..	..
21	0·102	..	0·071	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	0·080	0·135	0·003	..	..	..	..	..	..	..	..	..
23	0·102	..	..	..	..	..	..	..	..	..	..	..	..	..	..
24	0·100	..	..	..	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	0·132	..	0·013	..	..	..	..	..	..	..	..
Average	**0·099**	**0·106**	**0·068**	**0·077**	**$0·13_0$**	**0·003**	**0·014**	..	..	..	..	..	..	..	..

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

Figures in bold type standardized, figures in small italic type only approximate. [P.T.O.

CO-OPERATING ANALYSTS AND FIRMS.

REFEREE ANALYSTS—INDEPENDENT.

1. British Iron and Steel Research Association (per P. H. Scholes, *A.Met.*), Sheffield.
2. Clarke, W. E., *F.R.I.C.*, British Cast Iron Research Association, Birmingham.
3. Coppins, W. C., *M.Sc.*, *A.R.I.C.*, Ridsdale & Co. Ltd., Middlesbrough.

GOVERNMENT DEPARTMENT.

4. Edwards, F. H., *B.Sc.*, Bragg Laboratory, Naval Ordnance Inspection Establishment, Sheffield.

ANALYSTS representing MAKERS and USERS.

5. Bagshawe, B., *A.Met.*, *F.I.M.*, *M.Inst.F.*, Brown-Firth Research Laboratories, Sheffield.
6. Ballantyne, E. K., Colvilles Ltd., Cambuslang.
7. Booth, J., *B.Sc.*, The Park Gate Iron & Steel Co. Ltd., Rotherham.
8. Clyde, C., Lanarkshire Steel Co. Ltd., Motherwell.
9. Dunnill, P. B., *B.Sc.*, Steel Peech & Tozer, Rotherham.
10. Elwell, W. T., *F.R.I.C.*, Imperial Metal Industries (Kynoch) Ltd., Birmingham.
11. Gardner, L. E., *A.Met.*, *F.I.M.*, Edgar Allen & Co. Ltd., Sheffield.
12. Gentry, C. H. R., *B.Sc.*, *F.R.I.C.*, Mullard Radio Valve Co. Ltd., Mitcham.
13. Harrison, S., *A.Met.*, *A.I.M.*, Kayser Ellison & Co. Ltd., Sheffield.
14. Harrison, T. S., *B.Sc.*, *Ph.D.*, *B.Met.*, *F.R.I.C.*, Appleby-Frodingham Steel Company, Scunthorpe.
15. Hobson, J. D., *B.Sc.*, *Ph.D.*, *A.Met.*, *F.R.I.C.*, *F.I.M.*, Hadfields Ltd., Sheffield.
16. Jackson, L., *A.Met.*, Workington Iron & Steel Co., Workington.
17. Kidman, L., *A.Met.*, *A.I.M.*, *A.M.Inst.F.*, English Steel Corporation Ltd., Sheffield.
18. Kyle, J., William Beardmore & Co. Ltd., Glasgow.
19. Moxon, R., G. K. N. Group Research Laboratory, Wolverhampton.
20. Murray, G., Brown Bayley Steels Ltd., Sheffield.
21. Padget, G., *A.Met.*, United Steel Companies Ltd., Research and Development Dept., Rotherham.
22. Postlethwaite, R. T., Samuel Fox & Co. Ltd., Stocksbridge.
23. Shanahan, C. E. A., *B.Sc.*, *F.R.I.C.*, *F.I.M.*, R. Thomas and Baldwins Ltd., Central Research Laboratories, Aylesbury.
24. Taylor, L. N., Samuel Osborn & Co. Ltd., Sheffield.
25. Wright, A. K., Lysaght's Scunthorpe Works, Scunthorpe.

B.C.S. No. 321 (S.S. No. 51)
MILD STEEL (Second Residual Series)

NOTES ON METHODS USED

NICKEL

All Analysts determined nickel colorimetrically with dimethylglyoxime. Nos. 3, 16 and 24 removed iron by extraction with ether (Nos. 3 and 24) or *iso*-butyl acetate (No. 16) and then used methods similar to the Standard absorptiometric method B.S. 1121: Part 6B: 1948 Nos. 8, 19 and 23 used the Standard absorptiometric method without solvent extraction. Nos. 9 and 21 extracted the nickel dimethylglyoxime complex into chloroform from an ammoniacal citrate solution, returned it to the aqueous phase by shaking with dilute hydrochloric acid and developed the oxidized dimethylglyoxime complex using potassium persulphate as oxidizing agent (Sandell, Colorimetric Determination of Traces of Metals, 1959, p. 671).

Analyst No. 8 also used the Analoid volumetric method No. 62 and found 0·092%. No. 19 also carried out an ether extraction followed by volumetric determination of nickel by the cyanometric method and found 0·105%.

CHROMIUM

Analyst No. 2 removed iron by extraction with *iso*-butyl acetate and then determined chromium colorimetrically with diphenylcarbazide (Scholes and Smith, Metallurgia, 1963, **67**, 153). No. 3 used the Analoid volumetric method No. 37 and made a correction for the small amount of vanadium present. Nos. 6, 7, 10, 12 and 18 determined chromium colorimetrically with diphenylcarbazide using the Standard absorptiometric method B.S. 1121: Part 24: 1952.

Analyst No. 6 also used the Analoid diphenylcarbazide method No. 51 and found 0·114%. No. 18 also used the Standard volumetric method B.S. 1121: Part 13: 1954, and found 0·100%.

MOLYBDENUM

All Analysts except No. 5 determined molybdenum colorimetrically as the oxythiocyanate. No. 3 used the Analoid method No. 42. Nos. 4 and 13 used the Standard method B.S. 1121: Part 34: 1955 (including amendment No. 1, 1961). Nos. 14, 17 and 21 used a method involving extraction of the coloured complex with butyl acetate. No. 5 determined molybdenum colorimetrically with toluene–3:4–dithiol (Wells and Pemberton, Analyst, 1947, **72**, 185).

Analyst No. 4 also used a method involving extraction of molybdenum oxythiocyanate with butyl acetate and found 0·070%.

TUNGSTEN

Analysts Nos. 3, 11, 12, 13 and 22 determined tungsten colorimetrically as the thiocyanate complex by the Standard absorptiometric method B.S. 1121: Part 32: 1954. Nos. 5 and 15 used the toluene–3:4–dithiol colorimetric method (Bagshawe and Truman, Analyst, 1947, **72**, 189).

Analyst No. 15 also used the Standard absorptiometric method and found 0·09%.

TITANIUM

All Analysts separated titanium with cupferron and determined it colorimetrically with hydrogen peroxide in presence of citric and phosphoric acids.

Analyst No. 22 also used a difference method in which citric and phosphoric acids were not used and found 0·133%.

ARSENIC

All Analysts determined arsenic volumetrically by reduction with hypophosphite, solution of the precipitated arsenic in iodine solution and titration of excess iodine with arsenite solution. Nos. 1, 5, 13, 15 and 20 followed the procedure of the Standard method B.S. 1121: Part 38: 1958.

TIN

Analysts Nos. 3, 8, 13 and 20 determined tin volumetrically by dissolving the sample in hydrochloric acid, reducing with aluminium and titrating with iodate solution. Nos. 15 and 25 used the Standard volumetric method B.S. 1121: Part 20: 1961 which involves a preliminary separation of the tin as sulphide.

CARBON

Analyst No. 1 determined carbon conductimetrically using a balanced two-cell circuit. Nos. 3 and 11 used the Standard gravimetric method B.S. 1121: Part 11: 1948.

SILICON

Analysts Nos. 1 and 11 determined silicon colorimetrically as molybdenum-blue. No. 3 determined silicon gravimetrically using a nitro-sulphuric acid method (Dicks and Clarke, B.C.I.R.A. Journ., 1962, **10**, 303).

Analyst No. 1 also determined silicon colorimetrically using an automatic analyser and found 0·13%.

SULPHUR

Analysts Nos. 1 and 3 determined sulphur by combustion, completing volumetrically. No. 11 used the Standard gravimetric method B.S. 1121: Part 1A: 1957.

Analyst No. 1 also determined sulphur conductimetrically after combustion and found 0·010%.

PHOSPHORUS

Analyst No. 1 determined phosphorus colorimetrically using an automatic analyser. Nos. 3 and 11 determined phosphorus volumetrically.

MANGANESE

Analysts Nos. 1 and 11 determined manganese colorimetrically after oxidation to permanganate; No. 1 used the Standard absorptiometric method B.S.: 1121: Part 23: 1951. No. 3 used the Analoid volumetric method No. 53.

ALUMINIUM (Total)

Colorimetric determination with eriochromecyanine after removal of iron (Scholes and Smith, Analyst, 1958, **83**, 615).

VANADIUM

Analoid volumetric method No. 34.

ANTIMONY

Colorimetric method using rhodamine B (Kidman and Waite, Metallurgia, 1962, **66**, 143).

For BUREAU OF ANALYSED SAMPLES LTD.
P. D. Ridsdale,
Managing Director,
July, 1966

Newham Hall,
Middlesbrough
England

Kd & Fd—66/5808