



CASTINGS TECHNOLOGY INTERNATIONAL
and
BUREAU OF ANALYSED SAMPLES LTD.



CERTIFICATE OF ANALYSIS

SPECTROSCOPIC STANDARD CERTIFIED REFERENCE MATERIAL
(formerly known as Spectroscopic Standard)

SCRM No. 658/9 LOW PHOSPHORUS ENGINEERING IRON

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

The material for this SCRM was prepared at the Castings Technology International Laboratories at Sheffield, U.K. (formerly BCIRA) using a special method of casting known to provide material of uniform composition in a form suitable for use as a calibration standard in optical emission spectroscopic analysis. Blocks from this cast have been shown, by statistically designed procedures to provide reproducible results using vacuum direct reading emission spectroscopy.

The preparation of representative samples for chemical analysis and the certification by cooperative analysis was undertaken by Bureau of Analysed Samples Ltd.

CO-OPERATING ANALYSTS AND FIRMS

- | | |
|--|---|
| 1. BOUSTEAD, I., <i>B.Sc.</i> , & JUDGE, MISS C., <i>M.Chem.</i> | Bodycote Materials Testing Teesside, Middlesbrough. |
| 2. HEYWOOD, D.G., <i>A.Met.</i> , | Pattinson & Stead, Middlesbrough. |
| 3. PAGE-GIBSON, J.E., <i>B.Sc.</i> , <i>C.Chem.</i> , <i>M.R.S.C</i> | Ridsdale & Co Ltd., Middlesbrough. |
| 4. SCRIMSHIRE, P., | IncoTest, Hereford. |
| 5. WHITAKER, J. S., | Keighley Laboratories Ltd, Keighley. |

NOTE.

The samples of this SCRM are in the form of chill cast rectangular blocks, each approximately 50mm x 42mm x 12mm thick with a single chilled working face. Spectroscopic reproducibility has been shown to be reliable to a depth of 5mm below the original surface of this block. Sparking must be made on the fully ground surface only and the sample should be discarded when this face has been ground back as far as the small shoulder around the edge of the sample.

Using vacuum direct reading optical emission spectrometers it has been established that materials of similar composition from different sources may respond differently. This SCRM is primarily intended for the construction of basic response curves which should be related to the response curves obtained from an identical examination of the user's own material.

(P.T.O)

SCRM 658/9

LOW PHOSPHORUS ENGINEERING IRON

ANALYSES

Mean of 4 values – mass content in %.

Analyst No.	C	Si	Mn	P	S
1	3.4110	2.0075	0.5191	0.1808	0.0715
2	3.4335	1.9983	0.5053	0.1775	0.0708
3	3.4476	1.9560	0.4983	0.1752	0.0710
4	3.4225	1.9880	0.5110	0.1795	0.0686
5	3.4321	1.9603	0.5060	0.1797	0.0716
M_M	3.4293	1.9820	0.5079	0.1785	0.0707
s _M	0.0136	0.0229	0.0077	0.0022	0.0012
s _w	0.0155	0.0056	0.0027	0.0029	0.0012

M_M: Mean of the intralaboratory means. **s_M**: standard deviation of the intralaboratory means. **s_w**: Intralaboratory standard deviation.

CERTIFIED VALUES

mass content in %

	C	Si	Mn	P	S
M_M	3.429	1.982	0.508	0.179	0.071
C(95%)	0.017	0.029	0.010	0.003	0.002

The half width confidence interval $C(95\%) = \frac{t \times s_M}{\sqrt{n}}$ where "t" is the appropriate Student's t value and "n" is the number of acceptable mean values

For further information regarding the confidence interval for the certified value see ISO Guide 35:1989 section 4.

NOTES ON METHODS USED

CARBON

Analysts Nos. 1, 4 and 5 determined carbon by high frequency combustion and infrared absorption, calibrated with pure chemicals, Analyst No. 5 following BS EN ISO: 9556: 2001. Analysts Nos. 2 and 3 used a non-aqueous titration according to BS 6200: 3.8.2: 1991

SILICON

Analysts Nos. 1 and 4 used Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES). Analysts Nos. 2, 3 and 5 used gravimetric methods, dehydrating the silica using perchloric acid, according to BS 6200: 3.26.1: 1995.

MANGANESE

Analysts Nos. 1, 4 and 5 used ICP-OES. Analyst No. 2 used flame atomic absorption spectrometry and No. 3 determined manganese photometrically according to BS 6200: 3.18.2: 1995.

PHOSPHORUS

Analysts Nos. 1 and 4 used ICP-OES. The remaining analysts determined phosphorus photometrically after extraction of the phosphovanadomolybdate complex, Nos. 3 and 5 according to BS EN 10184: 1992

SULPHUR

Analysts Nos. 1, 4 and 5 determined sulphur using high frequency combustion and infrared absorption, No. 5 followed BS EN 24935: 1991. Analyst No. 2 liberated hydrogen sulphide followed by an iodimetric titration. Analyst No. 3 determined sulphur gravimetrically, following British Standard Sulphur Method 1 (Methods for Sampling and Analysis of Iron, Steel and other Ferrous Metals, B.S. Handbook 19 first published 1970 by the British Standards Institute.

For CASTINGS TECHNOLOGY INTERNATIONAL
Dr. M.C. ASHTON,
Chief Executive

For BUREAU OF ANALYSED SAMPLES LTD.
P. D. RIDSDALE
Chairman

August 2003



Certificate No Q3993