MAIN EDITION

BUREAU OF ANALYSED SAMPLES LTD.

BRITISH CHEMICAL STANDARD CERTIFIED REFERENCE MATERIAL 4004

CERTIFICATE OF ANALYSIS
BCS-CRM No. 361
CHROMIUM METAL

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

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9. WILSON, J., Allvac Ltd., Sheffield.

ANALYSES

Mean of 4 values – mass content in %.

Analyst No.	C	Si	S	N	Fe	O	*Al (Total)*
1	…	…	…	0.0076	…	...	…
2	0.0037	…	0.0045	0.0073	…	…	…
3	0.0039	0.0438	0.0039	0.0099	0.1016	…	*0.0819*
4	0.0031	…	0.0043	0.0070	…	0.0875	…
5	0.0046	0.0468	…	0.0075	0.0953	0.1029	…
6	0.0046	0.0424	0.0043	…	0.0835	…	*0.0709*
7	0.0037	0.0445	0.0047	0.0087	0.0868	0.1113	*0.0833*
8	0.0038	0.0483	0.0041	0.0074	0.0924	0.1035	*0.0853*
9	0.0035	0.0435	…	0.0078	0.0925	0.0997	*0.0920*
M_M	**0.0039**	**0.0449**	**0.0043**	**0.0079**	**0.0920**	**0.1010**	…
s_M	0.0006	0.0023	0.0003	0.0010	0.0064	0.0087	…
s_W	0.0003	0.0021	0.0003	0.0005	0.0032	0.0119	…

Analysts Nos. 7 and 8 determined soluble aluminium and found 0.002% and 0.0028% respectively.

The above figures are those which 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

CERTIFIED VALUES (Cv)

mass content in %

	C	Si	S	N	Fe	O
Cv	**0.0039**	**0.0449**	**0.0043**	**0.0079**	**0.092**	**0.101**
C(95%)	0.0005	0.0024	0.0003	0.0008	0.007	0.011

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 section 10.5.2.

DESCRIPTION OF SAMPLE

High purity chromium metal, crushed to a nominal particle size of less than 1700 µm. It is supplied in bottles of 100g of material to a nominal grading of 1700 – 250µm (10 – 60 mesh).

BCS-CRM 361
CHROMIUM METAL

NOTES ON METHODS USED

CARBON

All Analysts, except No. 3, determined carbon by high frequency combustion- infrared absorption. Analyst No 3 used non-aqueous titration according to the Standard Method BS 6200:3.8.2:1991.

SILICON

Analysts Nos. 3, 5 and 9 determined silicon gravimetrically after dehydration with perchloric acid. The other Analysts determined silicon using Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES).

SULPHUR

All Analysts, except No 3, determined sulphur by high frequency combustion-infrared absorption. Analyst No 3 determined sulphur photometrically as methylene blue after separation as H_2S in a manner similar to the Standard Method ISO 10701.

NITROGEN

All Analysts, except Nos. 1 and 3, determined nitrogen using thermal conductivity after decomposition in a graphite crucible. Analysts Nos. 1 and 3 used an acidimetric titration after distillation according to the Standard Method BS 6200:3.22.1: 1992.

IRON

Analysts Nos.3, 5 and 9 determined iron using Flame Atomic Absorption Spectrometry (FAAS). Analysts Nos. 6, 7 and 8 used ICP-OES.

OXYGEN

All Analysts determined oxygen after combustion in a graphite furnace in an inert atmosphere.

ALUMINIUM (TOTAL)

All Analysts except No.9 determined aluminium by ICP-OES after fusion of the insoluble residue. Analyst No. 9 determined aluminium by FAAS. Analysts Nos. 3 and 8 fused the insoluble residue with potassium hydrogen sulphate, No. 6 with sodium peroxide, No. 7 with a mixture of sodium peroxide and sodium carbonate and No.9 an equimolar mixture of sodium carbonate and potassium carbonate with boric acid.

INTENDED USE & STABILITY

This sample is intended for the verification 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.

It 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. If the contents should become discoloured (e.g. oxidised) by atmospheric contamination or by excessive heating they should be discarded.

From the homogeneity study it can be demonstrated statistically that there is no significant contribution to the uncertainty of the certified values of this Certified Reference Material, which has been established on a minimum sub-sample size of 0.15g. 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-CRM 361 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. Most methods used were either international or national standard methods or methods which are technically equivalent.

Two of the participating laboratories held accreditation to ISO/IEC 17025 for the analysis of all of the certified constituents at the time of analysis. Three of the remaining laboratories hold accreditation to ISO/IEC 17025, although not for the analysis of chromium metal. All laboratories used either stoichiometric analytical techniques or methods which were calibrated predominantly against pure metals or stoichiometric compounds.

It has been established statistically that there is no difference between the results of the accredited laboratories and those of the non-accredited laboratories for all of the elements reported.

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.

Bureau of Analysed Samples Ltd is a UKAS accredited Reference Material Producer No 4004 and is accredited in accordance with ISO Guide 34:2000 *General requirements for the competence of reference material producers.*

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For BUREAU OF ANALYSED SAMPLES LTD.

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