BUREAU OF ANALYSED SAMPLES LTD

BRITISH CHEMICAL STANDARD CERTIFIED REFERENCE MATERIAL

CERTIFICATE OF ANALYSIS

BCS-CRM No. 534

FLOAT GLASS

Prepared under rigorous laboratory conditions and, AFTER CERTIFICATION ANALYSIS IN GREAT BRITAIN, BELGIUM, GERMANY, ITALY, JAPAN AND TURKEY, issued by the Bureau of Analysed Samples Ltd and the Society of Glass Technology.

ANALYSES

Mean of 4 values - mass content in %. All elements relate to the dried (105°C) sample.

Analyst	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	BaO	Na_2O	K_2O	TiO_2	SO_3	Cr_2O_3
1	72.0388	0.4120	…	10.0335	3.4603	…	13.6638	0.2343	…	…	…
2	71.3400	…	…	9.8575	3.2900	0.0080	14.0975	0.2018	0.0210	0.2240	…
3	71.3620	0.4210	0.0565	9.9763	3.2868	0.0095	14.0518	0.2388	0.0233	0.2218	…
4	71.8015	0.4353	0.0568	9.9048	3.4708	0.0108	14.1693	0.2468	0.0250	0.2303	*<0.004*
5	…	0.4675	…	…	…	0.0094	13.6800	0.1980	0.0228	…	*0.0005*
6	71.4525	0.4180	0.0531	9.8698	3.3563	0.0092	14.0225	0.2370	0.0228	0.2297	*<0.001*
7	71.8550	0.4397	0.0513	9.9537	3.3708	0.0110	13.7927	0.2605	0.0239	0.1933	*<0.0015*
8	71.7540	0.4217	0.0612	9.8577	3.4669	0.0094	14.0191	0.2422	0.0198	…	*<0.005*
9	…	…	…	…	…	…	13.9075	0.2285	…	…	…
10	71.6050	…	0.0600	9.9650	3.4800	…	14.1350	0.2425	0.0300	…	*<0.002*
11	71.6000	0.4125	0.0550	9.8975	3.4025	0.0080	14.0900	0.2375	0.0243	0.2275	*<0.005*
12	…	0.4207	0.0537	9.8640	3.3936	0.0093	13.7183	0.2381	0.0212	0.2290	*0.0005*
13	…	…	…	…	…	0.0091	…	0.2247	0.0222	0.2196	*0.0003*
14	71.3675	…	0.0620	9.8953	3.3975	…	14.0490	0.2400	0.0238	…	*<0.01*
M_M	**71.6176**	**0.4276**	**0.0566**	**9.9159**	**3.3978**	**0.0094**	**13.9536**	**0.2336**	**0.0233**	**0.2219**	
s_M	0.2401	0.0176	0.0038	0.0582	0.0687	0.0010	0.1800	0.0165	0.0026	0.0122	
s_w	0.2075	0.0104	0.0015	0.0537	0.0326	0.0007	0.0710	0.0087	0.0006	0.0123	

Additional Information: Analyst No. 4 reported a value of 0.44% for Loss On Ignition.

M_M: Mean of the laboratory mean values. **s_M**: standard deviation of the laboratory mean values. **s_W**: average within laboratory standard deviation.

CERTIFIED VALUES (Cv)

mass content in %

	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	BaO	Na_2O	K_2O	TiO_2	SO_3
Cv	**71.62**	**0.428**	**0.057**	**9.92**	**3.40**	**0.0094**	**13.95**	**0.234**	**0.0233**	**0.222**
C(95%)	0.18	0.014	0.004	0.04	0.05	0.0007	0.12	0.010	0.0017	0.011

The half width confidence interval, C(95%), is an expression of the uncertainty of the certified value.

$C(95\%) = \frac{t \times s_M}{\sqrt{n}}$ 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.

NB: Although widely accepted within the industry "mass content in %" is neither an SI nor an IUPAC supported quantity. Multiplication of the certified value (Cv) by 10^4 will yield the value in µg/g.

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(The current edition is available at www.basrid.co.uk)

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NOTES ON METHODS USED

SILICA

Analysts Nos. 1, 3, 4, 10 and 14 determined silica using X-Ray Fluorescence Spectrophotometry (XRF) by fused bead, No. 3 following BS EN ISO 12677. The remaining Analysts all used gravimetric methods, No. 2 using the ICG-TC 2 method, No. 6 JIS R3101 (determining the residual silica with Inductively-Coupled Plasma Optical Emission Spectrometry (ICP-OES)), No. 8 dehydrating with hydrochloric acid whilst No 11 followed ASTM C169.

ALUMINA

Analysts Nos. 1, 3 and 4 determined alumina using XRF with fused beads, No. 3 with BS EN ISO 12677. Nos. 5, 6 and 11 used ICP-OES, No. 11 using EPA 3052 for the microwave digestion and EPA 6010D for the analysis. Nos. 7, 8 and 12 all used Flame Atomic Absorption Spectrometry (FAAS).

FERRIC OXIDE

Analysts Nos. 3, 4, 10 and 14 determined ferric oxide with X-Ray Fluorescence Spectrophotometry (XRF) by fused bead, No. 3 following BS EN ISO 12677. Nos. 6, 11 and 12 used ICP-OES, No. 11 following EPA 3052 for the microwave digestion and EPA 6010D for the analysis. Analysts Nos. 7 and 8 both used FAAS.

CALCIUM OXIDE

Analysts Nos. 1, 3, 4, 10 and 14 determined calcium oxide with X-Ray Fluorescence Spectrophotometry (XRF) by fused bead, No. 3 following BS EN ISO 12677. Analysts Nos. 2, 6 and 11 used ICP-OES, No. 2 using the method from ICG-TC2 and No. 11 EPA 3052 to prepare the solutions and EPA 6010D for the analysis. Nos. 7, 8 and 12 used FAAS.

MAGNESIUM OXIDE

Analysts Nos. 1, 3, 4, 10 and 14 determined magnesium oxide with X-Ray Fluorescence Spectrophotometry (XRF) by fused bead, No. 3 following BS EN ISO 12677 whilst Nos. 2, 6 and 11 used ICP-OES. No. 2 used the method from ICG-TC2 and No. 11 EPA 3052 to prepare the solutions and EPA 6010D for the analysis. Nos. 7, 8 and 12 all used FAAS.

BARIUM OXIDE

Most Analysts determined barium oxide using ICP-OES, No. 2 using the method from ICG-TC2 and No. 11 EPA 3052 and EPA 6010D for the analysis. Nos. 3 and 4 used XRF with fused bead, No. 3 following BS EN ISO 12677. Analyst No. 8 used FAAS.

SODIUM OXIDE

Analysts Nos. 1, 3, 4, 10 and 14 determined sodium oxide with X-Ray Fluorescence Spectrophotometry (XRF) by fused bead, No. 3 following BS EN ISO 12677. Nos. 2, 5, 6 and 11 used ICP-OES, No. 2 with the ICG-TC2 method and No. 11 EPA 3052 and EPA 6010D. Analysts Nos. 7, 8, 9 and 12 used FAAS.

POTASSIUM OXIDE

Analysts Nos. 1, 3, 4, 10 and 14 determined potassium oxide with X-Ray Fluorescence Spectrophotometry (XRF) by fused bead, No. 3 following BS EN ISO 12677. Nos. 2, 6, 11 and 13 used ICP-OES, No. 2 the ICG-TC2 method and No. 11 EPA 3052 and EPA 6010D. Analyst No. 5 used flame photometry, whilst Nos. 7, 8, 9 and 12 used FAAS.

TITANIUM DIOXIDE

Most Analysts determined titanium dioxide using ICP-OES, No. 2 with the ICG-TC2 method and No. 11 EPAs 3052 and 6010D. Nos. 3, 4, 10 and 14 used XRF, No. 3 in accordance with BS EN ISO 12677.

SULPHUR TRIOXIDE

Analysts Nos. 3 and 4 determined sulphur trioxide using XRF, No. 3 after BS EN ISO 12677. Analyst No. 7 used an acid/base titration, following combustion in a stream of oxygen. The remaining Analysts used ICP-OES, No. 2 using the method recommended by ICG-TC2 and No. 11 EPAs 3052 and 6010D.

CHROMIUM OXIDE

With the exception of Analysts Nos. 4, 10 and 14 who used XRF, and No. 8, who used FAAS, all of the Analysts determined Chromium Oxide by ICP-OES, No. 11 using EPAs 3052 and 6010D.

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CO-OPERATING ANALYSTS

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2	CARPENTIER, J-M.,	INISMa-CRIBC, Mons, Belgium.
3	SHAW, D.,	Lucideon, Stoke-on-Trent.
4	GRIMSLEY, L.,	Malvern Panalytical, Tollerton.
5	JAMIESON, S. N, *MSc, CChem, MRSC,*	NSG European Technology Centre Ltd., Lathom.
6	UCHIYAMA, K.,	Nippon Sheet Glass Co. Ltd., Itami, Japan.
7	ATKINSON, M. J.,	Pattinson & Stead (2005) Ltd., Middlesbrough.
8	JONES, S.J., *BSc, CChem, MRSC,*	Ridsdale & Co. Ltd., Middlesbrough.
9	WALTHER-RÄUSCHER, A.,	Schott AG, Corporate Research & Technology Development, Mainz, Germany.
10	HAMAEKERS, H.,	Sibelco, Dessel, Belgium.
11	SCARPA, M.,	Stazione Sperimentale Del Vetro S.C.P.A. - The Glass Research Centre, Murano, Venezia, Italy.
12	MERCAN, P.,	Science, Technology and Design Centre, Türkiye Şişe Ve Cam Fabrikalari A.Ş., Kocaeli, Turkey.
13, 14	ASHTON, A.,	GTS, Sheffield.

DESCRIPTION OF SAMPLE

British Chemical Standard BCS-CRM 534 is sold in the form of discs of approximately 40mm diameter.

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

Bureau of Analysed Samples Ltd is a United Kingdom Accreditation Service (UKAS) Accredited Reference Material Producer, No 4004, and, as the Producer of BCS-CRM 534 as defined in ISO 17034, is fully responsible for assigning the certified values and their uncertainties in accordance with ISO Guide 35.

INTENDED USE

This CRM is primarily intended for the calibration of optical instruments such as X-ray Spectrometers.

STABILITY

BCS-CRM 534 will remain stable provided that the discs are stored in a dry atmosphere.

TRACEABILITY

The characterisation of this material has been achieved by chemical analysis involving inter-laboratory study, each laboratory using the method of their choice, details of which are given above.

Most of the analytical methods used in the characterisation of this BCS-CRM were either international or national standard methods or methods which are technically equivalent. All laboratories used either stoichiometric analytical techniques or methods which were calibrated predominantly against pure metals or stoichiometric compounds, ensuring traceability of the individual results to the SI.

MEASUREMENT UNCERTAINTY

The uncertainty of each of the certified values of BCS-CRM 534 has been established by multiplying the standard error arising from the chemical analysis by the appropriate two-sided Student's t value at the 95% confidence level for the number of results. Homogeneity has been assessed on representative samples taken from the batch and found to be acceptable. Homogeneity has not, therefore, been included in the calculated measurement uncertainty. The stability of this CRM and its transportation also make negligible contributions to the overall uncertainty of the certified values.

COMMUTABILTY

The analytical sample was prepared by grinding representative samples of the raw material which were then mixed and subdivided. Each analyst received a representative sample of the bulk material, and the Certified Values accurately represent the chemical composition of the BCS-CRM. The user should be aware that the results so obtained may not be directly comparable with those obtained from the disc samples.

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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