MAIN EDITION

# BUREAU OF ANALYSED SAMPLES LTD

## BRITISH CHEMICAL STANDARD CERTIFIED REFERENCE MATERIAL

## CERTIFICATE OF ANALYSIS

# BCS-CRM No. 383

## ALCOMAX III (P.M.A. 69)

## PERMANENT MAGNET ALLOY

**Carbon and Sulphur Standard**

**Prepared under rigorous laboratory conditions in co-operation with the Permanent Magnet Association, Sheffield and AFTER CERTIFICATION ANALYSIS IN GREAT BRITAIN, issued by the Bureau of Analysed Samples Ltd.**

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### ANALYSES

Mean of 4 values - mass content in %.

| Analyst No. | C | S | *Mn* | *Ni* | *Cu* | *Co* | *Al* | *Nb (+Ta)* |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.026 | 0.193 | *0.07* | *13.2* | *2.63* | *24.4* | *7.7* | *0.51* |
| 2 | 0.025 | … | ... | ... | ... | ... | ... | ... |
| 3 | 0.026 | 0.208 | ... | ... | ... | ... | ... | ... |
| 4 | … | 0.201 | ... | ... | ... | ... | ... | ... |
| 5 | 0.027 | 0.201 | ... | ... | ... | ... | ... | ... |
| 6 | 0.025 | … | ... | ... | ... | ... | ... | ... |
| 7 | 0.025 | 0.201 | ... | ... | ... | ... | ... | ... |
| 8 | 0.027 | … | ... | ... | ... | ... | ... | ... |
| 9 | 0.025 | 0.203 | ... | ... | ... | ... | ... | ... |
| 10 | … | 0.198 | ... | ... | ... | ... | ... | ... |
| 11 | 0.023 | 0.209 | ... | ... | ... | ... | ... | ... |
| 12 | 0.023 | 0.213 | ... | ... | ... | ... | ... | ... |
| 13 | … | 0.212 | ... | ... | ... | ... | ... | ... |
| 14 | 0.026 | 0.199 | ... | ... | ... | ... | ... | ... |
| 15 | 0.025 | 0.187 | ... | ... | ... | ... | ... | ... |
| **$M_M$** | **0.025** | **0.202** | ... | ... | ... | ... | ... | ... |
| $s_M$ | 0.002 | 0.008 | ... | ... | ... | ... | ... | ... |

**The above figures are those which each Analyst has decided upon after careful verification.**
**Figures in bold type certified, figures in small italic type only approximate.**

$M_M$: Mean of the laboratory mean values. $s_M$: standard deviation of the laboratory mean values.

### CERTIFIED VALUES (Cv)

mass content in %

| | C | S |
|---|---|---|
| **Cv** | **0.025** | **0.202** |
| C(95%) | 0.001 | 0.005 |

The half width confidence interval **C**(95%) is an expression of the uncertainty of the certified value, where **C**(95%) = $\frac{t \times s_M}{\sqrt{n}}$ and "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.

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)

# BCS-CRM 383 (P.M.A. 69) ALCOMAX III
# PERMANENT MAGNET ALLOY
## NOTES ON METHODS USED

**CARBON**

All Analysts determined carbon by combustion in oxygen. Nos. 1, 7, 8, 9 and 14 used a non aqueous titration method (Jones et al., Analyst, 1965, 90, 623; 1966, 91, 399). No. 2 used an electrical conductivity method with a balanced two-cell circuit. Nos. 3, 5, 11, 12 and 15 determined carbon gravimetrically using large sample weights (Bagshawe and Pinder, Analyst, 1956, **81**, 153); Nos. 3, 5, 12 and 15 used four times the normal factor weight, No. 11 used five times the normal factor weight. No. 6 used a low pressure method (Cook and Speight, Analyst, 1956, **81**, 144).

**SULPHUR**

Analysts Nos. 1, 3, 7, 11 and 13 determined sulphur gravimetrically; Nos. 1 and 13 used the Standard method B.S. 1121: Part 1: 1966. The other Analysts used combustion methods.

Analyst No. 1 also used a combustion method and found 0.192%.

***MANGANESE***

*Standard colorimetric method B.S. 1121: Part 23: 1951.*

***NICKEL***

*The nickel was separated with dimethylglyoxime and the precipitate was dissolved in dilute sulphuric acid and boiled with excess ferric sulphate; the ferrous salt thus formed was titrated with dichromate solution (Analoid Method No. 62).*

***COPPER***

*Standard volumetric method B.S. 1121: Part 5: 1953.*

***COBALT***

*Potentiometric titration with potassium ferricyanide solution.*

***ALUMINIUM***

*Standard volumetric method B.S. 1121: Part 4: 1953.*

***NIOBIUM (+ TANTALUM)***

*Niobium was precipitated with phenylarsonic acid and determined gravimetrically. No attempt was made to separate tantalum.*

### DESCRIPTION OF SAMPLE

Bottles of 100g of powder crushed to pass through a 250 micron (60 mesh) sieve.

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

### INTENDED USE

This sample is intended for uses such as the verification of the accuracy and repeatability 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.

In order to ensure that a fully representative sample is taken users should take a minimum sub-sample size of 1.0g. 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.

The sample should be mixed thoroughly before each use.

### STABILITY

BCS-CRM 383 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.

### 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 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 383 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 the bulk material and has been found to be acceptable. It 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.

### COMMUTABILITY

BCS-CRM 383 is intended to be used in the same physical form as that used by the participating analysts and therefore commutability is not of relevance in respect of this CRM.

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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For BUREAU OF ANALYSED SAMPLES LTD

R.P. MEERES,
Managing Director

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