MAIN EDITION

BUREAU OF ANALYSED SAMPLES LTD.

BRITISH CHEMICAL STANDARD CERTIFIED REFERENCE MATERIAL

CERTIFICATE OF ANALYSIS
BCS-CRM No. 356 TITANIUM ALLOY

This CRM has been prepared under a joint project with the Laboratoire National D'Essais (LNE) in Paris. The specially cast billets were machined into chips, graded, homogenised and bottled by LNE and the Certification Analysis undertaken by laboratories in France and the United Kingdom. It is identical to the French CRM No. BNM 008 issued by LNE (Paris)

ANALYSES

Mean values - mass content in %

Line No.	Al	V	Fe	Cu	Ni	Cr	Mo	N
1	6.025	3.944	0.1161	0.0051	0.0058	0.0103	0.0017	0.0088
2	6.053	3.970	0.1174	0.0051	0.0060	0.0106	0.0020	0.0094
3	6.088	3.977	0.1200	0.0053	0.0063	0.0109	0.0020	0.0096
4	6.155	3.999	0.1204	0.0054	0.0069	0.0112	0.0022	0.0099
5	6.162	4.010	0.1223	0.0054	0.0071	0.0112	0.0022	0.0103
6	6.176	4.021	0.1248	0.0055	0.0071	0.0114		0.0103
7	6.191	4.053	0.1250	0.0056	0.0074	0.0115		0.0105
8	6.218	4.055	0.1261	0.0056	0.0076	0.0116		0.0110
9	6.226	4.065	0.1281	0.0056	0.0077	0.0116		0.0114
10	6.300	4.080	0.1287	0.0056	0.0078	0.0116		0.0114
11	6.308	4.081	0.1291	0.0057				
12	6.319	4.095	0.1295	0.0061				
13	6.397	4.097		0.0062				
14	6.434	4.120						
15	6.458	4.128						
16	6.505	4.175						
M_M	**6.251**	**4.054**	**0.1240**	**0.0055**	**0.0070**	**0.0112**	**0.0020**	**0.0103**
s_M	0.145	0.064	0.0047	0.0004	0.0007	0.0005	0.0003	0.0009

M_M: Mean of the intralaboratory means s_M: Standard deviation of the intralaboratory means

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

CERTIFIED VALUES

mass content in %

	Al	V	Fe	Cu	Ni	Cr	Mo	N
M_M	**6.25**	**4.05**	**0.124**	**0.0055**	**0.0070**	**0.0112**	**0.0020**	**0.0103**
Half-width of 95% confidence interval	0.08	0.04	0.003	0.0002	0.0005	0.0004	0.0003	0.0008

The half-width of 95% 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 laboratories

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

DESCRIPTION OF THE SAMPLE

This sample is available in the form of chips all passing a 1000 μm aperture sieve from which the dust passing a 250 μm aperture sieve has been removed. It is supplied in bottles containing 50g.

PARTICIPATING LABORATORIES

Aerospatiale, Chatillon sous Bagneux
Cameron Ironworks Ltd., Livingston
Centre d'Essais Aéronautique (C.E.A.T.), Toulouse
C.N.R.S./C.E.C.M., Vitry sur Seine
Compagnie Europeénne du Zirconium CEZUS, Albertville
École Nationalle Supérieure des Mines, Saint Etienne
Electricité de France (E.D.F.), Moret sur Loing
Establissement Technique Central de l'Armement (E.T.C.A.), Arcueil
Institut de Soudure, Paris
LNE/SMR, Paris
Laboratory of the Government Chemist, Teddington
Laboratoire Pierre Sue, Saclay
London & Scandinavian Metallurgical Co. Ltd., Rotherham
Messier Fonderies, Arudy
ONERA, Chatillon sous Bagneaux
Pattinson & Stead, Middlesbrough
Ridsdale & Co. Ltd., Middlesbrough
SNECMA, Corbeil
SNECMA, Gennevilliers
S.T.C.A.N., Paris

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APPROXIMATE VALUES FOR INFORMATION

mass content in µg/g

Line No.	*Sn*	*Si*	*W*	*C*	*H*	*O*
1	*131*	*148*	*9*	*76*	*16*	*1890*
2	*135*	*187*	*10*	*78*	*19*	*1913*
3	*148*	*200*	*12*	*80*	*19*	*1931*
4	*171*	*202*		*80*	*19*	*2010*
5	*184*	*215*		*80*	*20*	*2015*
6		*220*		*83*	*23*	*2044*
7		*246*		*85*		*2105*
8				*94*		*2110*
9				*96*		
10				*98*		
Indicative Value	*155*	*200*	*10*	*85*	*19*	*2000*

Additional information:- B, Zr <5 µg/g

NOTES ON METHODS USED

Element	Line Number	Method
Al	1 - 8 - 9 - 11 - 15	ICP-AES
	2 - 6 - 7 - 10 - 12 - 13	FAAS
	3	DCP-AES
	4	Gravimetric as oxinate
	5 - 14	Titrimetric
	16	XRF, fused bead technique
V	1 - 3 - 13	FAAS
	2 - 4 - 5 - 12 - 14	ICP-AES
	6 - 9 - 10 - 11 - 15 - 16	Titrimetric
	7	DCP-AES
	8	XRF, fused bead technique
Fe	1 - 2 - 3	Neutron activation
	4 - 5 - 6 - 9	FAAS
	7	Photometric with thiocyanate
	8 - 10 - 12	ICP-AES
	11	Photometric with bathophenanthroline
Cu	1 - 7	Neutron activation
	2	ETA-AAS
	3 - 4 - 8	ICP-AES
	5	Photometric with neocuproin
	6 - 9 - 10 - 12 - 13	FAAS
	11	DCP-AES
Ni	1 - 6 - 8	ICP-AES
	2 - 3	Neutron activation
	4 - 7 - 10	FAAS
	5	Photometric with dimethylglyoxime
	9	ETA-AAS
Cr	1 - 2 - 5	Neutron activation
	3	ETA-AAS
	4 - 6 - 8	ICP-AES
	7	Photometric with diphenylcarbazide
	9 - 10	FAAS
Mo	1 - 2 - 4	Neutron activation
	3	Photometric with thiocyanate
	5	ICP-AES
N	1 - 6 - 10	Titrimetric after distillation
	2 - 4 - 5 - 9	Thermal conductivity, inert gas fusion
	3	Manometry, vacuum fusion
	7 - 8	Photometric with Nessler reagent after distillation
Sn	1	Neutron activation
	2 - 4	ETA-AAS
	3 - 5	ICP-AES
Si	1 - 2	ICP-AES
	3 - 4 - 7	Photometric as molybdenum blue
	5	FAAS
	6	DCP-AES
W	1 - 2 - 3	Neutron activation
C	1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10	Combustion, infrared absorption
H	1 - 2 - 3 - 4 - 5 - 6	Thermal conductivity, inert gas fusion
O	1 - 3 - 8	Thermal conductivity, inert gas fusion
	2 - 4 - 5 - 6 - 7	Infrared absorption, inert gas fusion

Abbreviations:

ETA-AAS : Electro Thermal Atomisation - Atomic Absorption Spectrometry
ICP-AES : Inductively Coupled Plasma - Atomic Emission Spectrometry
DCP-AES : Direct Current Plasma - Atomic Emission Spectrometry
FAAS : Flame Atomic Absorption Spectrometry
XRF : X-Ray Fluorescence Spectrometry

NEWHAM HALL,
MIDDLESBROUGH,
ENGLAND.

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

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