



BUREAU OF ANALYSED SAMPLES LTD.

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BRITISH CHEMICAL STANDARD CERTIFIED REFERENCE MATERIAL

CERTIFICATE OF ANALYSIS BCS-CRM No. 357 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 009 issued by LNE (Paris)

ANALYSES

Mean values - mass content in %

Line No.	Al	V	Fe	Cu	Ni	Cr	Mo	N
1	5.248	3.433	0.1891	0.0496	0.0476	0.0482	0.0479	0.0118
2	5.260	3.450	0.1935	0.0510	0.0483	0.0503	0.0505	0.0123
3	5.330	3.454	0.1952	0.0526	0.0500	0.0511	0.0509	0.0130
4	5.339	3.470	0.1956	0.0535	0.0502	0.0513	0.0521	0.0139
5	5.414	3.484	0.1974	0.0538	0.0503	0.0516	0.0525	0.0149
6	5.416	3.502	0.2021	0.0540	0.0508	0.0518	0.0529	0.0151
7	5.433	3.529	0.2022	0.0541	0.0510	0.0520	0.0531	0.0152
8	5.437	3.530	0.2052	0.0544	0.0512	0.0531	0.0549	0.0154
9	5.473	3.543	0.2053	0.0545	0.0525	0.0535	0.0550	0.0164
10	5.485	3.563	0.2068	0.0549	0.0526	0.0540	0.0569	0.0170
11	5.505	3.563	0.2068	0.0556	0.0528	0.0542		0.0176
12	5.529	3.570	0.2083	0.0562	0.0532	0.0543		
13	5.550	3.645	0.2100		0.0535			
14	5.626	3.681	0.2150					
15	5.628							
16	5.690							
M_M	5.460	3.530	0.2023	0.0537	0.0511	0.0521	0.0527	0.0148
S_M	0.128	0.072	0.0073	0.0019	0.0019	0.0018	0.0026	0.0019

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	5.46	3.53	0.202	0.0537	0.0511	0.0521	0.053	0.0148
Half-width of 95% confidence interval	0.07	0.04	0.004	0.0012	0.0011	0.0012	0.002	0.0015

The half-width of 95% confidence interval $C(95\%) = t \times \frac{S_M}{\sqrt{n}}$ 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 Européenne du Zirconium CEZUS, Albertville
 École Nationale Supérieure des Mines, Saint Etienne
 Electricité de France (E.D.F.), Moret sur Loing
 Etablissement 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 Bagneux
 Pattinson & Stead, Middlesbrough
 Ridsdale & Co. Ltd., Middlesbrough
 SNECMA, Corbeil
 SNECMA, Gennevilliers
 S.T.C.A.N., Paris

BCS-CRM NO. 357 TITANIUM ALLOY

APPROXIMATE VALUES FOR INFORMATION

mass content in µg/g

Line No.	Sn	Si	B	C	H	O	Y	Zr
1	581	410	8	63	9	2204	42	454
2	581	460	13	67	10	2291	45	456
3	604	494	13	70	12	2293	47	457
4	608	526	14	72	12	2420	47	458
5	630	527	17	76	13	2480	48	
6	642	530		76	13	2522		
7	654	536		78		2857		
8	659					2860		
9								
10								
Indicative Value	620	500	13	72	12	2500	46	455

Additional information:- W < 10 µg/g

NOTES ON METHODS USED

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

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.