

Certificate of Certified Reference Material

NCS HC 11520 — NCS HC 11524

Superalloy Trace Elements

Reissued in 2013

Approved by China National Analysis Center for Iron and Steel

(Beijing China)

This set of certified reference material in form of fine milling has 5 samples which are intended for use in trace elemental analysis of high temperature Alloy. They are designed for all techniques applicable to trace analysis and especially suited for iron-nickel base high temperature alloy.

1.Preparation and Homogeneity

This set of certified reference materials used GH167 alloy as base, 15 trace elements were added. Each heats about 120 kg were vacuum melted, trace elements were added under argon atmosphere by way of intermediate alloy or their pure metals. A series of ingot were cast, samples of different part of ingot were checked, the result showed no detectable segregation of the trace element. After sampling and sifting the fine milling packed in minimum unit. Samples have good homogeneity and stability. The minimum weighing is 0.5g, each bottle contain 150g.

2. Certified Values and Standard Deviation

($\mu\text{g/g}$)

No.		Ag	As	Bi	Ca	Cd	Ga	In	Mg
NCS HC 11520	Certified Value	3.5	17	4.2	42	7.0	29	11	82
	Standard Deviation	0.3	2	0.6	4	0.4	3	1	2
NCS HC 11521	Certified Value	4.6	11	0.4	21	4.6	32	2.6	16
	Standard Deviation	0.5	2	0.1	2	0.4	2	0.4	2
NCS HC 11522	Certified Value	5.3	15	0.4	11	1.8	108	30	15
	Standard Deviation	0.4	2	0.1	2	0.2	7	3	2
NCS HC 11523	Certified Value	0.3	72	0.5	32	1.9	28	0.4	53
	Standard Deviation	0.1	3	0.2	2	0.2	3	0.2	4
NCS HC 11524	Certified Value	0.7	72	3.4	5.3	1.6	63	92	111
	Standard Deviation	0.2	3	0.5	0.5	0.3	4	7	8
		Pb	Sb	Se	Sn	Te	Tl	Zn	
NCS HC 11520	Certified Value	12	204	43	103	3.0	8.5	24	
	Standard Deviation	2	9	2	4	0.5	0.3	3	
NCS HC 11521	Certified Value	4.1	95	16	53	11	22	32	
	Standard Deviation	0.5	6	2	4	1	3	3	
NCS HC 11522	Certified Value	11	59	11	72	2.1	51	105	
	Standard Deviation	1	4	2	7	0.4	1	13	
NCS HC 11523	Certified Value	2.2	7.4	43	0.104*	0.5	83	20	
	Standard Deviation	0.8	1.0	4	0.007*	0.1	4	2	
NCS HC 11524	Certified Value	91	6.2	53	92	83	8.1	6.0	
	Standard Deviation	5	0.2	3	5	3	0.7	0.5	

*: Unit of certified value of the element is weight percent.

3. Analytical methods

Samples were submitted to many laboratories for analysis, using different kind of methods to determine the certified values, 15 trace elements used 76 analytical methods. So each value was determined by several analytical methods.

The details are as following:

Element	Method
Ag	Graphite furnace atomic absorption spectroscopy; Extraction-atomic absorption spectroscopy; Dithizone extraction-spectrophotometry; Sulfhydryl cotton fiber - ICP-AES; Atomic absorption spectroscopy
As	Arsenic hydride-DDTC-Ag photometry; Graphite furnace atomic absorption spectroscopy; Distillation-arsenic molybdenum blue photometry; Iodide extraction-ICP-AES; Iodide extraction arsenic molybdenum blue photometry
Bi	Graphite furnace atomic absorption spectroscopy; Hydride-atomic absorption spectroscopy; Coprecipitation brucine extraction photometry; Extraction-rodamine B extraction photometry; Extraction-AES; Sulfhydryl cotton fiber-oscillopolarography
Ca	Nitrous oxide-acetylene flame atomic absorption spectroscopy; ICP-AES
Cd	Graphite furnace atomic absorption spectroscopy; Sulfhydryl cotton fiber-polarography; Iodide extraction; Ion exchange-5-Br-PADAP photometry; Extraction-AES; Extraction-catalytic absorption polarography
Ga	Rodamine B extraction photometry; Extraction-rodamine B extraction photometry; Atomic absorption spectroscopy; Graphite furnace atomic absorption spectroscopy
In	Sulfhydryl cotton fiber-salicylfluorone photometry; Coprecipitation -P204/n -octane extraction-polarography; Extraction-atomic absorption spectroscopy; Graphite furnace atomic absorption spectroscopy; Bromide extraction-oscillopolarography; Rodamine B extraction photometry; Bromide extraction--rodamine B extraction photometry
Mg	Atomic absorption spectroscopy; ICP-AES; PMBP extraction-dimethylaniline blue photometry; Sodium diethyldithio-carbamate extraction-ICP-AES
Pb	Coprecipitation-polarography; Coprecipitation-dithizone extraction-xylene orange photometry; AES; Coprecipitation-ICP-AES; Coprecipitation xylene orange photometry; Graphite furnace atomic absorption spectroscopy
Sb	Malachite green extraction photometry; Graphite furnace atomic absorption spectroscopy; Extraction-AES; Iodide extraction-ICP-AES; Coprecipitation-molybdenum blue photometry
Se	Catalytic oscillopolarography; Coprecipitation-extraction(CHCl ₃)-polarography; Extraction(CCl ₄)-polarography; Coprecipitation-polarography; Graphite furnace atomic absorption spectroscopy; Sulfhydryl cotton fiber-catalytic polarography; SnCl ₂ -ascorbic acid reduction-ICP-AES
Sn	Graphite furnace atomic absorption spectroscopy; Extraction-salicylfluorone-CTMAB photometry; Iodide extraction-ICP-AES; Beryllium hydroxide coprecipitation-phenylfluorone photometry; Iodide extraction-phenylfluorone photometry

Te	Sulfhydryl cotton fiber-polarography; Arsenic coprecipitation-polarography; Sulfhydryl cotton fiber-rodamine B photometry; Arsenic coprecipitation-rodamine B photometry; Graphite furnace atomic absorption spectroscopy; Sulfhydryl cotton fiber-catalytic polarography; Solid sampling graphite furnace atomic absorption spectroscopy
Tl	Crystal violet extraction photometry; Extraction-ICP-AES; Graphite furnace atomic absorption spectroscopy; Bromide ether extraction-ethyl violet photometry
Zn	Atomic absorption spectroscopy; P507 extraction-dithizone photometry; Ion--exchange-5-Br-PADAP photometry

4. Additional Information

No.	Chemical composition (weight percent)							
	C	S	P	Si	Mn	Cr	Ni	W
NCS HC11520	0.07	0.005	0.004	0.06	0.04	14.5	38.0	5.6
NCS HC11521	0.06	0.006	0.004	0.08	0.04	14.6	37.8	5.6
NCS HC11522	0.06	0.004	0.004	0.07	0.04	14.6	37.8	5.6
NCS HC11523	0.11	0.003	0.004	0.12	0.10	14.4	36.2	5.6
NCS HC11524	0.09	0.006	0.004	0.08	0.03	14.4	37.8	5.6
	Ti	Mo	Al	B	Zr	Ce		
NCS HC11520	2.8	2.0	1.6	0.010	0.03	0.003		
NCS HC11521	3.0	2.0	1.7	0.010	0.03	0.004		
NCS HC11522	3.0	2.0	1.7	0.009	0.03	0.011		
NCS HC11523	3.0	2.0	1.9	0.010	0.03	0.001		
NCS HC11524	2.9	2.1	1.8	0.010	0.03	0.001		

5. Packing and Storage

This set of certified reference material are packed in glass bottle with internal gasket, cover and sealed with soft glue, a label is stucked on the bottle marked "Certified Reference Material" and kept in a box with the same label. After using the sample the cover of the bottle should be screwed on and stocked at dry place.

6. Participating Testing Laboratories

Research Institute of Metal, Academia Sinice
Shanghai Research Institute, for Materials, MMEI
Chang sha Research Institute of Mining and Metallurgy
No.52 Research Institute, MMI
Research Institute, Daye Steel Works
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