U. S. DEPARTMENT OF COMMERCE

National Bureau of Standards

Certificate of Analyses

OF

STANDARD SAMPLE 115

COPPER-NICKEL-CHROMIUM CAST IRON

ANALYST*	C		Mn	P		S		Si	Cu	Ni	Cr	V	Mo	Ti	As	Co
	Total	GRAPHITIC[a]		Gravimetric (Weighed as $Mg_2P_2O_7$ after removal of arsenic)	ALKALI-MOLYBDATE[b]	Gravimetric (Direct oxidation and final precipitation in reduced solution)	Evolution with HCl ZnS-Iodine (theoretical sulphur titre)[c]	Perchloric acid dehydration				VANADIUM	MOLYBDENUM Colorimetric	TITANIUM Determined colorimetrically in residue after HCl (sp gr 1.10) attack	ARSENIC	COBALT
1	2. 43	1. 83	1. 01 [d]	0. 111 [e]	0. 113 [e]	0. 033	0. 030 [f]	1. 60	6. 44 [g]	15. 89 [h]	2. 18 [i]	0. 009 [j]	0. 001	0. 021		0. 08 [k]
2	2. 39	1. 87	1. 03 [d]		. 115 [e]	. 030 [l]		1. 61	6. 42 [m]	15. 90 [h]	2. 15 [i]					
3	2. 41	1. 85	1. 00 [n]		. 115 [o]	. 034	. 031 [o]	1. 58 [p]	6. 44 [m]	15. 90 [q]	2. 14 [r]					
4	2. 42	1. 85	1. 01 [s]		. 108 [t]		. 031 [f]	1. 61	6. 43 [m]	15. 86 [h]	2. 18 [r]	. 008 [u]	. 001			
5	2. 44	1. 75	1. 00 [n]		. 114 [e]	. 032		1. 61	6. 44 [m]	15. 90 [h]	2. 16					
	2. 41	1. 92	1. 01 [v]		. 112 [o]	. 030		1. 60	6. 45 [m]	15. 89	2. 16		. 002			
7	2. 47	1. 93 [w]	1. 01 [n]	. 113 [e]		. 031		1. 60	6. 44 [m]	15. 84 [x]	2. 19 [r]	. 011 [y]	. 003		0. 007 [z]	. 08 [k]
8	2. 45	1. 82	1. 00	. 118		. 032	. 030	1. 60	6. 42	15. 88	2. 18	. 008	. 002		. 007	. 08
9	2. 41	1. 85 [w]	. 99					1. 59		15. 87 [x]						
10	2. 41	1. 81	1. 00 [z1]		. 113 [e]	. 034		1. 60	6. 45	15. 95 [z2]	2. 17 [r]				. 007 [z3]	
Averages	2. 42	1. 85	1. 01	. 113	. 114	. 032	. 031	1. 60	6. 44	15. 89	2. 17	. 009	. 002	. 021	. 007	. 08
Recommended values	2. 42	1. 85	1. 01	. 113		. 032		1. 60	6. 44	15. 89	2. 17	. 009	. 002	. 021	. 007	. 08

(a) Sample treated with HNO_3 (sp gr 1.20), filtered and washed. Residue digested with HCl (sp gr 1.19), filtered, washed, dried, and burned.

(b) Precipitated at 40° C, washed with 1 percent KNO_3, and titrated with alkali standardized by the use of National Bureau of Standards acid potassium phthalate and the 23:1 ratio.

(c) Value obtained by standardizing titrating solution by means of sodium oxalate through $KMnO_4$ and $Na_2S_2O_3$.

(d) Sample dissolved in HNO_3-HCl solution, fumed with $HClO_4$ and H_2SO_4 and iron and manganese-precipitated with NH_4OH and $(NH_4)_2S_2O_8$. Precipitate dissolved in dilute HNO_3 and manganese determined by the bismuthate method.

(e) Sample dissolved in HNO_3-HCl, solution fumed with $HClO_4$ to obtain complete decomposition of carbides. Silica filtered before precipitation of phosphomolybdate.

(f) Sample annealed by covering with a layer of graphite and heating for 20 minutes at 685° C.

(g) Most of the copper separated by direct electrolysis, remainder precipitated with H_2S. Precipitates combined, purified, and determination finished by electrolysis.

(h) Nickel precipitated with dimethylglyoxime from an aliquot portion of a 4- or 5-g sample. Precipitate filtered, dissolved, copper removed with H_2S, and nickel determined by electrolysis.

(i) Sample dissolved in HNO_3-HCl, solution fumed with $HClO_4$ and H_2SO_4, and chromium determined by the $AgNO_3$-$(NH_4)_2S_2O_8$ method.

(j) HNO_3 oxidation followed by potentiometric titration.

(k) Cobalt separated from iron and chromium by ether separation followed by double ZnO separation, then precipitated twice with α-nitroso-β-naphthol, and the ignited precipitate either weighed as Co_3O_4 or reduced and weighed as metal.

(l) Sample dissolved in HNO_3 and $HClO_4$ added. Solution evaporated to dense fumes of $HClO_4$ before precipitating sulphur as $BaSO_4$.

(m) H_2S, CuS, CuO; finished by electrolysis.

(n) ZnO separation followed by bismuthate oxidation.

(o) Titrating solution standardized on a standard cast iron.

(p) Nitric-sulphuric acid method.

(q) Nickel precipitated with dimethylglyoxime and determined by titration with KCN.

(r) Perchloric acid oxidation.

(s) Dissolved in HNO_3-$HClO_4$, chromium separated as $PbCrO_4$, and manganese determined by persulphate-arsenite method.

(t) Precipitation in hot solution and calculation based on 25:1 ratio.

(u) Vanadium gathered in phosphomolybdate precipitate.

(v) Ford-Williams method.

(w) Solution in HNO_3 (sp gr 1.20). Residue burned with 1 g red lead.

(x) Weighed as nickel dimethylglyoxime after removal of copper.

(y) Bicarbonate, cupferron, and mercury cathode separations used to concentrate the vanadium which was then determined by reduction and titration with $KMnO_4$.

(z) Weighed as As_2S_3.

(z1) ZnO separation, PbO_2 oxidation, and arsenite titration.

(z2) Direct KCN titration after removal of copper as sulfide.

(z3) Arsenic distilled as $AsCl_3$ and titrated with $KMnO_4$.

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Washington, D. C.
November 6, 1935

U.S. GOVERNMENT PRINTING OFFICE 35724