U. S. DEPARTMENT OF COMMERCE

National Bureau of Standards

Certificate of Analyses

OF

STANDARD SAMPLE 155

CHROMIUM—TUNGSTEN STEEL

ANALYST*	C	Mn		P		S		Si	COPPER H_2S–CuS–CuO	NICKEL Weighed as nickel dimethylglyoxime	Cr	VANADIUM	MOLYBDENUM Colorimetric	W	
	Direct combustion	Bismuthate ($FeSO_4$–$KMnO_4$) titration	Persulfate-Arsenite	Gravimetric (weighed as $Mg_2P_2O_7$ after removal of arsenic)	Alkali-Molybdate [a]	Gravimetric (direct oxidation and precipitation after reduction of iron)	Combustion	Perchloric acid dehydration			$FeSO_4$–$KMnO_4$ titration			Gravimetric	Colorimetric
1	0.901	[b]1.23	1.25	0.015	[c]0.013	0.010	[d]0.008	[e]0.318	0.083	0.098	[f]0.479	[g]0.014	0.039	[h]0.525	
2	.908		[i]1.24	.015	[c].015	.010	[j].010	.326	[k].078	[l].102	[m].488	.015	.038	[h].517	[n].518
3	.906		[o]1.23		[p].015	.010	[j].011	.325	[q].082	[l].101	[m].490	[g].013	.039	[h].521	
4	.904		1.25		.016		.012	.323	[r].087	[l].099	.489	.011	[r].043	.514	
5	.905		1.24		.016		[s].011	.323	[t].091	[l].098	[m].48		.040	.526	[n].52
6	.902	1.25	1.25		.015	.008	[s].008	.331	[r].08	.105	[m].484	[u].017	[r].041	[v].509	
7	.906		1.24		[p].018	.012	[s].012	[w,e].321	[r].073	[x].087	.493	[y].010	.035	[h].519	
8	.91		[z1]1.22	[z1].018	[p].016		[j].012	.313	[q].079	.105	[p].473	[g].022	.042	[h].508	
9	.904	[z2]1.26		.014	.013	.009	[d].012	[e].319	[z3].095	.103	.492	[g].013	.038	[z4].515	
Averages	0.905	1.25	1.24	0.016	0.015	0.010	0.011	0.322	0.083	0.100	0.485	0.014	0.039	0.517	0.519
General average	0.905	1.24		0.015		0.010		0.322	0.083	0.100	0.485	0.014	0.039	0.517	

[a] Precipitated at 40° C, washed with a 1-percent solution of KNO_3, and titrated with alkali standardized by the use of acid potassium phthalate and the ratio 23NaOH:1P.

[b] Chromium removed by bicarbonate hydrolysis.

[c] Molybdenum-blue photometric method. See J. Research NBS **26**, 405 (1941) RP1386.

[d] 1-g sample burned in oxygen at 1,400° C, and sulfur dioxide absorbed in acidified starch-iodine solution. The iodine was liberated from iodide by titration, during the combustion, with standard KIO_3 solution based on 93 percent of the theoretical factor.

[e] Double dehydration with intervening filtration.

[f] Persulfate oxidation and potentiometric titration with ferrous ammonium sulfate.

[g] Nitric acid oxidation and potentiometric titration with ferrous ammonium sulfate.

[h] Single precipitation with HCl-HNO_3 and cinchonine. Ignited precipitate corrected for R_2O_3, SiO_2, and MoO_3.

[i] Periodate photometric method.

[j] Sulfur gases absorbed in NaOH-H_2O_2 and excess NaOH titrated with H_2SO_4.

[k] Diethyldithiocarbamate photometric method.

[l] Glyoxime-cyanide titration method

[m] Perchloric acid oxidation.

[n] Hydroquinone photometric method.

[o] Red lead oxidation.

[p] Titrating solution standardized by use of a standard steel.

[q] CuCNS precipitation, iodide titration method.

[r] α-Benzoinoxime method.

Unprecipitated tungsten in filtrate determined by α-benzoinoxime-hydroquinone colorimetric method.

[s] Combustion at 2,220° to 2,400° F with tin, titration as in [d] with iodate standardized on standard steels.

[t] CuCNS precipitation, KCN titration.

[u] Mercury cathode-$KMnO_4$ titration method.

[v] As in [h], except recovery made by second evaporation and precipitation with cinchonine.

[w] Nitric-hydrochloric acid dehydration.

[x] Glyoxime precipitate ignited to NiO.

[y] $FeSO_4$-$(NH_4)_2S_2O_8$-$KMnO_4$ titration method.

[z] Chromium volatilized as CrO_2Cl_2.

[z1] Weighed as $(NH_4)_3PO_4.12MoO_3$.

[z2] Chromium removed by ZnO precipitation.

[z3] Finished by electrolysis.

[z4] As in [h], except α-benzoinoxime precipitate added to main precipitate.

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