U. S. Department of Commerce

National Bureau of Standards

Certificate of Analyses

Standard Sample 11F

Basic Open-Hearth Steel, 0.2% Carbon

ANALYST	C	Mn		P		S			Si	Cu	Ni	Cr	V	Mo	
	Direct combustion	Bismuthate ($FeSO_4$-$KMnO_4$)	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)	Evolution with HCl (1-1) ZnS-Iodine (theoretical sulfur titre) [b]	Combustion	Sulfuric acid dehydration	H_2S-CuS-CuO	Weighed as nickel dimethylglyoxime	$FeSO_4$-$KMnO_4$ titration		Colorimetric	
1	0.205		[c]0.646	0.013	[d]0.013	0.031	0.031	[e]0.032	[f]0.174	0.095	0.049	[g]0.041	[h]0.001	0.017	
2	.208	.650	[i].645	.015	[d].014	.033	.033	[i,j].033	[f].170	.095	[k].052	.040	[l].002	.018	
3	.203		.638	.015	.016	.035	[i,m].034	[i,n].034	[f,o].179	.099	.042	.042		.018	
4	.198		[i].644		[i].016		[m].032	[i,p].034	[f,q].164	[r].099	.054	.040	[s].002	.019	
5	.209		[i].645		[d].016			[t].033	[q].175	.101	[k].052	.042	[u].001	.020	
6	.198		.643		.016	.031		.032	[f,q].183	[v].101	[w].048	.039	[s].002	[x].017	
7	.207	.651	[i].650	.015	.015	.035	[i].034	[y].035	[f,q].167	[r].101	[z].047	.040		.020	
	.198		[i].643		.016	.035	.034		[f].172	[z1].092	[k].046	[z2].041	[u].002	.020	
Average	0.203	0.650	0.644	0.014	0.015	0.033	0.033	0.033	0.173	0.098	0.049	0.041	0.002	0.019	
General average	0.203	0.646		0.015		0.033			0.173	0.098	0.049	0.041	0.002	0.019	

[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 23 NaOH:1P.

[b] Value obtained by standardizing the titrating solution by means of sodium oxalate through $KMnO_4$ and $Na_2S_2O_3$ and use of the ratio 2I:1S.

[c] Potentiometric titration.

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

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

[f] Double dehydration with intervening filtration.

[g] Chromium separated from the bulk of the iron in a 10-g sample by $NaHCO_3$ hydrolysis, oxidized with persulfate, and titrated potentiometrically with ferrous ammonium sulfate.

[h] Vanadium separated as in (g), oxidized with nitric acid, and titrated potentiometrically with ferrous ammonium sulfate.

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

[j] Sulfur gases absorbed in neutral H_2O_2, and titrated with NaOH.

[k] Dimethylglyoxime photometric method.

[l] Phosphotungstate photometric method.

[m] Absorbed in ammoniacal cadmium chloride.

[n] As in (j), except titrated with borax solution.

[o] Nitric-sulfuric acid dehydration.

[p] As in (e), except combustion at 2,050° F.

[q] Perchloric acid dehydration.

[r] Finished by electrolysis.

[s] Cupferron, $FeSO_4$-$(NH_4)_2S_2O_8$-$KMnO_4$ titration.

[t] As in (e), except combustion at 2,500° F.

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

[v] H_2S-α-benzoinoxime-CuO method.

[w] $K_3Fe(CN)_6$-dimethylglyoxime-KCN titration.

[x] α-benzoinoxime method, 20-g sample.

[y] As in (e), except combustion at 2,400° F, and 90-percent factor.

[z] Dimethylglyoxime-KCN titration.

[z1] Copper-ammonia complex photometric method.

[z2] Diphenylcarbazide photometric method.

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