U. S. DEPARTMENT OF COMMERCE

National Bureau of Standards

Certificate of Analyses

OF

STANDARD SAMPLE 20D

ACID OPEN-HEARTH STEEL, 0.4% CARBON

ANALYST*	C	Mn		P		S		Si	COPPER H_2S-CuS-CuO	NICKEL Weighed as nickel dimethylglyoxime	CHROMIUM $FeSO_4$-$KMnO_4$ titration	VANADIUM	MOLYBDENUM Colorimetric	
	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 final precipitation in reduced solution)	Evolution with HCl (1–1) ZnS-Iodine (theoretical sulfur titre)[b]	Sulfuric acid dehydration						
1	0.408	0.916	0.912	0.047	0.047	0.100	[c]0.096 .090	[d]0.256	[e]0.166	0.230	[f]0.281	[f]0.045	0.061	
2	.413		[g].918	.048	[g].049	.097	.095	.250	[e].169	.218	.285		[h].057	
3	.408		[gi].918		[g].051		[cg].094	[j].263	[e].160	.217	.291	.049	.065	
4	.408		[g].900	[k].049	.047	.095	.096	[dj].255	[e].161	.223	.270	[l].055	[m].065	
5	.413		.924		.052	.095	.090	.245	[e].161	.219	.291	.048	.064	
6	.414		[g].910	.045	[g].046	.097	[g].099	[n].255	[o].166	.230	.297	.049	.065	
7	.410		[f].913		.047	.101	.093	.252	.158	.239	.278			
8	.412	.92	.92		.050	.101	[c].096	[d].261	.165	.228	[f].272			
9	.414		[g].916		.050	.100	.088	[dj].252	[o].166	.235	.287			
10	.409	.914	.915		.050	.097	[p].096	.255	.171	.234	.28	[q].046	.06	
Averages	**0.411**	**0.917**	**0.915**	**0.047**	**0.049**	**0.098**	**0.093**	**0.254**	**0.164**	**0.227**	**0.283**	**0.049**	**0.062**	
Recommended values	**0.411**	**0.916**		**0.048**		**0.098**		**0.254**	**0.164**	**0.227**	**0.283**	**0.049**	**0.062**	

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

[b] Value obtained by standardizing the titrating solution by means of sodium oxalate through $KMnO_4$ and $Na_2S_2O_3$.

[c] Solution in concentrated HCl.

[d] Double dehydration.

[e] Finished by electrolysis.

[f] Potentiometric titration.

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

[h] Initial H_2S precipitation. Copper separated with NaOH, molybdenum again precipitated with H_2S, and ignited to MoO_3.

[i] Bismuthate-arsenite method.

[j] Nitric-sulfuric acid dehydration.

[k] Weighed as $(NH_4)_3PO_4.12\,MoO_3$.

[l] Vanadium separated from the bulk of the iron (ferrous) by precipitation with cupferron. Determination finished by the ferrous sulfate-persulfate method.

[m] α-Benzoinoxime method. See BS J. Research 9, 1 (1932) RP453.

[n] Perchloric acid dehydration.

[o] KI-$Na_2S_2O_3$ titration.

[p] Sample ignited in oxygen, gases passed into H_2O_2, and H_2SO_4 titrated with 0.01 *N* NaOH.

[q] Mercury cathode separation, titrated with $KMnO_4$.

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