U. S. DEPARTMENT OF COMMERCE

National Bureau of Standards

Certificate of Analyses

OF

STANDARD SAMPLE 111A

NICKEL-MOLYBDENUM STEEL

(SAE 4620)

ANALYST*	C	Mn		P		S			Si	Cu	Ni	Cr	V	Mo		N	
	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 (HCl sp gr 1.18-ZnS-iodine-theoretical sulfur titer) [b]	Combustion	Sulfuric acid dehydration	H_2S-CuS-CuO	Weighed as nickel dimethylglyoxime	$FeSO_4$-$KMnO_4$ titration		Gravimetric	Colorimetric		
1	0.199	0.742	0.740	0.016	[c] 0.018	0.016	0.017		[d] 0.273	0.082	1.74	[e] 0.244	[f] 0.002	[g] 0.225	0.224	[h] 0.009	
2	.207		.74		.018	.018		[i] 0.018	[j] .264	[k] .081	1.74	.240			.224		
3	.198		.75		.023	.014	.013		[d] .271	.079	1.76	.236			.214		
4	.200		.740		[l] .020		[l] [m] .019	.019	.274	[n] .080	1.73	.240	.001	[o] .220			
5	.204		.736		[l] .017	.017	[l] .017		[i] .273	[p] .077	1.75	.243		[g] .223			
	.202		.732		.018		[q] [l] .020		[j] [d] .271	[p] .083	1.74	[r] .240		[g] .219			
7	.203		.747		.018	.019	[m] .018		[d] .270	[n] .082	[s] 1.74	[r] .244		[t] .216	.214		
8	.205		.745	.018	[l] .018	.015	.013	[u] .015	[j] [d] .263	.080	[v] 1.76	.248		[t] .218	.221		
9	.203	.747	.745		[l] .018	.018		[i] .018	[d] .271	[w] .075	[v] 1.76	.243		[x] .223	.222		
10	.210	.75			.015	.020			.264	[n] .076	1.74	.232		.216			
11	.198	.738	.739		.020	.016		[i] .017	.272	[n] .078	[y] 1.74	[r] .249		[t] .228 [g] .229	.227		
Averages	0.203	0.744	0.741	0.017	0.018	0.017	0.017	0.017	0.270	0.079	1.75	0.242	0.002	0.222	0.221	0.009	
General Averages	0.203	0.743		0.017		0.017			0.270	0.079	1.75	0.242	0.002	0.222		0.009	

[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: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] Colorimetric method. See J. Research NBS **26**, 405 (1941) RP1386.

[d] Double dehydration.

[e] Persulfate oxidation and potentiometric titration with ferrous ammonium sulfate solution standardized with recrystallized potassium dichromate.

[f] Nitric acid oxidation and potentiometric titration with ferrous ammonium sulfate solution standardized with recrystallized potassium dichromate.

[g] Alpha-benzoinoxime method. See BS J. Research **9**, 1 (1932) RP453.

[h] Determination made by M. Marie Cron, by the vacuum-fusion method. See BS J. Research **7**, 376 (1931) RP 346.

[i] Sulfur dioxide absorbed in HCl (1:99). Solution titrated with KIO_3; standardized with a standard steel.

[j] Perchloric acid dehydration.

[k] Sodium diethyldithiocarbamate colorimetric method.

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

[m] Evolution with diluted HCl (2:1).

[n] Finished by electrolysis.

[o] Molybdenum separated with alpha-benzoinoxime; weighed as lead molybdate.

[p] Copper precipitated with $Na_2S_2O_3$. Finished by electrolysis.

[q] Evolution with diluted HCl (3:2).

[r] Perchloric acid oxidation.

[s] Iron removed with ether. Nickel precipitated with dimethylglyoxime. Precipitate titrated with KCN.

[t] H_2S-MoS_3-MoO_3.

[u] Absorption in H_2O_2-NaOH solution. Titration with H_2SO_4 standardized with a standard steel.

[v] Glyoxime precipitate dissolved and titrated with KCN.

[w] Copper precipitated with $Na_2S_2O_3$. Solution filtered, precipitate dissolved, copper precipitated with alpha-benzoinoxime. Precipitate separated and ignited to CuO.

[x] H_2S-$PbMoO_4$.

[y] Glyoxime precipitate ignited to NiO.

LIST OF ANALYSTS

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