

DEPARTMENT OF COMMERCE

Bureau of Standards
Certificate of Analyses

OF

STANDARD SAMPLE No. 106

CHROMIUM-MOLYBDENUM-ALUMINUM STEEL

ANALYST*	C	Mn	P		S		Si			Cr	Mo		Al				
	CARBON Direct Combustion	MANGANESE 1. Bismuthate (FeSO ₄ -KMnO ₄ after removing Cr) 2. Persulphate-Arsenite	PHOSPHORUS 1. Alkali-Molybdate ^a 2. Gravimetric (Weighed as Mg ₂ P ₂ O ₇ after removal of arsenite)	SULPHUR 1. Gravimetric (Direct oxida- tion and final precipita- tion in reduced solution) 2. Evolution with HCl (2:1) % S. Oxidation (Theoretical sulphur titre) ^b	SILICON Sulphuric acid dehydration	COPPER H ₂ S-CuS-CuO	NICKEL Weighed as nickel dimethyl- glyoxime	CHROMIUM FeSO ₄ -KMnO ₄ titration	VANADIUM	MOLYBDENUM 1. Gravimetric 2. Colorimetric	ALUMINUM ARSENIC NITROGEN						
1.....	0.339	0.480	0.022	0.020	0.018	0.019	0.253	0.145	0.130	1.29 ^c	0.008 ^e	0.164 ^d	0.161	1.06 ^e	0.010	0.009	
2.....	.345	.483	.019	.019	.020		.245 ^f	.147 ^g	.125	1.28		.166 ^h	.165	1.08			
3.....	.337	.491 ⁱ	0.493	.022	.022	.021	.022	.245 ^j	.143 ^k	1.28	.006 ^k	.164 ^l	.156	1.06 ^m	.008		
4.....	.342						.246			1.28			.163	1.05 ⁿ			
	.347 ^o	.470	.020	.021 ^p	.018	.020	.252	.150 ^q		1.29 ^a		.159 ^l	.156	1.07 ^e			
6.....	.342	.481 ⁱ		.021	.022	.021	.020	.255	.135 ^g	.125	1.29		.171	1.06			
7.....	.345	.482	.021 ^r		.017 ^s	.016 ^t	.246	.134 ^g		1.30		.165 ^u		1.08 ^e			
8.....	.345	.49	.021 ^r		.021	.022 ^t	.257		.14	1.30 ^c		.16 ^v	.16	1.05 ^v			
9.....	.346	.491 ^e		.022	.020	.020 ^t	.244 ^f	.147 ^g		1.30 ^c	.008 ^e	.174 ^l		1.05			
10.....	.344		.018		.019		.26	.149	.127	1.28	.01 ^e	.159 ^h		1.07 ^w			
11.....	.341	.475 ^x	.021		.017		.259	.133 ^y		1.28		.170 ^h		1.06 ^z			
Averages....	.343	.485	.482	.021	.020	.019	.020	.250	.142	.129	1.29	.008	.165	.162	1.06	.009	.009
General av- erages....	.343	.484		.020		.019	.250	.142	.129	1.29	.008	.164		1.06 [†]	.009	.009	

† Includes 0.017 percent of Al present as Al₂O₃.
^a Precipitated at 40°C., washed with 1 percent KNO₃ and titrated with alkali standardized by the use of the Bureau of Standards standard acid potassium phthalate and the 23:1 ratio.
^b Value obtained by standardization of titrating solution against sodium oxalate through KMnO₄ and Na₂S₂O₈.
^c Electrometric titration.
^d Precipitated with α-benzoinxime and weighed as MoO₃. B. S. Jour. Research, vol. 9 (RP453), p. 1, July 1932.
^e Iron removed with ether and cupferron, chromium oxidized with HClO₄ and aluminum precipitated twice with NH₄OH, ignited to the oxide and corrected for P₂O₅, Cr₂O₃, and SiO₂.
^f HCl dehydration.
^g Finished by electrolysis.

^h Precipitated with H₂S, molybdenum sulphide ignited to MoO₃ and corrected for impurities.
ⁱ Bismuthate-arsenite.
^j HClO₄ dehydration.
^k Spectrographic method.
^l Weighed as PbMoO₄.
^m Aluminum precipitated with NH₄OH after removing interfering elements with ether, H₂S, and the mercury cathode.
ⁿ Iron separated with cupferron, chromium oxidized with HClO₄ and aluminum precipitated twice with NH₄OH.
^o CO₂ absorbed in Ba(OH)₂ and titrated with C₂H₂O₄.
^p Ignited and weighed as P₂O₅. 24MoO₃.
^q HClO₄ oxidation.
^r Titrating solution standardized on standard steel.

^s FeSO₄ precipitated in FeCl₃ solution.
^t H₂S absorbed in CdCl₂ solution.
^u Iron separated with NaOH, molybdenum reduced in Jones reductor and titrated with KMnO₄.
^v Iron and chromium separated with ether and NaOH, and aluminum precipitated twice with NH₄OH.
^w Most of the iron removed with ether, chromium and aluminum separated with Na₂CO₃ and Na₂O₂, and aluminum precipitated in the filtrate as hydroxide by carefully neutralizing with HCl.
^x Oxidized with lead peroxide.
^y KCN titration.
^z Aluminum separated from most of the iron and chromium by hydrolysis in an ammonium sulphite-sulphurous acid solution. Precipitate dissolved, the acid solution treated with NaOH-Na₂O₂, filtered, and aluminum precipitated with NH₄OH.

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Director.