

# Certificate of Analysis

## Standard Reference Material 163

### CHROMIUM STEEL

ANALYST	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	N
	Direct combustion gravimetric	Persulfate- Arsenite	Alkali-Molybdate <sup>a</sup>	Combustion Iodate titration	Perchloric acid dehydration		Weighed as nickel dimethylglyoxime	FeSO <sub>4</sub> -KMnO <sub>4</sub> titration	Thiocyanate, Photometric	Distillation- Photometric
1-----	0.934	{ <sup>b</sup> 0.898 <sup>c</sup> 0.908}	<sup>d</sup> 0.007	<sup>e</sup> 0.027	<sup>f</sup> 0.487	<sup>g</sup> 0.092	<sup>h</sup> 0.083	<sup>i</sup> 0.982	0.030	<sup>j</sup> 0.009
2-----	.940	<sup>b</sup> .895	<sup>k</sup> 0.006	.026	.482	1.087	<sup>h</sup> .078	.980	.029	.009
3-----	.933	<sup>m</sup> .904	<sup>n</sup> 0.009	.026	.489	<sup>m</sup> .085	<sup>m</sup> .078	<sup>o</sup> .986	.027	.006
4-----	.938	<sup>b</sup> .902	.008	<sup>e</sup> .027	<sup>f</sup> .486	<sup>p</sup> .086	<sup>h</sup> .080	<sup>o</sup> .980	.030	.005
5-----	<sup>q</sup> .929	.895	.007	.029	<sup>f</sup> .487	<sup>p</sup> .088	.079	.980	<sup>r</sup> .027	.006
6-----	.937	<sup>b</sup> .890	<sup>s</sup> .007	{ <sup>t</sup> .028 <sup>u</sup> .027}	<sup>f</sup> .483	<sup>p</sup> .092	<sup>h</sup> .086	<sup>o</sup> .974	.028	.008
7-----	.929	<sup>b</sup> .898	<sup>d</sup> .006	.030	<sup>f</sup> .492	<sup>u</sup> .092	.081	<sup>o</sup> .988	.029	.008
8-----	.933	<sup>b</sup> .894	<sup>s</sup> .007	.028	.486	1.085	<sup>h</sup> .079	.988	.032	.005
9-----	.938	<sup>b</sup> .892	<sup>k</sup> 0.007	.026	.493	<sup>p</sup> .089	.084	.984	.030	-----
10-----	<sup>v</sup> .934	{ <sup>m</sup> .900 <sup>o</sup> .905}	.007	.027	.485	{ <sup>1</sup> .088 <sup>m</sup> .088}	<sup>m</sup> .088	.985	.036	.006
11-----	<sup>w</sup> .927	.889	.007	.027	.490	<sup>x</sup> .083	.081	.981	.026	<sup>y</sup> .006
12-----	<sup>w</sup> .932	.893	.009	.027	<sup>z</sup> .493	<sup>aa</sup> .084	.080	.976	<sup>bb</sup> .028	.008
13-----	<sup>w</sup> .929	-----	-----	.028	-----	-----	-----	-----	-----	-----
Average-----	0.933	0.897	0.007	0.027	0.488	0.087	0.081	0.982	0.029	0.007

<sup>a</sup> Precipitated at 40°C, washed with a 1-percent solution of KNO<sub>3</sub>, and titrated with alkali standardized by the use of acid potassium phthalate and the ratio of 23NaOH:1P.

<sup>b</sup> Periodate photometric method.

<sup>c</sup> Potentiometric titration.

<sup>d</sup> Molybdenum-blue photometric method. See J. Research NBS 26, 405 (1941) RP1386.

<sup>e</sup> 1-g sample burned in oxygen at 1,425°C and sulfur dioxide absorbed in starch-iodide solution. Iodine is liberated from iodide by titration, during the combustion, with standard KIO<sub>3</sub> solution. Titer is based on 93 percent of the theoretical factor.

<sup>f</sup> Double dehydration with intervening filtration.

<sup>g</sup> 1-g sample dissolved in HCl-HNO<sub>3</sub>-HClO<sub>4</sub>. Iron removed with methyl-isobutylketone. Copper determined by atomic absorption method.

<sup>h</sup> Dimethylglyoxime photometric method.

<sup>i</sup> 0.5-g sample oxidized with persulfate, and titrated potentiometrically with ferrous ammonium sulfate.

<sup>j</sup> 0.5-g sample digested 4 hr. with sulfuric acid. See J. Research NBS 43, 201 (1949) RP2021.

<sup>k</sup> Molybdenum-blue photometric method. Color complex extracted with isobutyl alcohol.

<sup>l</sup> Diethyldithiocarbamate photometric method.

<sup>m</sup> Atomic absorption method.

<sup>n</sup> Molybdo-vanadate photometric method. Color complex extracted with isobutyl alcohol.

#### List of Analysts

<sup>o</sup> Potentiometric titration with ferrous ammonium sulfate.

<sup>p</sup> Neocuproine photometric method.

<sup>q</sup> Differential gasometric method.

<sup>r</sup> H<sub>2</sub>S-MoS<sub>3</sub> - photometric method.

<sup>s</sup> Molybdenum-blue photometric method.

<sup>t</sup> Sulfate ions adsorbed on alumina column, eluted with NH<sub>4</sub>OH, and sulfur determined gravimetrically as BaSO<sub>4</sub>.

<sup>u</sup> 2,2' biquinoline photometric method.

<sup>v</sup> Conductometric method.

<sup>w</sup> Thermal conductivity method.

<sup>x</sup> CuCNS-KIO<sub>3</sub> titration method.

<sup>y</sup> Distillation-titration.

<sup>z</sup> Double dehydration with sulfuric acid.

<sup>aa</sup> H<sub>2</sub>S-CuS-CuO.

<sup>bb</sup> H<sub>2</sub>S-MoS<sub>3</sub>-MoO<sub>3</sub>.

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The material for this Standard was prepared in powder form by argon atomization, followed by a hydrogen anneal, at the Hoeganaes Sponge Iron Corporation, Riverton, N.J. The material has been sized between 25 and 100 mesh sieves.

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