

UNITED STATES DEPARTMENT OF COMMERCE
WASHINGTON

National Bureau of Standards
Certificate of Analyses
Standard Sample 169
Electrical-Heating Alloy
(77 Ni-20 Cr)

ANALYST	NICKEL Weighed as nickel dime-thylglyoxime	CHROMIUM FeSC ₄ -KMnO ₄ titration	SILICON Perchloric acid dehydration	IRON Volumetric	COBALT Colorimetric	ALUMINUM Weighed as Al ₂ O ₃	MANGANESE Colorimetric	ZIRCONIUM Weighed as ZrF ₂ O ₇	VANADIUM Volumetric	CALCIUM Weighed as CaO	COPPER Electrolytic	TITANIUM Colorimetric	CARBON Combustion	SULFUR Combustion	NITROGEN Solution-distillation
1	77.25	^a 20.23	^b 1.41	^c 0.55	0.19	^d 0.090	^e 0.071	0.042	0.018	^f 0.018	^g 0.013	0.005	0.042	^h 0.001 ⁱ 0.002	^j 0.030
2	77.26	20.29	1.44	^k .53	.19	1.097	.073	.037	^m .017	ⁿ .014	.015	.006	.044	^o .003	.033
3	77.21	20.23	1.40	^e .56	.19	.095	^e .078	.036	.013	^p .016	.013	.009	.045	^q .002	-----
4	77.28	^a 20.24	1.43	^r .52	.18	-----	.066	-----	-----	-----	^s .018	^r .007	.050	-----	-----
5	{ 77.25 ^a 77.26 }	20.24	^b 1.43	{ ^c .53 ^k .53 }	^t .19	^u .095	{ ^v .070 ^v .072 }	.043	{ ^m .015 ^m .014 }	.014	^w .013	.006	.039	1.002	-----
6	77.21	20.29	^b 1.44	.54	{ ^t .19 ^t .18 }	.094	.071	.035	.023	-----	.016	.008	.045	-----	-----
7	77.31	^a 20.28	^b 1.43	.56	^t .19	.105	^v .074	.042	.024	-----	.020	.008	.037	.002	-----
8	77.25	20.26	1.41	^x .55	.20	^v .087	^e .076	.042	{ ^m .017 ^m .020 }	.013	^s .017	.006	.042	^z 1.002	-----
9	77.26	20.30	^b 1.40	.55	{ ^z .19 ^z .20 }	.090	.071	.048	.016	.013	{ ^s .015 ^s .013 }	.006	.043	^z 3.002	-----
10	77.31	20.28	^a 1.42	^x .53	.20	^u .098	.072	{ ^u .045 ^u .041 }	.016	-----	.014	.005	.042	.003	-----
11	77.27	^a 20.23	1.45	.55	^u .21	.10	^v .076	.046	.019	.014	^u .014	.006	.049	.003	-----
Average	77.26	20.26	1.42	0.54	0.19	0.095	0.073	0.042	0.018	0.015	0.015	0.006	0.043	0.002	0.031

^a Persulfate oxidation and potentiometric titration with ferrous ammonium sulfate standardized against potassium dichromate.

^b Double dehydration with intervening filtration.
^c SnCl₂-K₂Cr₂O₇ method.

^d Mercury cathode separation, residual chromium volatilized as CrO₂Cl₂. NH₄OH precipitation, cyanide-H₂S-8-hydroxyquinoline-cupferron-Al₂O₃.

^e Persulfate-arsenite method.

^f Manganese precipitated with NH₄OH+Br in filtrate from the first Al(OH)₃ separation (footnote d). Calcium precipitated twice with ammonium oxalate.

^g HBr-photometric method.

^h l-g sample burned in oxygen at 1480° C. Sulfur dioxide absorbed in starch-iodine solution and titrated with standard KIO₃ solution.

ⁱ Meiske method.

^j Distillation-titration method. See J. Research NBS 43, 201 (1949) RP2021.

^k NH₄CNS-photometric method.

^l Chromium volatilized as CrO₂Cl₂, mercury cathode separation, cupferron precipitation. NH₄OH precipitation, and aluminum determined by the 8-hydroxyquinoline-photometric method. See Anal. Chem. 21, 609 (1949).

^m Photometric method.

ⁿ Slight excess of oxalic acid added to filtrate from Al(OH)₃ separation (footnote l), calcium precipitated with ammonium oxalate and titrated with KMnO₄.

^o Solution in HNO₃-HCl, and weighed as BaSO₄.

^p Calcium precipitated as oxalate, and ultimately weighed as CaSO₄.

^q Evolution method.

^r Iron-photometric method. See Anal. Chem 20, 1208 (1948).

^s Dimethylglyoxime-electrolytic method.

^t α-Nitroso-β-naphthol-CoSO₄.

^u Mercury cathode-cupferron-AlPO₄ method.

^v Bismuthate method.

^w Diethylthiocarbamate-photometric method.

^x Iron reduced in a silver reductor and titrated with Ce(SO₄)₂.

^y Mercury cathode, cupferron-chloroform extraction, 8-hydroxyquinoline-chloroform extraction, aluminum-photometric method. See Anal. Chem. 24, 1120 (1952).

^z H₂S-thiosulfate titration.

^{aa} HI reduction—PbS photometric method. See Anal. Chem. 21, 1369 (1949).

^{ab} Electrolytic method.

^{ac} Methylene blue-photometric method.

^{ad} Double dehydration with H₂SO₄ with intervening filtration.

^{ae} Mercury cathode-cupferron-aluminum method.

^{af} Mercury cathode-cupferron-ZrO₂ with correction for titanium.

^{ag} HClO₄-persulfate oxidation, and FeSO₄-K₂Cr₂O₇ titration with α-phenanthroline indicator.

^{ah} Thiocyanate-photometric method. See Anal. Chem. 19, 236 (1947).

^{ai} CuCNS—cupric chloride-photometric method.

Several analysts reported less than 0.01 percent each of phosphorus and magnesium.

List of Analysts

1. Nonferrous Laboratory, National Bureau of Standards. R. K. Bell, in charge. Analysis by E. E. Maczkowske and B. B. Bendigo.
2. Robert S. Kelly and Ruth F. Cluett, Wilbur B. Driver Co., Newark, N. J.
3. T. L. Fluck, Driver-Harris Co., Harrison, N. J.
4. G. V. Potter and K. L. Rohrer, Sylvania Electric Products, Towanda, Pa.
A. D. Middleton, W. J. Moore, W. W. Bragg, E. B. Sharps, J. Sandmann, R. W. Simmons, and W. E. Clagg, The International Nickel Co., Huntington, W. Va.
J. Penkrot, H. K. Lembersky, and T. C. Bryson, Materials Engineer-

- ing Chemical Laboratory, Westinghouse Electric Corp., East Pittsburgh, Pa.
7. F. W. Dillon, A. Sloan, R. Mogel, and J. O. Strauss, The Carpenter Steel Co., Reading, Pa.
8. Bell Telephone Laboratories, Murray Hill, N. J. K. H. Storks in Charge of Analytical Chemistry. Analysis by A. L. Beach, E. Bloom, M. E. Campbell, J. F. Jensen, and E. Wennerblad.
9. Silve Kallmann, Ledoux and Co., Teaneck, N. J.
10. H. L. Hovis, Hamilton Watch Co., Lancaster, Pa.
11. J. L. Martin, H. M. Putsche, C. J. Yoder, and W. J. Boyer, Armo Steel Corp., Rustless Division, Baltimore, Md.

The metal for the preparation of this standard was furnished by the Wilbur B. Driver Co., Newark, N. J.

WASHINGTON, D. C. October 26, 1953.

A. V. ASTIN, Director.