U. S. Department of Commerce
Malcolm Baldrige
Secretary
National Bureau of Standards
Ernest Ambler, Director

Certificate of Analysis

Standard Reference Materials

1206-2, 1207-1, 1207-2, 1208-1, 1208-2

High-Temperature Alloys: René 41, Waspaloy, and Inco 718

These standards are in the form of solid sections primarily for application in x-ray spectrometric analysis although they also may be useful in optical emission spectrometric analysis.

	Rene 41	Waspaloy		Inco 718	
	1206-2	1207-1	1207-2	1208-1	1208-2
Carbon	0.21_7	0.043	0.083	0.046	0.022
Manganese	.030	.34	$.29_5$	$.38_5$	$.23_0$
Phosphorus	(.004)[a]	.005	.005	.003	.003
Sulfur	.006	.009	.009	$.01_1$	.007
Silicon	$.21_6$	$.47_2$	$.61_5$	$.43_4$	$.08_3$
Copper	.040	.026	.033	$.14_7$	.077
Nickel	53.3	56.1	55.7	51.9	51.5
Chromium	19.17	18.88	19.4_4	17.5	17.4
Molybdenum	10.3_0	4.50	4.34	3.2_4	3.13
Titanium	2.9_4	3.09	2.54	0.46	(0.8_5)
Aluminum	1.7_4	1.26	1.3_9	(.15)	$(.8_5)$
Cobalt	11.5_5	13.0_5	13.5_0	.82	.76
Niobium	--	--	--	5.3_8	4.9_8
Iron	0.46	2.22	2.09	19.2	19.8
Tantalum	--	--	--	(0.012)	(0.012)
Lead	(.0027)[b]	(0.0012)[b]	(0.0022)[b]	(.00054)	(.0022)
Bismuth	(.000045)	(.000016)	(.000036)	(.000032)	(.000012)
Selenium	(.00012)	(.00035)	(.00018)	(.00024)	(<.0001)
Tellurium	(.000016)	(.0001)	(.000016)	(.00008)	(.00001)

[a] Values in parenthesis are not certified but are provided for additional information on the composition.

[b] Limited data on millings suggests some segregation.

SIZE AND METALLURGICAL CONDITION: Samples are approximately 31 mm (1 1/4 in) square and 13 mm (1/2 in) thick; they were chill-cast by a rapid unidirectional solidification technique.

CERTIFIED PORTION: The certified portion for each sample is that extending upward 8 mm (5/16 in) from the chill-cast or test surface (the largest surface opposite the numbered surface). This portion only was analyzed in the cooperative program for certification.

ANALYTICAL CERTIFICATION: The value listed for a certified element is the present best estimate of the true value based on the results of the cooperative analytical program. The value listed is not expected to deviate from the true value by more than ± 1 in the last significant figure reported; for a subscript figure, the deviation is not expected to be more than ± 5. Based on the results of homogeneity testing, maximum variations within and among samples are estimated less than the accuracy figures given above.

Washington, D.C. 20234
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(Revision of certificates
dated 11-6-70 & 1-16-73)

George A. Uriano
Office of Standard Reference Materials

(over)

Note 1. The total for elements determined in SRMs 1206-2, 1207-1, and 1207-2 is 100.0 percent ± 0.05; for SRMs 1208-1 and 1208-2 the total is 99.7 percent ± 0.05, suggesting the presence of one or more additional elements not yet sought nor determined.

Note 2: Metallographic examination of the material from SRM 1206-1 revealed considerable porosity precluding certification at this time.

PREPARATION, TESTING, ANALYSIS: The material for the standards was melted and cast at the American Cast Iron Pipe Company, Birmingham, Alabama, with use of the NBS chill-cast mold assembly. This procedure for the preparation and homogeneity testing was similar to that described in NBS Misc. Publ. 260-1, Standard Reference Materials: Preparation of NBS White Cast Iron Spectrochemical Standards, Robert E. Michaelis and LeRoy L. Wyman, June 19, 1964.

Homogeneity testing was performed at NBS by D. M. Bouchette and was found to be satisfactory for the elements certified.

Cooperative analyses for certification were performed in the analytical laboratories of Cameron Iron Works, Inc., Houston, Texas, R. A. Clarke; Carpenter Technology Corporation, Research and Development Center, Reading, Pennsylvania, E. J. Cramer; Ladish Co., Cudahy, Wisconsin, F. J. Kohls, J. Rafalski, and J. Szmania; and Cyclops Corporation, Universal-Cyclops Specialty Steel Division, Bridgeville, Pennsylvania, R. C. Host.

Analyses were performed in the Analytical Chemistry Division of the National Bureau of Standards by R. K. Bell, E. J. Maienthal, and S. A. Wicks.

Technical measurements performed at NBS for certification were coordinated by J. I. Shultz and J. L. Weber, Jr. under the chairmanship of B. F. Scribner.

The technical and support aspects involved in the preparation, certification, and issuance of these standard reference materials were coordinated through the Office of Standard Reference Materials by R. E. Michaelis.

CAUTIONS:

1. Determinations made on other than the chill-cast or test surface are not recommended because of the unidirectional solidification structure.

2. These chill-cast standards are designed for calibration in the analysis of samples prepared in the same manner; samples prepared by other casting techniques may result in considerable bias.

3. Because the samples exhibit some change with respect to the solidification structure, both among standards and from bottom to top of the certified portion of the samples, the surface preparation for x-ray spectrometric analysis may be critical. (A metallographic polishing technique is recommended.)

4. Because of the poor heat conductivity of the high-temperature alloys, difference in volatility rates for certain elements in emission spectrometric analysis may occur depending on the location of the burn and the source parameters.