



National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material C1221

Resulfurized/Rephosphorized Steel, AISI 1211 (Mod.)

(In Cooperation with the American Society for Testing and Materials)

This Standard Reference Material (SRM) is in the form of a chill-cast disk approximately 32 mm (1 1/4 in) in diameter and 16 mm (5/8 in) thick, intended for use in optical emission and X-ray spectrometric methods of analysis.

<u>Element</u>	<u>Certified Value, wt % * 1</u>	<u>Estimated Uncertainty 2</u>
Carbon	0.020	0.002
Manganese	0.102	0.004
Phosphorus	0.090	0.002
Sulfur	0.112	0.004
Silicon	0.876	0.015
Copper	0.041	0.002
Nickel	0.067	0.001
Chromium	0.049	0.002
Molybdenum	0.038	0.003
Aluminum (Total)	0.111	0.006

* wt % = mg/kg x 10⁻⁴

¹The certified value listed for an element is the present best estimate of the "true" value based on the results of the cooperative program for certification.

²The estimated uncertainty listed for an element is based on judgment and represents an evaluation of the combined effects of method imprecision, possible systematic errors among methods, and material variability. (No attempt was made to derive exact statistical measures of imprecision because several methods were involved in the determination of most constituents.)

Metallurgical Condition: The specimens were chill-cast by a rapid unidirectional solidification technique.

Certified Portion: The certified portion for each specimen is that extending upward 13 mm (1/2 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.

This Certificate of Analysis has undergone editorial revision to reflect program and organizational changes at NIST and at the Department of Commerce. No attempt was made to reevaluate the certificate values or any technical data presented on this certificate.

The overall coordination of the technical measurements leading to certification was performed under the direction of J.I. Shultz, Research Associate, ASTM/NIST Research Associate Program.

Gaithersburg, MD 20899
April 9, 1993
(Revision of certificate dated 1-20-82)

Thomas E. Gills, Acting Chief
Standard Reference Materials Program

(over)

The technical and support aspects involved in the original preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program by R.E. Michaelis. Revision of this certificate was coordinated through the Standard Reference Materials Program by P.A. Lundberg.

PLANNING, PREPARATION, TESTING, ANALYSIS

The material for this SRM was melted and chill-cast at Esco Corp., Portland, OR, (L.E. Finch), using a massive water-cooled, copper-plate mold assembly belonging to the Steel Founders' Society of America. The 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, R.E. Michaelis and L.L. Wyman, June 19, 1964.

Homogeneity testing was performed at NIST by J.A. Norris using optical emission spectrometric analysis, and initially showed an unacceptable carbon variability near the chill-cast surface of some selected specimens. After removing 3.2 mm (1/8 in) additional material from the chill-cast surfaces, each specimen from the entire lot (~575 specimens) was retested (n=2) and only those meeting the requirement of 0.020 ± 0.002 percent of carbon were accepted (~500 specimens).

Cooperative analyses for certification were performed in the following laboratories:

Armco Inc., Research and Technology, Middletown, OH, R.L. LeRoy, G. Smith, O. Brezny, R. Swigert, K. Strom, D. Bigelow, D. Boatman, T. Terrell, and J. Leeker.

Ford Motor Company, Central Laboratory Services, Dearborn, MI, D.H. Craig, J. Pinner, and T. Munie.

National Institute of Standards and Technology, Inorganic Analytical Research Division, B.I. Diamondstone and R.K. Bell, ASTM/NIST Research Associate.

Republic Steel Corp., Chicago District, Chicago, IL, P.P. Blaszak.

Stelco, Inc., Hamilton, Ontario, Canada, O.P. Bhargava.

Although *not certified*, the following compositional values are given to provide additional information.

<u>Element</u>	<u>Information Value, wt %</u>
V	(0.0007)
Ti	(0.0014)
Co	(0.010)
Zr	(0.0017)

CAUTIONS:

1. Determinations made on other than the chill-cast surface are not recommended because of the unidirectional solidification structure.
2. Chill-cast samples of SRM C1221 are designed for calibration in the analysis of samples prepared in a similar manner; analytical results for samples prepared by other casting techniques (or in wrought form) may exhibit considerable bias if analyzed using SRM C1221 for calibration.
3. The samples of SRM C1221 exhibit changes in the solidification structure particularly from bottom to top of the certified portion. Care must be observed in optical emission spectrometric analysis to ensure that a bias is not introduced as the specimen is consumed.

Care should be taken to match closely the structure of SRM C1221 samples with test samples to achieve the most accurate results. Because of these structure differences, the surface preparation for X-ray spectrometric analysis may be critical and a metallographic polishing technique is recommended.