

# National Bureau of Standards

## Certificate of Analysis

### Standard Reference Material C1153a

#### Stainless Steel, 17Cr-9Ni

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

This Standard Reference Material (SRM) is in the form of a disk, approximately 32 mm (1 1/4 in) in diameter and 19 mm (3/4 in) thick, intended for use in optical emission and x-ray spectrometric methods of analysis.

| <u>Element</u> | <u>Certified Value<sup>1</sup></u><br><u>% by wt.</u> | <u>Estimated</u><br><u>Uncertainty<sup>2</sup></u> |
|----------------|---|--|
| Carbon         | 0.225   | 0.005  |
| Manganese      | .544  | .003   |
| Phosphorus     | .030  | .003   |
| Sulfur         | .019  | .002   |
| Silicon        | 1.00  | .02  |
| Copper         | .226  | .004   |
| Nickel         | 8.76  | .04  |
| Chromium       | 16.70   | .08  |
| Vanadium       | 0.176   | .004   |
| Molybdenum     | .24   | .01  |
| Cobalt         | .127  | .007   |
| Lead           | .006  | .001   |

<sup>1</sup>The certified value listed for a constituent is the present best estimate of the "true" value based on the results of the cooperative program for certification.

<sup>2</sup>The estimated uncertainty listed for a constituent 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 16 mm (5/8 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.

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

The technical and support aspects involved in the preparation, certification, and issuance of this Standard Reference Material were coordinated through the Office of Standard Reference Materials by W.P. Reed.

Gaithersburg, MD 20899  
April 21, 1986

Stanley D. Rasberry, Chief  
Office of Standard Reference Materials

(Over)

## PLANNING, PREPARATION, TESTING, ANALYSIS:

This Stainless Steel Standard is one of a set of four SRM's (C1151, C1152, C1153, C1154) and their renewals that have been prepared in a cooperative Industry-ASTM-NBS Program. The compositions were designed to provide concentration ranges for the elements normally specified in most austenitic stainless steels of the 18 Cr - 8 Ni type. A concentration range for a number of trace elements also has been provided to enhance the utility of the four standards.

The material for this standard was melted and cast at Esco Corporation, Portland, Ore., L.E. Finch, under an NBS contract with the Steel Founders' Society of America (SFSA).

A massive water-cooled, copper-plate mold assembly made by Esco for the SFSA was used in the preparation of the chill-castings. The preparation and plan for 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.

Extensive homogeneity testing was carried out at the National Bureau of Standards by C.H. Brady using metallographic studies, by J.A. Norris using optical emission analysis, and by P.A. Pella using x-ray fluorescence analysis.

Composite samples for chemical analyses were prepared in the form of millings cut from the certified portion of representative specimens of the lot of chill castings.

Cooperative analyses for certification, carried out under the auspices of the ASTM-NBS Research Associate Program, were performed in the following analytical laboratories:

Allegheny Ludlum Steel Corporation, Flat Rolled Products Division, Brackenridge, Pa., A.I. Fulton and C.W. Hartig.

Allegheny Ludlum Steel Corporation, Research Center, Brackenridge, Pa., M.A. McMahon.

Bethlehem Steel Corporation, Sparrows Point Plant, Sparrows Point, Md., F.T. Kowalczyk.

Cyclops Corporation, Universal Cyclops Specialty Steel Division, Titusville, Pa., A.V. Mirarchi and R.A. Hall.

National Bureau of Standards, Center for Analytical Chemistry, Inorganic Analytical Research Division, B.I. Diamondstone, J.D. Fassett, H.M. Kingston, L.A. Machlan, E.J. Maienthal, L.J. Moore, J.A. Norris and P.J. Paulsen.

**ADDITIONAL INFORMATION ON THE COMPOSITION:** This SRM contains additional elements as indicated below. These are not certified, but are provided for information only.

| <u>Element</u> | <u>Non-Certified Value</u><br><u>% by wt.</u> |
|----------------|---|
| Aluminum       | (0.004)                                       |
| Antimony       | (0.003)                                       |
| Arsenic        | (0.007)                                       |
| Bismuth        | (<0.0001)                                     |
| Boron          | (0.001)                                       |
| Niobium        | (0.48)  |
| Nitrogen       | (0.11)  |
| Selenium       | (0.0007)                                      |
| Silver         | (0.001)                                       |
| Tantalum       | (0.03)  |
| Tellurium      | (0.01)  |
| Titanium       | (0.002)                                       |
| Tin            | (0.013)                                       |
| Zinc           | (0.005)                                       |
| Zirconium      | (0.0001)                                      |
| Iron, by diff. | (71.2)  |

## CAUTIONS:

1. Analyses made on other than the chill-cast surface and within the portion certified are not recommended because of the unidirectional solidification structure.
2. This SRM is designed for use in the analysis of samples prepared in the same manner; samples prepared by other casting techniques or having other than a chill-cast structure may exhibit systematic errors in the analytical results.

NBS Standard Reference Materials  
Stainless Steel Series  
April 21, 1986  
W.P. Reed, NBS Office of Standard Reference Materials  
and  
J.I. Shultz, ASTM Research Associate

The following table gives the values for four chill-cast stainless steel SRM's that are available in the form of disks approximately 32 mm (1 1/4 in) in diameter and 19 mm (3/4 in) thick for use in optical emission and x-ray spectrometric methods of analysis. They are being issued as a culmination of a major Industry-SFSA-ASTM-NBS cooperative program.

| SRM No.<br>Designation | C1151<br>23Cr-7Ni    | C1152<br>18Cr-11Ni   | C1153a<br>17Cr-9Ni   | C1154<br>19Cr-13Ni   |
|------------------------|----------------------|----------------------|----------------------|----------------------|
| Element                | Percent by Weight    |                      |                      |                      |
| Carbon                 | 0.039                | 0.148                | 0.225                | 0.086                |
| Manganese              | 2.50                 | 0.96                 | .544                 | 1.42                 |
| Phosphorus             | 0.017                | 0.021                | .030                 | 0.06                 |
| Sulfur                 | 0.038                | 0.0064               | .019                 | 0.053                |
| Silicon                | 0.38                 | 0.80                 | 1.00                 | 0.50                 |
| Copper                 | 0.418                | 0.102                | .226                 | 0.40                 |
| Nickel                 | 7.29                 | 10.88                | 8.76                 | 12.92                |
| Chromium               | 22.70                | 17.81                | 16.70                | 19.06                |
| Vanadium               | 0.037                | 0.030                | 0.176                | 0.135                |
| Molybdenum             | 0.80                 | 0.43                 | .24                  | 0.07                 |
| Cobalt                 | 0.032                | 0.22                 | .127                 | 0.38                 |
| Lead                   | 0.0039               | 0.0047               | .006                 | 0.0178               |
| Aluminum               | (0.004) <sup>a</sup> | (0.004) <sup>a</sup> | (0.004) <sup>a</sup> | (0.004) <sup>a</sup> |
| Antimony               | (0.005)              | (0.015)              | (0.003)              | (0.023)              |
| Arsenic                | (0.010)              | (0.016)              | (0.007)              | (0.030)              |
| Bismuth                | (<0.00005)           | (<0.0001)            | (<0.0001)            | (<0.001)             |
| Boron                  | (0.0012)             | (0.004)              | (0.001)              | (0.0018)             |
| Niobium                | (0.014)              | (0.16)               | (0.48)               | (0.23)               |
| Nitrogen               | (0.23)               | (0.055)              | (0.11)               | (0.084)              |
| Selenium               | (0.0021)             | (0.024)              | (0.0007)             | (0.0078)             |
| Silver                 | (0.0001)             | (<0.0001)            | (0.001)              | (0.0025)             |
| Tantalum               | (0.006)              | (0.001)              | (0.03)               | (0.075)              |
| Tellurium              | (0.0020)             | (0.0091)             | (0.01)               | (0.0007)             |
| Thallium               | (0.00001)            | (0.00005)            |                      |                      |
| Titanium               | (0.006)              | (0.011)              | (0.002)              | (0.004)              |
| Tin                    | (0.004)              | (0.013)              | (0.013)              | (0.024)              |
| Zinc                   | (<0.01)              | (<0.01)              | (0.005)              | (0.011)              |
| Zirconium              | (0.005)              | (0.004)              | (0.0001)             | (0.004)              |
| Iron, by diff.         | (65.4)               | (68.3)               | (71.2)               | (64.3)               |

<sup>a</sup>Values in parentheses are *not certified*.

The value listed for a certified constituent is the *present best estimate* of the "true" value based on the results of the analytical program for certification. The individual certificates of analysis list the "estimated uncertainties" associated with the certified values.

Inquiries regarding the chill-cast stainless steel SRM's C1151-C1154 should be directed to the Office of Standard Reference Materials, Chemistry Building, B311, National Bureau of Standards, Gaithersburg, MD 20899 (301) 921-2045.