National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 131f

Low Carbon Silicon Steel

(In Cooperation with ASTM)

This Standard Reference Material (SRM) is a low alloy silicon steel (nominally 3 % silicon) intended primarily for use in checking and/or calibrating carbon/sulfur analyzers. One unit of SRM 131f consists of 150 g of material in the form of chips sized between 0.5 mm and 1.0 mm sieve openings (35 mesh and 18 mesh, respectively).

The material designated SRM 131f is a portion of the same bulk material that was used to prepare SRM 131e. The SRM 131f portion was reblended to reduce any inhomogeneities that may have developed during bulk storage and then bottled. Sulfur measurements were made on eight bottles of SRM 131f (selected by stratified random sampling) by isotope dilution mass spectrometry.

The carbon concentrations of SRM 131e and SRM 131f were directly compared by combustion-infrared detection. Triplicate carbon determinations were made, using a randomized run order, on six bottles of SRM 131e and six bottles of SRM 131f. Based on these intercomparison data, the carbon value of SRM 131e has been transferred directly to SRM 131f without modification. The uncertainty of the carbon value of SRM 131f has been increased slightly to incorporate the uncertainty of the intercomparison.

The certified values for carbon and sulfur are listed in Table 1. All values are reported as mass fractions [1].

Table 1. Certified Mass Fractions

Element	(mg/kg)
Carbon	35.1 ± 1.7
Sulfur	4.34 ± 0.10

The uncertainties listed in Table 1 are expanded uncertainties calculated according to the ISO/CIPM approach [2] and represent the 95 % level of confidence. The expanded uncertainties are calculated as $U = ku_c$, where u_c is the combined standard uncertainty and k is a coverage factor. For carbon, $u_c = 0.74$ mg/kg and represents the combined effects of uncertainty components associated with the original certification of SRM 131e and the intercomparison of SRM 131e with SRM 131f. For sulfur, $u_c = 0.045$ mg/kg and represents, at the level of one standard deviation, the combined effect of all known uncertainty components associated with the mass spectrometry measurements, including spike calibration and assay of standards.

The technical and support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program by C.M. Beck II.

Gaithersburg, MD 20899
Certificate Issue Date: May 20, 1997

Thomas E. Gills, Chief
Standard Reference Materials Program

The material for this SRM was provided by the Armco Advanced Materials Corporation, Butler, PA.

Coordination of the technical measurements leading to the certification of SRM 131f was provided by G.C. Turk and R.L. Watters, Jr., of the NIST Analytical Chemistry Division. Isotope dilution mass spectrometric sulfur analysis was performed by W.R. Kelly and R.D. Vocke of the NIST Analytical Chemistry Division.

SRM 131e carbon determinations by combustion-infrared detection were originally performed by T.A. Rush and T.W. Vetter of the NIST Analytical Chemistry Division and by seven cooperating laboratories (see Table 2). Combustion-infrared carbon analysis of both SRM 131e and 131f was performed by D. Lawrenz of Leco Corp., St. Joseph, MI.

Statistical consultation was provided by K.R. Eberhardt of the NIST Statistical Engineering Division.

Table 2. Cooperating Laboratories

C.K. Deak; Analytical Associates, Inc., Detroit, MI
C.C. Borland, R. Doebler, D. Gillum, and H. Vail; Armco Research Technologies, Middletown, OH
D. Hobson; Bethlehem Steel Corp., Burns Harbor Plant, Chesterton, IN
L.W. Leonard and R. Hawkins; Inland Steel Flat Products Co., Inland Steel, East Chicago, IN
R. Hancock; Leco Corp., St. Joseph, MI
J.M. Hlebek; LTV Steel Co., Indiana Harbor Works, East Chicago, IN
J.H. Morris and S. Forese; Lukens Steel Co., Coatesville, PA

REFERENCES

[1] Taylor, B.N., "Guide for the Use of the International System of Units (SI)," NIST Special Publication 811, 1995 Ed., (April 1995).

[2] *Guide to the Expression of Uncertainty in Measurement*, ISBN 92-67-10188-9, lst Ed. ISO, Geneva, Switzerland, (1993): see also Taylor, B.N. and Kuyatt, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results," NIST Technical Note 1297, U.S. Government Printing Office, Washington DC, (1994).