



# National Institute of Standards & Technology

## Certificate of Analysis

### Standard Reference Material® 1772

#### S-7 Tool Steel

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

This Standard Reference Material (SRM) is in the form of a disk approximately 34 mm (1 3/8 in) in diameter and 19 mm (3/4 in) thick and is intended primarily for use in optical emission and x-ray spectrometric methods of analysis. Material from the same lot is available in the form of chips as SRM 2172.

The certified values for ten elements are listed in Table 1. The noncertified values for an additional six elements are provided in Table 2. for information only. All values are reported as mass fractions [1].

Table 1. Certified Mass Fractions ( $w_b$ ) with Uncertainties and Methods

Element	$w_b$ (in %)	Methods
Carbon	0.477 ± 0.006	COMB-IR
Chromium	3.10 ± 0.08	DCP, ICP, TITR
Copper	0.083 ± 0.004	DCP, FAAS, ICP
Manganese	0.61 ± 0.01	DCP, FAAS, ICP, TITR
Molybdenum	1.39 ± 0.04	DCP, FAAS, ICP, MAS
Nickel	0.105 ± 0.001	DCP, FAAS, ICP
Phosphorus	0.008 ± 0.002	DCP, ICP, MAS
Silicon	0.264 ± 0.003	DCP, FAAS, GRAV, ICP
Sulfur	0.0031 ± 0.0007	COMB-IR
Vanadium	0.236 ± 0.002	DCP, FAAS, ICP

The uncertainty listed for each certified value is expressed as the “combined uncertainty” calculated according to the ISO Guide [2]. Each value listed is the 95 % confidence limit of the “true value”, and is intended to represent the combined effect of uncertainty components associated with various analytical factors, such as method imprecision, possible systematic errors among methods, and material variability.

#### Methods

COMB-IR	Combustion-infrared detection
DCP	Direct current plasma atomic emission spectrometry
FAAS	Flame atomic absorption spectrometry
GRAV	Gravimetry
ICP	Inductively coupled plasma atomic emission spectrometry
MAS	Molecular absorption spectrometry (spectrophotometry)
TITR	Titrimetry

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

Gaithersburg, MD 20899  
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Standard Reference Materials Program

Statistical analysis was provided by L.M. Gill and L. Alvarez-Rojas of the NIST Statistical Engineering Division.

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

Elements other than those certified are present in this material as indicated below. These values are not certified, but are given as additional information on the composition of SRM 1772.

Table 2. Noncertified Mass Fractions ( $w_B$ )

Element	$w_B$ (in %)
Boron	<0.001
Calcium	0.001
Cobalt	0.007
Lead	<0.001
Tin	0.008
Tungsten	0.002

## PLANNING, PREPARATION, TESTING, AND ANALYSIS

The material for this SRM was provided by Lukens Steel Co., Coatesville, PA.

Homogeneity testing was performed by J.H. Morris, Lukens Steel Co., Coatesville, PA.

Cooperative analyses for certification were performed in the following laboratories:

Allegheny Ludlum Steel Corp., Technical Center, Brackenridge, PA; R.M. Crain, S.A. Bissell-Seymour, C.M. Bottegal-Farrell, J.L. Fleeger and C.C. Gabrielli.

Armco Research and Technology, Middletown, OH; H.P. Vail and T.M. Minor.

Bethlehem Steel Corp., Homer Research Laboratories, Bethlehem, PA; D.A. Flinchbaugh, T.A. Klotz, and J.G. Matyas.

General Motors Corp., NAO Research and Development Center, Warren, MI; N.M. Potter, D.F. Esch, and T.J. Chapaton.

LTV Steel Co., Indiana Harbor Works, East Chicago, IN; J.M. Hlebek, R. Isenbarger, E. Withrow, P. Logsdon, D. Dotson, A. Shoemaker, and R. Behary.

## 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, 1st 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).