# National Institute of Standards & Technology

# Certificate

## Standard Reference Material® 1006d

### Smoke Density Chamber Standard for Non-Flaming Exposure Condition

This Standard Reference Material (SRM) consists of paper sheets, principally α-cellulose, derived from wood chips. The SRM is intended primarily for checking the operation of smoke density chambers under non-flaming exposure conditions in accordance with the prescribed calibration and standardization techniques outlined in the ASTM Method E 662-95 [1] and NFPA 258 [2]. A unit of SRM 1006d consists of nine single-layer sheets, each approximately 172 mm × 254 mm × 1.23 mm thick.

The certified value [3] and expanded uncertainty [4] for maximum specific optical density of a single-layer thickness is:

$D_m = 210 \pm 18$ (without correction for window deposit)
$D_{m\,corr.} = 193 \pm 20$

**Certified Values:** The certified values and uncertainties are the result of 30 tests on representative **single**-layer thickness specimens of the SRM lot. A certified value is a value for which NIST has the highest confidence in its accuracy in that all known or suspected sources of bias have been investigated or taken into account [3]. A **single** sheet approximately 76.2 × mm × 76.2 mm × 1.23 mm thick was used for each test. The series of 30 tests resulted in a mean maximum specific optical density, $D_m$, of 210 with a standard deviation of 8, when uncorrected for window deposit, and a mean corrected maximum specific optical density, $D_{m\,corr.}$, of 193 with a standard deviation of 9.

The uncertainty analysis included component standard uncertainties for repeatability, chart recorder reading, pathlength, sample thickness, distance from heater to sample, photometric system, radiant flux, sample area, chamber volume, chamber temperature, and chamber pressure. After estimating uncertainties by either Type A or B analysis, the uncertainties were combined in quadrature to yield the combined standard uncertainty. Multiplying the combined standard uncertainty by a coverage factor of two results in the expanded uncertainty which corresponds to a 95 % confidence interval (2σ). The total expanded uncertainties for $D_m$ and $D_{m\,corr.}$ were 18 and 20, respectively.

**Expiration of Certification:** The certification of **SRM 1006d** is valid **indefinitely**, within the measurement uncertainty specified, provided the SRM is handled and stored in accordance with instructions given in this certificate (see "Instructions for Handling, Storage, and Use"). The certification is nullified if the SRM is damaged, contaminated, or otherwise modified.

**Maintenance of SRM Certification:** NIST will monitor this SRM over the period of its certification. If substantive technical changes occur that affect the certification of this SRM, before the expiration of the certificate, NIST will notify the purchaser. Registration (see attached sheet) will facilitate notification.

Engineering testing and statistical analysis leading to the certification of this SRM were performed by N.P. Bryner, J. Lee, and R.L. Vettori of the NIST Fire Safety Engineering Division.

Support aspects involved in the issuance of this SRM were coordinated through the NIST Measurement Services Division.

Anthony P. Hamins, Chief
Fire Research Division

Gaithersburg, MD 20899
Certificate Issue Date: 07 March 2011
*Certificate Revision History on Last Page.*

Robert L. Watters, Jr., Chief
Measurement Services Division

## INSTRUCTIONS FOR HANDLING, STORAGE, AND USE

This material degrades with exposure to humidity and light. If exposure has occurred or is suspected, discontinue use. Prior to use, the material must be dried for 24 h at 60 °C and then conditioned to equilibrium at 23 °C ± 3 °C and 50 % ± 5 % relative humidity. SRM 1006d is packaged in a resealable light-resistant bag, purged with nitrogen to protect against humidity and light. Any unused sheets should be kept in the original packaging and should be stored in a cool, dry environment, or in a manner that assures protection against humidity and light.

## SOURCE, PREPARATION, AND ANALYSIS

Tests of optical density were conducted in a commercially available smoke density chamber. Smoke density measurements were made under non-flaming exposure conditions in accordance with the detailed procedures given in ASTM Standard E 662-95 [1] and in NFPA Standard 258 [2].

## REFERENCES


[1] ASTM E 662-95; *Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials*; Annual Book of Standards, Vol. 04.07, ASTM: West Conshohocken, PA (1995).

[2] NFPA Standard 258; *Standard Research Test Method for Determining Smoke Generation of Solid Materials*; 1997 ed.; NFPA: Quincy, MA (1997).

[3] May, W.; Parris, R.; Beck, C.; Fassett, J.; Greenberg, R.; Guenther, F.; Kramer, G.; Wise, S.; Gills, T.; Colbert, J.; Gettings, R.; MacDonald, B.; *Definitions of Terms and Modes Used at NIST for Value-Assignment of Reference Materials for Chemical Measurements;* NIST Special Publication 260-136; U.S. Government Printing Office: Gaithersburg, MD (2000); available at http://www.nist.gov/srm/publications.cfm (accessed Mar 2011).

[4] JCGM 100:2008; *Evaluation of Measurement Data — Guide to the Expression of Uncertainty in Measurement* (ISO GUM 1995 with Minor Corrections); Joint Committee for Guides in Metrology (JCGM) (2008); available at http://www.bipm.org/utils/common/documents/jcgm/JCGM_100_2008_E.pdf (accessed Mar 2011); see also Taylor, B.N.; 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); available at http://physics.nist.gov/Pubs/ (accessed Mar 2011).



**Certificate Revision History:** 07 March 2011(This revision includes an update to the sheet thickness measurement and other minor editorial revisions.); 19 October 1999 (editorial revision); 27 August 1999 (original certificate date).


*Users of this SRM should ensure that the Certificate of Analysis in their possession is current. This can be accomplished by contacting the SRM Program: telephone (301) 975-2200, fax (301) 926-4751; e-mail srminfo@nist.gov, or via the Internet at http://www.nist.gov/srm.*