National Institute of Standards and Technology
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Reference Material 8044
Common Commercial Asbestos: Chrysotile
REFERENCE MATERIAL INFORMATION SHEET

Purpose: This reference material (RM) is intended for harmonizing optical microscopy methods used in the identification of chrysotile asbestos in bulk materials, specifically manufactured building materials.

Description: A unit of RM 8044 consists of one bottle of loosely packed mine-grade chrysotile asbestos. Each bottle contains approximately 2.6 g of material.

Non-Certified Values: Non-certified values are suitable for use in method development, method harmonization, and process control but do not provide metrological traceability to the International System of Units (SI) or other higher-order reference system [1]. Non-certified refractive index values are provided below.

	Refractive Index[(a)]	
Wavelength (nm)	Parallel (α')	Perpendicular (γ')
589.3	1.548 ± 0.006	1.556 ± 0.006
480	1.557 ± 0.006	1.565 ± 0.006
500	1.555 ± 0.006	1.563 ± 0.006
520	1.553 ± 0.006	1.561 ± 0.006
540	1.551 ± 0.006	1.559 ± 0.006
560	1.550 ± 0.006	1.558 ± 0.006
580	1.548 ± 0.006	1.556 ± 0.006
600	1.547 ± 0.006	1.555 ± 0.006
620	1.546 ± 0.006	1.554 ± 0.006

[(a)] Values are expressed as $x \pm U_{95\%}(x)$, where x is the non-certified value and $U_{95\%}(x)$ is the expanded uncertainty of the non-certified value. The expanded uncertainties were computed as simultaneous tolerance interval values designed to cover 95 % of the refractive index values measured at the nominal wavelength at a 95 % confidence level [2,3]. The uncertainties reported do not take into account the internal correlation associated with the measurements on each individual fiber that is characteristic of these particular dispersion curves.

Period of Validity: The non-certified values are valid within the measurement uncertainty specified until **24 August 2029.** The value assignments are nullified if the material is stored or used improperly, damaged, contaminated, or otherwise modified.

Maintenance of Non-Certified Value: NIST will monitor this material to the end of its period of validity. If substantive technical changes occur that affect the non-certified values during this period, NIST will update this Reference Material Information Sheet. Before making use of any of the values delivered by this material, users should obtain the most recent version of this documentation, available free of charge through the https://www.nist.gov/srm website.

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Safety: RM 8044 contains asbestos which is a known carcinogen. The primary route of exposure is through inhalation. The bottle containing RM 8044 should be opened and used under conditions which prevent inhalation, and waste materials should be disposed of properly. Please see Safety Data Sheet.

Storage: The original unopened bottle of RM 8044 should be stored at room temperature (20 °C ± 5 °C). An open bottle can be reused until the material reaches its expiration date, provided that the open bottle is resealed and stored at room temperature (20 °C ± 5 °C).

Use: Tweezers/forceps or similar tools should be used to extract a visible amount of fibrous material from the opened bottle of RM 8044 for dispersal in immersion liquid on a glass microscope slide for observation under polarized light microscopy (PLM). A minimum of 10 fibers should be analyzed per preparation to determine average values of refractive index. Differences in refractive index among fibers in each preparation can be observed.

Source and Preparation: Mine-grade chrysotile asbestos was purchased in the late 1980s under contract to NIST by Research Triangle Institute (RTI), Research Triangle Park, from the Ontario Research Foundation in Canada, and was held in the asbestos repository at RTI. The source locality of the chrysotile was an unspecified asbestos mine in Canada. This material was previously subsampled to produce SRMs 1866, 1866a, and 1866b. Fresh subsamples were extracted for RM 8044 and packaged at NIST. The identification of the primary component as chrysotile was accomplished through x-ray diffraction analysis (XRD) with minor (< 5 % mass fraction) magnetite (Fe_3O_4) identified as an accessory component.

Analysis: Refractive indices were measured parallel (γ') and perpendicular (α') to fiber elongation using PLM and a variable-wavelength immersion technique [4].

Additional Information: Additional optical properties observed during PLM analysis and relevant to asbestos analysis include 1) low birefringence, 2) parallel or wavy extinction, 3) a positive sign of elongation, and 4) an absence of color. The sample displays an asbestiform habit defined under observation by PLM as 1) mean aspect ratios ranging from 20:1 to 100:1 or higher for fibers longer than 5 μm, 2) very thin fibrils, usually less than 0.5 μm in width, 3) parallel fibers occurring in bundles, 4) fiber bundles displaying splayed ends , and 5) fibers showing curvature.

REFERENCES

[1] Beauchamp, C.R.; Camara, J.E.; Carney, J.; Choquette, S.J.; Cole, K.D.; DeRose, P.C.; Duewer, D.L.; Epstein, M.S.; Kline, M.C.; Lippa, K.A.; Lucon, E.; Molloy, J.; Nelson, M.A.; Phinney, K.W.; Polakoski, M.; Possolo, A.; Sander, L.C.; Schiel, J.E.; Sharpless, K.E.; Toman, B.; Winchester, M.R.; Windover, D.; *Metrological Tools for the Reference Materials and Reference Instruments of the NIST Material Measurement Laboratory*; NIST Special Publication (NIST SP) 260-136, 2021 edition; U.S. Government Printing Office: Washington, DC (2021); available at https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.260-136-2021.pdf (accessed Oct 2021).

[2] Vangel, M.G.; *A User's Guide to RECIPE: A FORTRAN Program for Determining One-Sided Tolerance Limits for Mixed Models with Two Components of Variance Version 1.0* (1994) available at https://www.itl.nist.gov/div898/software/recipe/recidoc.pdf (accessed Oct 2021).

[3] MIL-HDBK-17-1F; *Composite Materials Handbook, Vol. 1: Polymer Matrix Composites Guidelines for Characterization of Structural Materials*; Department of Defense Handbook, Vol. 1, pp. 8-1–8-112 (2002).

[4] Verkouteren, J.R.; Steel, E.B.; Windsor, E.S.; Phelps, J.M.; *Accuracy of the Double Variation Technique of Refractive Index Measurement*; J. Res. Natl Inst Stand Technol, Vol. 97, pp. 693–705 (1992).

Certain commercial equipment, instruments, or materials may be identified in this Reference Material Information Sheet to adequately specify the experimental procedure. Such identification does not imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the materials or equipment identified are necessarily the best available for the purpose.

Users of this RM should ensure that the Reference Material Information Sheet in their possession is current. This can be accomplished by contacting the Office of Reference Materials 100 Bureau Drive, Stop 2300, Gaithersburg, MD 20899-2300; telephone (301) 975-2200; e-mail srminfo@nist.gov; or the Internet at https://www.nist.gov/srm.

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