

Standard Reference Material[®] 706a
Polystyrene
(Broad Molecular Mass Distribution)
CERTIFICATE

Purpose: The certified values delivered by this Standard Reference Material (SRM) are intended for calibrating and evaluating performance of instruments used to determine the molar mass and molar mass distribution.

Description: A unit of SRM 706a consists of approximately 18 g of polystyrene pellets. Each pellet weighs approximately 80 mg.

Certified Value: The certified value for mass average molar mass (M_w) is based on original results from light scattering and ultracentrifugation measurements on SRM 706 [1,2] and a remeasurement of SRM 706a using light scattering [3]. The certified value represents the highest level of confidence NIST has in its accuracy in that all known or suspected sources of bias have been fully investigated or taken into account [4]. Metrological traceability is the SI unit mole.

The certified measurement uncertainty is expressed as a combined expanded uncertainty with a coverage factor $k = 2$, calculated according to the ISO/JCGM and NIST Guides [5]. Type A and Type B contributions to the expanded uncertainty of the certified molar mass include the uncertainties in the light scattering method due to the Rayleigh ratio of the scattering standard, optical alignment, and calibration of the differential refractometer.

Mass Average Molar Mass (M_w): $2.85 \times 10^5 \text{ g/mol} \pm 0.23 \times 10^5 \text{ g/mol}$

^(a) Expressed as molar mass, previously expressed as molecular weight [6].

Non-Certified Values: Non-certified values are provided in Appendix A.

Period of Validity: The certified value delivered by **SRM 706a** is valid within the measurement uncertainty specified until **20 January 2031**. The certified value is nullified if the material is stored or used improperly, damaged, contaminated, or otherwise modified.

Maintenance of Certified Value: NIST will monitor this SRM over the period of its validity. If substantive technical changes occur that affect the certification, NIST will issue an amended certificate through the NIST SRM website (<https://www.nist.gov/srm>). Before making use of any value delivered by this material, users should verify they have the most recent version of this documentation, available through the NIST SRM website (<https://www.nist.gov/srm>).

Safety: Consult the Safety Data Sheet (SDS) for hazard information.

Storage: The SRM should be stored in the original bottle with the lid tightly closed under normal laboratory conditions (nominally 22 °C ± 5 °C).

Use: Additional information concerning the preparation, purity, and homogeneity of SRM 706a is contained in reference 2 and is consistent in the testing and recertification of SRM 706a in reference 3.

Homogeneity and Characterization: The homogeneity of SRM 706a was tested using size exclusion chromatography (SEC) analysis of solutions in tetrahydrofuran at 30 °C. The characterization of this polymer is described in reference 3. SRM 706a is a reblending and bottling of the remaining stock of polystyrene used to produce SRM 706.

The SRM 706 polystyrene was originally prepared by thermal polymerization of styrene at 140 °C to 37 % conversion. Ash content is less than 0.001 %. Volatile content is approximately 0.8 %. Determinations of molar mass and intrinsic viscosity are based on the mass of the polystyrene pellets uncorrected for volatiles.

REFERENCES

- [1] SRM 706; *Polystyrene (Broad Molecular Weight Distribution)*; National Bureau of Standards; U.S. Department of Commerce: Washington, DC (1967); available at https://shop.nist.gov/ccrz__CCPage?pageKey=SRMArchive&cclcl=en_US (accessed Jul 2026).
- [2] McIntyre, D.; *Preparation, Purity, and Homogeneity of NBS Standard Samples 705 and 706, Polystyrene*; J. Res. Natl. Bur. Stand., Vol. 71A, No. 1, pp. 43–47 (1967).
- [3] Guttman, C.M.; Blair, W.R.; Maurey, J.R.; *Recertification of SRM 706a, a Polystyrene*; NISTIR 6091; NIST, U.S. Department of Commerce: Gaithersburg, MD (1998).
- [4] 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 Jul 2026).
- [5] JCGM 100:2008; *Evaluation of Measurement Data — Guide to the Expression of Uncertainty in Measurement*; Joint Committee for Guides in Metrology (JCGM) (2008); available at <https://www.bipm.org/en/committees/jc/jcgm/publications> (accessed Jul 2026); 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 <https://www.nist.gov/pml/nist-technical-note-1297> (accessed Jul 2026).
- [6] Thompson, A.; Taylor, B.N.; *Guide for the Use of the International System of Units (SI)*; NIST Special Publication 811; U.S. Government Printing Office: Washington, DC (2008); available at <https://www.nist.gov/pml/special-publication-811> (accessed Jul 2026).

Certificate Revision History: 14 July 2026 (Format update; editorial changes); 16 January 2026 (Change of expiration date; editorial changes); 12 January 2021 (Change of expiration date; editorial changes); 09 February 2016 (Change of expiration date; editorial changes); 29 August 2011 (Extension of the certification period; editorial changes); 17 November 2003 (This revision reflects a change in the certification expiration date); 02 September 1998 (Original certificate date).

Certain commercial equipment, instruments, or materials may be identified in this Certificate 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 SRM should ensure that the Certificate 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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APPENDIX A

Non-Certified Values: A non-certified value is the best estimate of the true value; however, all known or suspected sources of bias have not been fully investigated [4]. The uncertainties in the non-certified values for intrinsic viscosity are expressed as the standard deviation of the mean. The non-certified values for intrinsic viscosity were determined by measurements made on SRM 706 in the solvent benzene at 25 °C and in cyclohexane at 35 °C. The measurand is the intrinsic viscosities, listed in the table below, as determined by the methods indicated in references 1 and 2. Non-certified values do not provide traceability to the International System of Units (SI) or other higher order reference system.

Intrinsic Viscosity [η], in benzene at 25 °C:	93.70 mL/g $\pm$ 0.19 mL/g
Intrinsic Viscosity [η], in cyclohexane at 35 °C:	39.50 mL/g $\pm$ 0.10 mL/g

Period of Validity: The non-certified values are valid within the measurement uncertainty specified until **20 January 2031**. The value assignments are nullified if the material is stored or used improperly, damaged, contaminated, or otherwise modified.

Maintenance of Non-Certified Values: 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 certificate. Before making use of any of the values delivered by this material, users should verify they have the most recent version of this documentation, available through the NIST SRM website (<https://www.nist.gov/srm>).

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