



# National Institute of Standards & Technology

## Certificate

### Standard Reference Material<sup>®</sup> 706

#### Polystyrene (Broad Molecular Weight Distribution)

This Standard Reference Material (SRM) is intended for use in the calibration of instruments used in polymer science and technology for the determination of molecular weight. This SRM is provided in the form of pellets in an 18 g unit.

Property	Value	Standard deviation of the mean	Degrees of freedom
Weight-average molecular weight, $M_w$ , g/mol:			
Measured by light scattering	257,800 <sup>a</sup>	930	12
Measured by sedimentation equilibrium	288,100 <sup>a</sup>	9600	4
Limiting viscosity number (intrinsic viscosity), mL/g:			
at 25 °C in benzene	93.7 <sup>a</sup>	0.19	17
at 35 °C in cyclohexane	39.5 <sup>b</sup>	0.10	4
Ratios of molecular weight (Based on fractionation)		$M_z:M_w:M_n = 2.9:2.1:1$	

<sup>a</sup>The value reported includes results from the pooled sample and from a separate study made to determine possible heterogeneity of the lot. No evidence was found of additional variability from location to location. The standard deviation of the mean is based on the combined data.

<sup>b</sup>Average of individual determinations made on a pooled sample combining portions of material taken from the entire lot.

*This certificate has undergone editorial revision to reflect program and organizational changes at NIST and at the Department of Commerce. No attempt was made to reevaluate the certificate values or any technical data presented on this certificate.*

Certification measurements were made in the NIST Polymer Science Division by D. McIntyre.

The support aspects involved in the issuance of this SRM were coordinated through the Standard Reference Materials Program by T.W. Mears. Revision of this certificate was coordinated through the Standard Reference Materials Program by J.C. Colbert.

Gaithersburg, MD 20899  
April 17, 1995  
(Revision of certificate dated 2-19-79)

Thomas E. Gills, Chief  
Standard Reference Materials Program

**Material Characterizations:** The polystyrene sample was 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 molecular weight and intrinsic viscosity are based on the sample weights of the polystyrene pellets uncorrected for volatiles. Each pellet weighs approximately 80 mg. Several pellets were used in all above determinations.

Osmotic pressure measurements with # 600 gel cellophane membranes gave a number-average molecular weight of 136,500. The true number-average molecular weight is not likely to exceed this value. The light scattering and sedimentation molecular weight determinations were calculated using the following constants for polystyrene-cyclohexane solutions at 35 °C: 0.1705 mL/g for the refractive index increment and 0.930 ml/g for the partial specific volume. The maximum rate of shear in the Ubbelohde viscometers used to determine the intrinsic viscosities was about 1500 s<sup>-1</sup> for water. The z-average, ( $M_z$ ), weight average, ( $M_w$ ), and number-average, ( $M_n$ ), molecular weight ratios are based upon a complete viscometric analysis of 41 fractions and a summation assuming uniformly distributed fractions.

Additional information concerning the preparation, purity, and homogeneity of SRM 706 is contained in reference [1].

#### REFERENCE

- [1] Journal of Research of the National Bureau of Standards, 71A, No. 1, 43 (1967).