U. S. Department of Commerce
Maurice H. Stans
Secretary

National Bureau of Standards
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National Bureau of Standards

Certificate

Standard Reference Material 705

Polystyrene

(Narrow Molecular Weight Distribution)

Donald McIntyre

	Number of Determinations	Average	Standard Deviation of Average
Number-Average Molecular Weight (Measured by osmotic pressure)	12	170,900**	580
Weight-Average Molecular Weight (Measured by light scattering)	9	179,300*	740
Weight-Average Molecular Weight (Measured by sedimentation equilibrium)	22	189,800*	2,100
Limiting Viscosity Number (ml/g) (Intrinsic viscosity)			
Benzene, 25 °C	5	74.3*	0.18
Benzene, 35 °C	13	74.5***	0.23
Cyclohexane, 35°C	6	35.4*	0.24
Ratios of Molecular Weight (Based on fractionation)		$M_z:M_w:M_n = 1.12:1.07:1$	

*Average of individual determinations made on a pooled sample combining portions of material taken from the entire lot.

**The average includes results from the pooled sample and from a separate study made to determine possible heterogeneity of the lot. It was found that samples taken from different locations showed slightly more variability than samples taken from adjacent locations. The standard deviation of the reported average includes the effect of lot heterogeneity.

***The average is obtained from a study made on samples from six locations to determine possible heterogeneity of the lot. It was found that samples taken from different locations showed slightly more variability than samples taken from adjacent locations. The standard deviation of the reported average includes the effect of lot heterogeneity.

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J. Paul Cali, Chief
Office of Standard Reference Materials

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The polystyrene sample was prepared by the polymerization of styrene in benzene using butyllithium as an initiator. Ash content is 0.05% of sample. Volatile content is about 0.5%. Determinations of molecular weight and intrinsic viscosity are based on sample weights of the polystyrene pellets uncorrected for volatiles. Each pellet weighs approximately 10 mg. Several pellets were always used in the above determinations.

The osmotic pressure measurements were made with #600 gel cellophane membranes. 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 at 546 nm 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 sec^{-1} 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 and selected osmometric analysis of 36 fractions.