

Certified Reference Material

BAM-P011

Molar mass and intrinsic viscosity of Polystyrene

Certified Values

Characteristic (method specific)	M_w in g/mol	Uncertainty $U^{(3)}$ in g/mol
Molar mass by LS ¹⁾	286,000	4,000
Molar mass by SEC ²⁾	284,000	9,000
Intrinsic viscosity by viscometry	$\eta_{30^\circ\text{C, THF}}$ in mL/g	in mL/g
	88.7	0.8

¹⁾ Light scattering, Rayleigh-ratio $R_\Theta = 1.406 \text{ E-}5 \text{ cm}^{-1}$ at 633 nm in toluene

²⁾ Size exclusion chromatography

³⁾ U expressed as expanded uncertainty (coverage factor $k = 2$)

Informative Values

derived from certified molar mass by SEC

Characteristic (SEC specific)	Molar Mass in g/mol	Uncertainty $U^{(3)}$ in g/mol
Number-averaged M_n	122,000	7,000
Z-averaged M_z	473,000	14,000
M at peak maximum M_p	256,000	11,000
Ratio	- no unit -	- no unit -
M_w/M_n	2.33	0.02

This certificate is valid for 5 years after date of shipment considering the storage instructions given below.

Description of the Material

The Certified Reference Material BAM-P011 is distributed in packaging sizes of 1 g, 2 g, 5 g and 10 g. The weight of single pellets of the polymer material is approximately 20 mg.

Intended Use

BAM-P011 is primarily intended for calibration and performance evaluation of instruments used to determine the molar mass and the molar mass distribution of polymers.

Storage

This material should be stored at dry and light protected conditions below +7 °C.

Experimental Conditions

Tetrahydrofuran (THF) was used as the solvent of the polymer in all experiments.

BAM light scattering investigations were carried out at 25 °C using a Multi Angle Laser Light Scattering Photometer (MALS). The LS values correspond to a Rayleigh-ratio $R_{\theta} = 1.406 \text{ E-5 cm}^{-1}$ at 633 nm in toluene at 25 °C.

BAM tests by means of Size Exclusion Chromatography (SEC) were performed and evaluated according to ISO 13885-1 using THF as eluent at 30 °C. For SEC calibration polystyrene samples with narrow molar mass distribution were characterized by LS and coupling SEC with LS. The SEC-LS Debye plot M_p values were used for SEC calibration.

Viscosity measurements were performed at BAM according to DIN 51562-1 using an Ubbelohde type viscometer and THF at 30 °C.

Homogeneity of the material was tested using SEC, described in more detail in the certification report, which is available on request.

References

1. U. Just, St. Weidner, Certification Report of Reference Material BAM-P011 – Polystyrene http://www.rm-certificates.bam.de/en/certificates/polymer_materials/index.htm
2. Guidelines for the production of BAM reference materials, BAM, Berlin 2006 <http://www.bam.de/en/fachthemen/referenzmaterialien/index.htm>
3. ISO 13885–1 (GPC using tetrahydrofuran (THF) as eluent)
4. DIN 51562–1 (Viscometry: Determination of kinematic viscosity using a Ubbelohde – Viscometer, Part 1: Design and realisation of measurements)

BAM Bundesanstalt für Materialforschung und -prüfung

D-12200 Berlin, Germany, December 2007

Date of shipment:

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