

National Institute of Advanced Industrial Science and Technology

## National Metrology Institute of Japan



## Reference Material Report

NMIJ RM 5009-a  
No. +++

Polystyrene 8500

This reference material (RM) is produced in accordance with the NMIJ's management system and is in compliance with ISO 17034 and ISO/IEC 17025. This RM is intended for use in control of the precision of analyses as well as validation of analytical methods and instruments for the determination of molecular weight distribution of polymers.

**Indicative Value**

The indicative value of number-average molecular weight  $M_n$  is given in the table below. The uncertainty of the indicative value is the half-width of the expanded uncertainty interval calculated using a coverage factor ( $k$ ) of 2, which gives a level of confidence of approximately 95 %.

	Indicative value	Expanded uncertainty
Number-average Molecular Weight, $M_n$	8570	190

**Analysis**

The indicative value was determined using the matrix-assisted laser desorption and ionization time-of-flight mass spectrometry (MALDI-TOFMS). The molecular weight distribution was calculated from the distribution of peak area fraction which was determined by the MALDI-TOFMS spectra, was corrected for mass discrimination effect. The molecular weight of each constituent of this RM was calculated using "Atomic Weights of the Elements 2007" published by IUPAC.<sup>1)</sup> The correction for the mass discrimination effect was performed using a correction model expressed as an exponential function which was validated by a series of MALDI-TOFMS measurements for mixtures of monodisperse polystyrenes with different molecular weights.

1) IUPAC Inorganic Chemistry Division, CIAAW : Atomic Weights of the Elements 2007. *Pure Appl. Chem.*, 2009, **81**, 2131.

**Expiration of Report**

The report of this RM is valid until 31 March 2021, provided that the material remains unopened and is stored in accordance with the storage instructions given in this report.

**Sample Form**

This RM is in the form of a white polystyrene powder. This RM of ca. 0.3 g in net volume is kept in an amber glass vial.

**Homogeneity**

The homogeneity of this RM was evaluated by the SEC analysis for 10 vials sampled randomly from the total of 320 vials. The analysis of the variance demonstrated the homogeneity and no differences among the vials.

**Instructions for Storage**

This RM should be stored at a temperature between 5 °C and 35 °C in the original vial with the lid tightly closed, and shielded from light.

**Instructions for Use**

This RM is for laboratory use only. It should be used promptly as soon as possible once the vial is opened

**Precautions for Handling**

Dispose of this RM in accordance with all the relevant laws regarding waste handling and management. Refer to the safety data sheet (SDS) on this RM before use.

**Preparation**

The polystyrene was synthesized by the anionic polymerization with a sec-butyl group as an initiator and with a proton as terminator for the polymerization.

**Technical Information**

It is well known that observed value of  $M_n$  is varied, depending on the MALDI-TOFMS experimental conditions. Due to the mass discrimination effect, MALDI-TOFMS measurements of this RM do not always give the indicative value reported above. In our experience, the observed values of  $M_n$  were often smaller than the indicative value by 300 to 400. The calculated weight-average molecular weight  $M_w$  of this RM is 8670. However, it should be noted that the polydisperse index  $M_w/M_n$  calculated from the indicative value of  $M_n$  and this  $M_w$  value is possibly smaller than the true value.

**NMIJ Analysts**

The technical manager for this RM is KINUGASA S. The production manager is KINUGASA S. The analysts are KINUGASA S. and KAWASAKI A.

**Information**

If substantive technical changes occur that affect the value assignment before the expiration of this report, NMIJ will notify the registered customer. Customer registration on the NMIJ Website (given below) will facilitate notification. Technical reports regarding this RM can be obtained from the contact details given below.

**Reproduction of Report**

In reproducing this report, it should be clearly indicated that the document is a copy.

April 1, 2020

ISHIMURA Kazuhiko  
President

National Institute of Advanced Industrial Science and Technology

If you have any questions about this RM, please contact  
National Institute of Advanced Industrial Science and Technology,  
National Metrology Institute of Japan,  
Center for Quality Measurement of Metrology, Reference Materials Office,  
1-1-1 Umezono, Tsukuba, Ibaraki 305-8563, Japan  
Phone: +81-29-861-4059; Fax: +81-29-861-4009, <https://unit.aist.go.jp/nmij/english/refmate/>

**Revision history**

April 1, 2015: "Metrology Management Center" was renamed to "Center for Quality Management of Metrology."