National Institute of Advanced Industrial Science and Technology

National Metrology Institute of Japan

Reference Material Certificate

NMJ CRM 5702-a
No. +++

Polystyrene Latex Nanoparticle, 150 nm

This certified reference material (CRM) was produced in accordance with the NMJ’s management system and in compliance with ISO GUIDE 34:2009 and ISO/IEC 17025:2005. This CRM is intended for use in controlling the precision of analysis and validating analytical methods and instruments for the determination of the light-scattering-intensity-averaged diameter of nanoparticles in liquid phase using dynamic light scattering (DLS).

Certified Value
The certified value of the light-scattering-averaged diameter for this CRM is given in the table below. The uncertainty of the certified 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%.

<table>
<thead>
<tr>
<th>Light-scattering-intensity-averaged diameter</th>
<th>Certified value (nm)</th>
<th>Expanded uncertainty (nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>157.9</td>
<td>2.0</td>
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</tbody>
</table>

Analysis
The light-scattering-intensity-averaged diameter is calculated from the diffusion coefficient of the polystyrene (PS) latex nanoparticle measured by DLS using the Stokes–Einstein equation. The diameter is determined as a limiting value by extrapolating apparent diameters at different scattering angles and concentrations to both zero scattering angle and zero concentration.

Metrological Traceability
In the determination of the certified value of this CRM, the value $\lambda = 632.991 \times 10^{-9}$ m was used as the wavelength of the He-Ne laser and $k_B = 1.3806488 \times 10^{-23}$ m$^2$ kg s$^{-2}$K$^{-1}$ was used as the value of the Boltzmann constant. The literature values $n = 1.332$ and $\eta = 0.8902$ g m s$^{-1}$ were used as the refractive index and viscosity of water, respectively, at 25 °C. Temperature was determined by the precise thermometer that is traceable to the Japan Calibration Service System. The certified value of this CRM is traceable to the International System of Units (SI).

Indicative Values
The indicative values of the weight-averaged diameter, the standard deviation of the distribution for the light-scattering-intensity diameter, and the standard deviation of the weight-averaged diameter of this CRM are given in the table below. The uncertainties of indicative values are the half-width of the expanded uncertainty intervals calculated using a coverage factor ($k$) of 2, which gives a level of confidence of approximately 95%.
Indicative value | Expanded uncertainty
---|---
Weight-averaged diameter | 141.0 | 9.8
Standard deviation of the light-scattering-intensity-averaged diameter distribution | 19.2 | 6.4
Standard deviation of the weight-averaged-diameter distribution | 22.7 | 4.5

Expiration of Certification
This certificate is valid for one year from the date of shipment, provided that the material is stored in accordance with the instructions given in this certificate.

Sample Form
This CRM is in the form of aqueous particle dispersion of approximately 10 mg mL\(^{-1}\) particle concentration, including 0.5 mg mL\(^{-1}\) sodium azide as a preservative. A unit of this CRM consists of approximately 10 mL in a polypropylene bottle.

Homogeneity
The homogeneity of this CRM was determined by DLS and Flow-Field-Flow Fractionation (FFFF) analysis for 10 bottles taken from 160 bottles. Analysis of variance applied to the DLS data and traces of FFFF-UV proved the homogeneity of this CRM. The homogeneity is reflected in the uncertainty of the certified value.

Instructions for Storage
The CRM should be stored at a temperature between 4 °C and 30 °C in the original, tightly closed bottle and shielded from light. The CRM must not be allowed to freeze.

Instructions for Use
This CRM is for laboratory use only under clean conditions and at a temperature between 4 °C and 30 °C. In order to prevent drying the sample solution, the cap of the bottle should be tightly closed. Take care to prevent aggregation of particles when dissolving this CRM by aqueous media. The CRM should be gently inverted several times before use.

Precautions for Handling
If the CRM comes into contact with the eyes, rinse with a large amount of running water. If the CRM comes into contact with skin, rinse with running water. If the CRM leaks, clean using paper or cloth if necessary. Dispose of the CRM according to the relevant laws. Refer to the safety data sheet (SDS) on this CRM before use.

Preparation Method
This PS latex nanoparticle suspension was purchased from Fujikura Kasei Co., Saitama, Japan.

Information
The zeta potential of this CRM is −51.3 mV at 25 °C and pH 6.7 by electrophoretic mobility measurements.

NMIJ Analysts
The technical manager for this CRM is H. Sakurai. The production manager and analyst is H. Kato.

Technical Information
Customer registration on the NMIJ Website (given below) will facilitate notification of any revision of the information given
above. Technical reports regarding this CRM can be obtained from the contact details given below.

**Reproduction of Certificate**

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

**April 1, 2015**

Ryoji Chubachi  
President
National Institute of Advanced Industrial Science and Technology

If you have any questions about this CRM, please contact:
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**Revision history**

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