

Bundesanstalt für Materialforschung und -prüfung (BAM)

Certified Reference Material

BAM-N008

Size distribution and concentration of silver nanoparticles
calculated from small-angle X-ray scattering (SAXS)

Values

Property	Value ¹	Uncertainty ² U	Certified ³	Unit
Diameter ⁴ (D)	5.8	0.5 (9%)	yes	nm
Size distribution width ⁵ (σ)	1.33	0.18 (14%)	no	nm
Number density ⁶ (N)	3.7	0.7 (19%)	no	$10^{-6} \text{ mol l}^{-1}$
Concentration ⁷ (c)	3.0	0.5 (17%)	no	g l^{-1}

¹ Values are means from values of a homogeneity study. Rounding of the values was done according to standard DIN 1333.

² Expanded uncertainties $U = k \cdot u_c$ were calculated according to ISO Guide 35 with the coverage factor $k = 2$ giving a level of confidence of approximately 95%. The value of the combined standard uncertainty u_c of the property includes an uncertainty contribution resulting from the study of homogeneities, long-term stability of the material, variation in the measurement results from a gold standard, and variation in the individual instruments.

³ Certified is labelled with "yes" for certified values, i.e., values are traceable to SI under the assumptions of the model used for interpretation of the SAXS data. Traceable is labelled as "no" for values without proven traceability.

⁴ Median value of the distribution of the diameters of the particles (for calculation see certification report, section 5.2.1).

⁵ Standard deviation of the width of the diameter size distribution (see certification report, section 5.2.1).

⁶ Number of particles per volume (certification report, section 5.2.2).

⁷ Weight concentration (certification report, section 5.2.3).

End of Validity

This certificate is valid for 12 months after dispatch.

Date of dispatch: TT.MM.JJJJ

Material Description

BAM-N008 is filled in amber narrow-mouth plastic bottles containing 5 ml of aqueous suspension of silver nanoparticles. Figure 1 displays the SAXS curve of BAM-N008.

Recommended Use

The intended purpose of BAM-N008 is the verification of analytical results obtained for determination of diameter, size distribution width, number density and mass concentration of nanoparticles in dispersion. Preferred use is quality control of particle size analysis with the SAXS method according to ISO 17867. The recommended minimum sample volume for a measurement is 50 μl . Deionized water is recommended for background measurements.

Handling

The material should be used as it is from the bottle. Before taking a sample, homogenization by manually shaking the closed bottle for 20 seconds is strongly recommended.

Transport and Storage

BAM-N008 can be shipped at ambient temperature. Upon receipt, the material should be stored in the dark at a temperature of $(20 \pm 3)^\circ\text{C}$ in its original tightly closed bottle. When handling the sample, the bottle shall be left unclosed as short as possible.

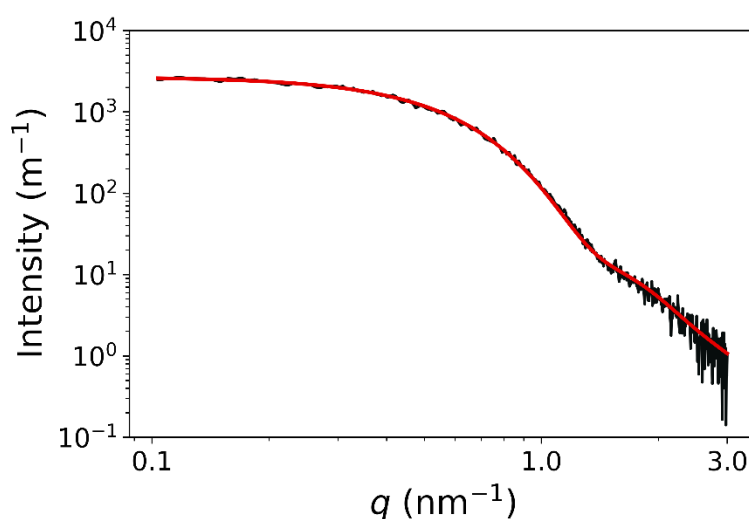


Figure 1. SAXS data and model curve (black and red line, respectively). The SAXS data are given in terms of the scattering intensity as a function of the scattering vector q . The model curve is a best fit of the data utilizing the model of solid spheres with a lognormal size distribution according to standard ISO 17867. Data for evaluation should be chosen in the q -range between 0.1 nm^{-1} and 3.0 nm^{-1} . Data outside this range should be discarded.

Metrological Traceability

The diameter of the particles is traceable to a gold standard reference material SRM 8011 (NIST, USA).

Literature

A detailed technical report describing the analysis procedures and the treatment of the analytical data used to certify BAM-N008 is available on request or can be downloaded from BAM website (<https://rrr.bam.de>).

Accepted as a BAM-CRM on May 25th 2022

Bundesanstalt für Materialforschung und -prüfung (BAM)

(Dienstsiegel/Dienststempel)

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