

CERTIFICATE OF ANALYSIS

ERM[®] - FD304

COLLOIDAL SILICA IN AQUEOUS SOLUTION		
	Equivalent spherical diameters	
	Certified value ³⁾ [nm]	Uncertainty ⁴⁾ [nm]
Scattering intensity-weighted harmonic mean diameter ¹⁾	42.1	0.6
Extinction intensity-based modal Stokes diameter ²⁾	33.0	3.0
<p>1) As obtained by dynamic light scattering (DLS) according to ISO 22412:2008 applying the method of cumulants according to ISO 13321:1996.</p> <p>2) As obtained by centrifugal liquid sedimentation (CLS) according to ISO 13318-1:2001, line-start method and using an effective particle density of 2.305 g/cm³.</p> <p>3) Unweighted mean value of the means of accepted sets of data each set being obtained in a different laboratory and with the method of determination indicated in the respective line of the table. The certified value and its uncertainty are traceable to the International System of Units (SI).</p> <p>4) The certified uncertainty is the expanded uncertainty with a coverage factor $k = 2$ corresponding to a level of confidence of about 95 % estimated in accordance with ISO/IEC Guide 98-3:2008, Guide to the Expression of Uncertainty in Measurement (GUM:1995)</p>		

This certificate is valid for one year after purchase.

Sales date:

The minimum amount of sample to be used is 170 µL for CLS and DLS and 3 µL for EM.

NOTE

European Reference Material ERM[®]-FD304 was produced and certified under the responsibility of the Institute for Reference Materials and Measurements of the European Commission's Joint Research Centre according to the principles laid down in the technical guidelines of the European Reference Materials[®] co-operation agreement between BAM-IRMM-LGC. Information on these guidelines is available on the internet (<http://www.erm-crm.org>).

Accepted as an ERM[®], Geel, January 2012

Signed: _____



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Indicative Values		
	Indicative value ²⁾ [nm]	Uncertainty ³⁾ [nm]
Number based modal diameter ¹⁾	27.8	1.5
¹⁾ As obtained by Electron Microscopy (Transmission Electron Microscopy/Scanning Electron Microscopy) ²⁾ Unweighted mean value of the means of accepted sets of data, each set being obtained in a different laboratory and/or with the method of determination indicated in the respective line of the table. The indicative value and its uncertainty are traceable to the International System of Units (SI). ³⁾ The assigned uncertainty is the expanded uncertainty with a coverage factor $k=2$ corresponding to a level of confidence of about 95 % estimated in accordance with ISO/IEC Guide 98-3:2008, Guide to the Expression of Uncertainty in Measurement (GUM:1995).		

Additional Material Information	
	Value
zeta-Potential ¹⁾	-48 mV
pH ¹⁾	8.8
¹⁾ As obtained by electrophoretic light scattering (zeta-potential) and potentiometry (pH) in the characterisation study.	

DESCRIPTION OF THE SAMPLE

ERM-FD304 consists of colloidal silica nanoparticles suspended in a water-based solution. It is available in 10 mL pre-scored amber glass ampoules containing approximately 9 mL of suspension. Besides NaOH to establish the pH values, minor amounts (< 0.1 g/kg) of Cl⁻ and SO₄²⁻ are present in the suspension.

ANALYTICAL METHODS USED FOR CERTIFICATION

The particle sizing methods used are listed below.

Dynamic light scattering (DLS) according to ISO 22412:2008 applying the method of cumulants ISO 13321:1996

Centrifugal Liquid Sedimentation (CLS) - line-start method according to ISO 13318-1:2001

Electron Microscopy: Transmission Electron Microscopy (TEM)/ Scanning Electron Microscopy (SEM)

Zeta potential and pH were determined by Electrophoretic Light Scattering (ELS) and potentiometry (pH)

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(CMS/ITRI, accreditation to ISO/IEC 17025, Taiwan Accreditation Foundation, N0688/2000.10.15.

NTRC/ITRI, accreditation to ISO/IEC 17025, Taiwan Accreditation Foundation, 1569/2006.8.10.)

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SAFETY INFORMATION

The usual laboratory safety measures apply.

This material should be handled with care. Nanoparticles might have an impact on environment and human health. Any spillage of the suspension should be handled according to the usual laboratory safety precautions.

INSTRUCTIONS FOR USE

The intended use of this material is to check the performance of instruments and/or methods that characterise the particle size distribution of nanoparticles (particle size ranging from approximately 1 nm to approximately 100 nm) suspended in a liquid medium.

Comparing an analytical result with the certified value

A result is unbiased if the combined uncertainty of measurement and certified value covers the difference between the certified value and the measurement result. (see also ERM Application Note 1; www.erm-crm.org).

Use in quality control charts

The materials can be used for quality control charts. Different CRM-units will give the same result as heterogeneity was included in the uncertainties of the certified values.

Use as a calibrant

It is not recommended to use these matrix materials as calibrants, unless the method in question requires calibration with matrix materials. If used nevertheless, the uncertainty of the certified value shall be taken into account in the final estimation of measurement uncertainty.

Before opening the ampoule, it should be gently inverted several times to ensure the homogeneity of the suspension and re-suspension of any settled particles. If some suspension is still present in the upper portion of the ampoule (the nipple), it can be removed by gently flicking the nipple with the forefinger while tilting the ampoule. The ampoule is pre-scored and can be opened by applying moderate pressure with one's

thumb to snap off the nipple. The contents of an ampoule should be used the same day as opened (except for zeta-potential and pH measurements; see below) without any dilution (except for EM studies; see below).

DLS method: The use of quartz cuvettes is recommended for the measurement. Manual adjustment of the measurement position to the middle of the cell may be needed before applying the DLS method (cumulants).

CLS method: A density of 2.305 g/cm³ was taken for the evaluation of the results. These figures should be used in laboratory calculations and instrument procedure set-up.

EM method (TEM/SEM): A drop of the sample should be put on a holder/grid; after drying at least 500 particles should be measured. If necessary the sample can be diluted with distilled water.

Zeta potential and pH should be measured immediately after opening (storage in air affects the pH and therefore also zeta potential).

STORAGE

The material shall be stored at 18 ± 5 °C. Samples should not be allowed to freeze, as this will irreversibly compromise the integrity of the material.

However, the European Commission cannot be held responsible for changes that happen during storage of the material at the customer's premises, especially of opened samples.

LEGAL NOTICE

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NOTE

A detailed technical report is available on www.irmm.jrc.be. A paper copy can be obtained from the Joint Research Centre, Institute for Reference Materials and Measurements on request.