

CERTIFICATE OF ANALYSIS

ERM[®] - FD100

COLLOIDAL SILICA IN WATER		
	Equivalent spherical diameter	
	Certified value ⁵⁾ [nm]	Uncertainty ⁶⁾ [nm]
Intensity-weighted harmonic mean diameter ¹⁾	19.0	0.6
Intensity-based modal Stokes diameter ²⁾	20.1	1.3
Number-based modal diameter ³⁾	19.4	1.3
Intensity-weighted mean diameter ⁴⁾	21.8	0.7

¹⁾ As obtained by dynamic light scattering according to ISO 22412:2008 (cumulants method).
²⁾ As obtained by centrifuge liquid sedimentation according to ISO 13318-1:2001 (line-start method); density 2.3 g/cm³.
³⁾ As obtained by electron microscopy (transmission electron microscopy/scanning electron microscopy).
⁴⁾ As obtained by small angle X-ray scattering.
⁵⁾ 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).
⁶⁾ 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, Guide to the Expression of Uncertainty in Measurement (GUM:1995), ISO, 2008.

This certificate is valid for one year after purchase.

Sales date:

The minimum amount of sample to be used is 20 μ L.

NOTE

European Reference Material ERM[®]-FD100 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>).

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Signed: _____



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Indicative Values			
	Indicative value ³⁾	Uncertainty	Unit
Equivalent spherical diameter, volume-weighted mean ¹⁾	20.4	1.6 ⁴⁾	nm
Zeta Potential ²⁾	-43	22 ⁵⁾	mV

¹⁾ As obtained by small angle X-ray scattering.
²⁾ As obtained by electrophoretic mobility.
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 indicative value and its uncertainty are traceable to the International System of Units (SI).
⁴⁾ The uncertainty is the expanded uncertainty with a coverage factor $k = 2.8$ corresponding to a level of confidence of about 95 % estimated in accordance with ISO/IEC Guide 98-3, Guide to the Expression of Uncertainty in Measurement (GUM:1995), ISO, 2008.
⁵⁾ The 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, Guide to the Expression of Uncertainty in Measurement (GUM:1995), ISO, 2008.

Additional Material Information		
	Value	Unit
Equivalent spherical diameter, volume-weighted mean ¹⁾	16.9	nm
pH ²⁾	9.7	

¹⁾ Mean of all measurements obtained using dynamic light scattering; refractive index of 1.46 for silica.
²⁾ Mean of all measurements obtained by the potentiometric method with a glass electrode.

DESCRIPTION OF THE MATERIAL

ERM-FD100 is a certified reference material and 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.

ANALYTICAL METHODS USED FOR CERTIFICATION

Dynamic light scattering (DLS)
Dynamic light scattering (DLS) - cumulants method
Centrifugal liquid sedimentation (CLS) - line-start method
Electron microscopy: transmission electron microscopy (TEM)/ scanning electron microscopy (SEM)
Small angle X-ray scattering (SAXS)
Electrophoretic mobility (ELM)
Potentiometric method with a glass electrode (pH).

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* Measurements within the scope of accreditation to ISO/IEC 17025

SAFETY INFORMATION

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

INSTRUCTIONS FOR USE

The intended use 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.

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.

DLS method: The contents of an ampoule should be used the same day as opened without any dilution when used for the 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. A refractive index of 1.46 for silica was used.

CLS method: A density of 2.3 g/cm³ and a refractive index of 1.46 were taken for the evaluation of the results. These figures should be used in laboratory calculations and for the 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.

SAXS method: Samples to be measured as received.

Zeta potential and pH should be measured immediately after opening (no storage in air).

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.erm-crm.org. A paper copy can be obtained from the Joint Research Centre, Institute for Reference Materials and Measurements on request.