LGC Standards

Excellence through measurement

Science of the very small

LGC Standards introduces reference nanomaterials range

Nanoscience aims to establish how materials behave when structured at atomic dimensions. A common definition of a nanomaterial, according to the International Standardisation Organisation, is a material which has been intentionally produced to have at least one dimension that measures between 1 and 100 nanometres.

Application of nanoscience to everyday products means that they can be made lighter, stronger, cleaner and more effective. With the increasing presence of nanomaterials in new products and processes, there has been a substantial increase in research into their manufacture, characterisation, and applications. The potential for human and environmental exposure to nanomaterials is driving research into their effects and safety.

With all testing regimes, reliable research requires the use of characterised reference materials. Investigations into the impacts and effects of nanomaterials are now supported by reference nanomaterials available from LGC Standards.

One of the most comprehensive nanomaterial research programmes is being carried out by the Organisation for Economic Co-operation and Development's (OECD) Working Party on Manufactured Nanomaterials (WPMN). The programme involves OECD member countries, as well as some non-member economies and other stakeholders to pool expertise and to fund the safety testing of specific manufactured nanomaterials, selected based on their industrial and commercial importance. This programme focuses on the implications of the use of nanomaterials for human health and environmental safety, focusing on testing and assessment methods.

The reference nanomaterials used within the OECD WPMN international testing programme[1], as released by the EUROPEAN COMMISSION JRC under the NM series are now available from LGC Standards.

The materials have been produced from a selected homogenised master batch of raw material and sub-sampled under Good Laboratory Practice (GLP) conditions. The homogeneity and stability of all the samples follow the principles of ISO Guide 34 and are continuously monitored for stability under an isochronous monitoring study scheme.

The materials have been characterised using OECD recommended test methods and may serve as:

- Performance standard materials for testing and test method development
- Control materials for safety testing
- Testing materials for quality assurance schemes and inter-laboratory comparisons

Reference nanomaterials (NM series) available from LGC Standards include:

- **Carbon nanotubes**
  Multi walled carbon nanotubes consist of multiple layers of graphite self-arranged to form a tubular shape. Such cylindrical graphitic polymeric structures have novel or improved properties that make them potentially useful in a wide variety of applications in electronics, optics and other fields of materials science.

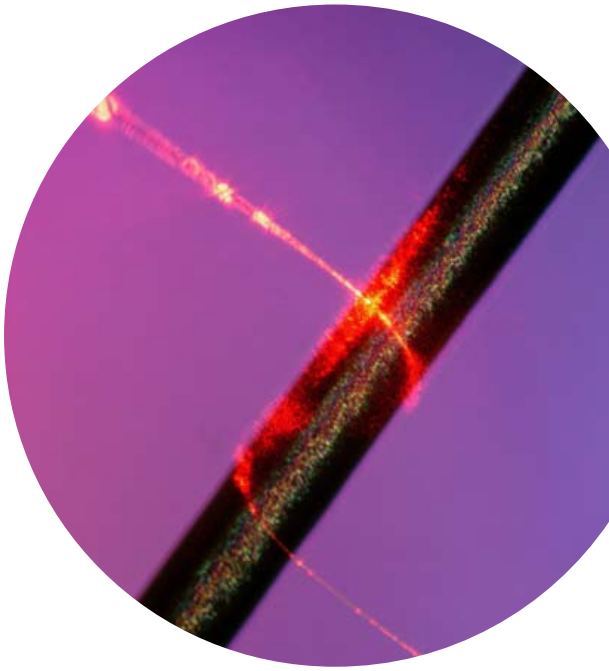
- **Silver nanoparticles**
  Nanosilver has seen increasing applications in consumer products, including food and health, water, food contact surfaces, packaging materials, clothing, disinfectants and household appliances.

- **Titanium dioxide**
  Titanium dioxide is a component of a number of consumer products such as paints, coatings, sunscreens and cosmetics and its use may extend to foodstuffs, such as application of nanoscale coatings directly on food surfaces to provide a barrier to moisture and oxygen and thus improve shelf life. Nanotitanium dioxide is also used as a photocatalyst in water treatment applications.

- **Cerium oxide**
  Ceria nanomaterial is currently used as a fuel catalyst for automobiles, in fuel cells and as a polishing agent. It has a wide range of potential applications in biomedical research and microelectronics and optics, such as in an insulating layer on silica substrates.

- **Zinc oxide**
  Nano zinc oxide is used in sunscreens and cosmetics, surface coatings, paints and outdoor furniture varnishes, and is also a promising candidate for nanoelectronics and photonics.

- **Silicon dioxide**
  Amorphous nanosilica is used in food contact surfaces and food packaging applications. Amorphous silica has been used for many years in food applications, such as in clearing of beers and wines, and as a free flowing agent in powdered soups.



A light-conducting silica nanowire wraps a beam of light around a strand of human hair.

(Image Credit: Limin Tong - Harvard University)

[1] LIST OF MANUFACTURED NANOMATERIALS AND LIST OF ENDPOINTS FOR PHASE ONE OF THE OECD TESTING PROGRAMME, ENV/JM/MONO (2008)13/REV (http://www.oecd.org/officialdocuments/displaydocumentpdf?cote=ENV/JM/MONO(2008)13/REV&doclanguage=en)

The NM series materials from LGC Standards are intended for testing purposes, single use and for research purposes only. Products are supplied with a Material Information Sheet from the European Commission JRC.

Reference data

Available information includes material identification data such as CAS number, structural formula/molecular structure, composition (including degree of purity, known impurities or additives), basic morphology and surface chemistry. Extensive data on the endpoints tested is being collated to provide further information on the material's *Physical-Chemical Properties and Material Characterization, Environmental Fate* and *Mammalian Toxicology.*

Product description	Product reference	Pack size	Particle characterisation methods
Titanium Dioxide (anatase, uncoated)	NM-101	2000 mg	Primary crystal size according to Scherrer 8 nm Primary crystal size according to XRD determination 6 nm Specific surface area according to BET 320 m²/g
Titanium Dioxide (anatase, uncoated)	NM-102	500 mg	Primary crystal size according to Scherrer 22 nm Primary crystal size according to XRD determination 20 nm Specific surface area according to BET 90 m²/g
Titanium Dioxide (rutile, hydrophobic)	NM-103	2000 mg	Primary crystal size according to Scherrer 20 nm Primary crystal size according to XRD determination 20 nm Specific surface area according to BET 60 m²/g
Titanium Dioxide (rutile, hydrophilic)	NM-104	500 mg	Primary crystal size according to Scherrer 20 nm Primary crystal size according to XRD determination 20 nm Specific surface area according to BET 60 m²/g
Titanium Dioxide (rutile-anatase, uncoated)	NM-105	250mg	Primary crystal size according to Scherrer 21 nm Primary crystal size according to XRD determination 22 nm Specific surface area according to BET 61 m²/g
Zinc Oxide (uncoated)	NM-110	2000 mg	Primary crystal size according to Horiba Light scattering 70-200 nm Primary crystal size according to XRD determination 41.5 nm Specific surface area according to BET 13 m²/g
Zinc Oxide (coated)	NM-111	2000 mg	Particle size < 200 nm (mean ca. 130 nm, range about 90 to 190 nm analyzed by Horiba Light Scattering) Primary crystal size according to XRD determination 33.8 nm Specific surface area according to BET 16 m²/g
Synthetic Amorphous Silica (precipitated)	NM-200	500 mg	Primary particles in the 10-25 nm range, particles aggregated Primary crystal size by TEM 20 nm Specific surface area according to BET 230 m²/g
Synthetic Amorphous Silica (precipitated)	NM-201	500 mg	Primary particles in the 10-25 nm range, particles aggregated Primary crystal size by TEM 20 nm
Synthetic Amorphous Silica (thermal)	NM-202	500 mg	Primary particles in the 10-25 nm range, particles aggregated Primary crystal size by TEM 20 nm
Synthetic Amorphous Silica (thermal)	NM-203	500 mg	Primary particles in the 5-30 nm range, particles aggregated Primary crystal size by TEM 20 nm Specific surface area according to BET 226 m²/g
Synthetic Amorphous Silica (precipitated)	NM-204	500 mg	Primary particles in the 10-25 nm range, particles aggregated Primary crystal size by TEM 20 nm Specific surface area according to BET 144 m²/g
Cerium (IV) Oxide (precipitated, uncoated)	NM-211	500 mg	Primary crystal size according to Scherrer 10.3 nm Specific surface area according to BET 66 m²/g
Cerium (IV) Oxide (precipitated, uncoated)	NM-212	500 mg	Primary crystal size according to Scherrer 33 nm Specific surface area according to BET 28 m²/g
Silver <20nm	NM-300K	2000 mg	Solid Contents: 10.16 weight % Particle size: 15 nm; D90 <20nm (90% < 20nm)
Ag - dispersant	NM-300K DIS	1000 mg	The material corresponds to the matrix/media/vehicle of NM 300K including all components, but without silver and serves as control material
Silver rods	NM-302	2000 mg	Solid contents: 8.3 weight % Particles size 50nm diameter, elongated, rods
Multi-walled carbon nanotubes	NM-400	250 mg	Average diameter: 9.5 nm Average length: 1.5 µm Specific surface area according to BET 280 m²/g
Multi-walled carbon nanotubes	NM-401	150 mg	Average diameter 10-30 nm Length 5-15 µm Specific surface area according to BET 300m2/g
Multi-walled carbon nanotubes	NM-402	250 mg	Average diameter: 5-15 nm Length: 0.1-10 µm Specific surface area according to BET 50-300 m²/g

Characterised reference materials

The development of certified reference materials requires standard and traceable methods to be in place. While these methods, and therefore 'certified' materials, are not in place for nanomaterials, LGC Standards' range of characterised reference materials represent the highest quality alternative for performance standards, predictive toxicity testing, reference result and hazard testing.

REACH applications

The EU REACH regulations covering the Registration, Evaluation, Authorisation, and Restriction of Chemical Substances applies to nanomaterials.

REACH requires all companies manufacturing or importing chemical substances into the European Union in quantities of one tonne or more per year to register these substances with the European Chemicals Agency. REACH also applies to some substances that are contained in 'articles' and could affect a wide range of products imported into Europe.

As stated in the REACH guidance, registration dossiers should include "Available information from assessments carried out under other international and national programmes …..Deviations from such assessments shall be justified". For nanomaterials, an important source of assessments are those carried out by the Organisation for Economic Co-operation and Development's Working Party on Manufactured Nanomaterials, using these NM series products.

For further information, or if you require substances or materials not currently listed please contact one of our local sales offices.

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