ANSI-NSP Newsletter Volume III, Issue III ● December 2017

The ANSI-NSP Newsletter provides information on nanotechnology standards and related topics of interest. Stakeholders are encouraged to submit information to the ANSI-NSP that they feel would be of interest to the larger ANSI-NSP Community.

While ANSI will be providing some of the content to be included in this newsletter, this is a community-driven project, with developers and organizations providing updates on any documents published or upcoming meetings that may be of interest to the ANSI-NSP. If you do have any information you would like to share, please feel free to forward it to hbenko@ansi.org.

For further information and updates on the Panel, please visit the ANSI-NSP Website.

WELCOME

Happy New Year! 2017 was an active year for ANSI's Nanotechnology Standards Panel. Below are two highlights:

- In February 2017, the ANSI-NSP held a meeting focused on graphene standardization. This meeting saw over 35 participants from graphene-specific industries coming together to identify what, if any, standards were needed to help support graphene's utilization and commercialization. The outcomes from February, 2017 meeting will be further considered and discussed during our next ANSI-NSP meeting, scheduled to take place later this year.

- In October, ANSI and the NSP participated in the 2nd Annual National Nanotechnology Day (10.9.2017) by creating a special webpage to recognize the efforts of those organizations involved in the development of standards for nanomaterials and nanotechnology applications. ASTM International E56 Committee, the Institute of Environmental Sciences and Technology (IEST) Nanotechnology Institute, People for the Ethical Treatment of Animals

(PETA) International Science Consortium, and TAPPI's International Nanotechnology Division, along with the U.S. Technical Advisory Groups (TAGs) to both ISO/TC 229 and IEC TC 113 all submitted case studies on their efforts to develop and promote timely and relevant standards for nanomaterials.

All of the ANSI-NSP efforts are community-driven, and are developed in response to the input from our experts. We thank you for another successful year and look forward to meeting and hearing more from you in 2018!

SAVE THE DATE: ANSI NANOTECHNOLOGY STANDARDS PANEL MEETING – MARCH 20, 2018

ANSI's Nanotechnology Standards Panel (ANSI-NSP) will be holding its next Panel meeting on March 20, 2018 in Washington, DC. The focus of this meeting will be to consider the outcomes from the February 28, 2017, ANSI-NSP meeting to further the development of graphene-related standards. For additional information or updates on how to register, please contact Heather Benko (hbenko@ansi.org). More information to be distributed shortly.

NEWS & INFORMATION

ASTM E56 Committee on Nanotechnology

ASTM E56 formed a new Subcommittee, E56.08: Nano-Enabled Medical Products, in April 2017. This Subcommittee has three work items, all led by the FDA, targeted for the regulation of drug products. These work items are:

- WK60373: *New Standard Test Method for Quantitative Measurement of the Chemoattractant Capacity of a Nanoparticulate Material In Vitro*
- WK60553: *New Standard Test Method for Evaluation of Nanoparticulate Material Internalization by Phagocytic Cells In Vitro*
- WK60554: *New Standard Test Method Detection of Nitric Oxide Production*

Interlaboratory studies are planned for each of these standards, a requirement for assignment of an ASTM standard as a Test Method. In addition, there is a new standard in the final balloting stage, *Standard Practice for Performing Electron Cryo-Microscopy of Liposomes*, also led by FDA.

In August 2017, FDA added four ASTM E56 standards to their list of recognized consensus standards for nanotechnology:

- E2859-11: *Standard Guide for Size Measurement of Nanoparticles using Atomic Force Microscopy*
- E2865-12: *Standard Guide for Measurement of Electrophoretic Mobility and Zeta Potential of Nanosized Biological Materials*

- E2834-12: *Standard Guide for Measurement of Particle Size Distribution of Nanomaterials in Suspension by Nanoparticle Tracking Analysis (NTA)*
- E2578-07 (2012): *Standard Practice for Calculation of Mean Sizes/Diameters and Standard Deviations of Particle Size Distributions*

These standards, in addition to the two E56 standards recognized in 2014, brings the total number of ASTM standards adopted for the use of nanotechnology in medical devices to six. If you are interested in learning more about the work of ASTM E56, please contact Kate Chalfin at kchalfin@astm.org.

IEC TC 113 *Nanotechnology for electrotechnical products and systems*

The following IEC TC 113 documents were published in 2017, are awaiting publication or are in development:

Published in 2017

IEC TS 62607-3-2:2017

Edition 1.0 (2017-01-10)

Nanomanufacturing - Key control characteristics - Part 3-2: Luminescent nanoparticles - Determination of mass of quantum dot dispersion

This Technical Specification, a USNC-led project, specifies a method for determining the mass of a sample of QD dispersion after the removal of impurities and surfactant ligands through heating at high temperatures.

IEC TS 62607-4-5:2017

Edition 1.0 (2017-01-12)

Nanomanufacturing - Key control characteristics - Part 4-5: Cathode nanomaterials for nano-enabled electrical energy storage - Electrochemical characterization, 3-electrode cell method

This Technical Specification provides a standardized method for the determination of electrochemical properties of cathode nanomaterials such as lithium iron phosphate (LFP) for electrical energy storage devices. This method will enable the industry to decide whether or not a cathode nanomaterial is usable, and to select a cathode nanomaterial suitable for their application.

IEC TS 80004-9:2017

Edition 1.0 (2017-01-10)

Nanotechnologies - Vocabulary - Part 9: Nano-enabled electrotechnical products and systems

This Technical Specification provides terms and definitions for electrotechnical products and systems that are reliant on nanomaterials for their essential functionalities. It is intended to facilitate communications between organizations and individuals in industry and those who interact with them.

ISO TS 80004-11:2017

Edition 1.0 (2017-06-01)

Nanotechnologies - Vocabulary - Part 11: Nanolayer, nanocoating, nanofilm, and related terms

This Technical Specification lists terms and definitions, and specifies an extensible taxonomic terminology framework for nanolayers, nanocoatings, nanofilms, and related terms in the field of nanotechnologies.

ISO TS 80004-13:2017

Edition 1.0 (2017-11-14)

Nanotechnologies - Vocabulary - Part 13: Graphene and related two-dimensional (2D) materials

This Technical Specification lists terms and definitions for graphene and related two-dimensional (2D) materials, and includes related terms naming production methods, properties and their characterization. It is intended to facilitate communication between organizations and individuals in research, industry and other interested parties and those who interact with them.

In development:

IEC TS 62565-1 ED1

Nanomanufacturing - Material specifications, Part 1 - Basic concept

This Technical Specification provides guidelines which defines and describes the system of IEC specifications for nano-enabled products used in the value adding chain of nanomanufacturing. This includes all kinds of nanomaterials and nano-subassemblies described by a consensus-based set of key control characteristics (KCCs). It explains the concept of blank detail specifications, sectional blank detail specifications and detail specifications within IEC 62565 series as well as their interaction which each other. Circulate of the first Committee Draft is expected in March, 2018.

IEC 62565-3-1 ED1

Nanomanufacturing - Material specifications - Part 3-1: Graphene - Blank detail specification

This standard, a USNC-led project, will establish a blank detail specification and format for listing essential electrical and certain other characteristics including optical, dimensional, and mechanical properties of single and few layer and functionalized graphene for use in electrotechnical applications. The CDV will be circulated in 2018.

IEC TS 62565-4-2 ED1

Nanomanufacturing - Material specifications - Part 4-2: Luminescent nanomaterials - Detail specification for general lighting and display applications

This TS, a USNC-led project, specifies the essential general and optical requirements of monodisperse luminescent nanomaterials used in general lighting and display products to enable their reliable mass production and quality control during the manufacturing process. A Draft Technical Specification has received the necessary votes for approval and publication is expected in the first quarter of 2018.

IEC TS 62607-2-4 ED1

Nanomanufacturing - Key control characteristics - Part 2-4: Carbon nanotube materials - Accuracy and repeatability of test methods for determination of resistance of individual carbon nanotubes

This Technical Specification specifies the test method for determining the resistivity and the contact resistance of an individual CNT and the dependability of the measurement. The Committee Draft is expected to be circulated in March, 2018.

IEC TS 62607-3-3 ED1

Nanomanufacturing–Key control characteristics–Part 3-3: Luminescent nanomaterials - Determination of fluorescence lifetime using Time Correlated Single Photon Counting (TCSPC)

This Technical Specification provides a standardized method for determining the fluorescence lifetime of luminescent nanomaterials using the time correlated single photon counting methods (TCSPC). The TCSPC method is suitable for testing fluorescence lifetime in the range from picoseconds to microseconds. It provides users a key control characteristic to decide whether or not luminescent nanomaterials, such as quantum dots (QDs), clusters, organic dyes etc. are usable or suitable for their application. The Committee Draft is expected to be circulated in March, 2018.

IEC TS 62607-4-6 ED1

Nanomanufacturing-Key control characteristics - Part 4-6: Nano-enabled electrical energy storage devices - Determination of carbon content for nano electrode materials, infrared absorption method

This Technical Specification describes a method for determining the carbon content in nano electrode materials with carbon concentrations ranging from 0,001 % (m/m) to 100 % (m/m) by combusting the materials in an induction furnace and performing infrared absorption spectroscopy measurement on the combustion by-products. Balloting of the Draft Technical Specification (final voting document) closed in December, 2017. Publication is expected in March, 2018.

IEC 62607-4-7 ED1

Nanomanufacturing - Key control characteristics - Part 4-7: Anode nanomaterials for nano-enabled electrical energy storage- Determination of magnetic impurities, ICP-OES method

This Technical Specification provides a method for the determination of magnetic impurities in anode nanomaterials for energy storage device using Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES), including measurement overview, reagents, apparatus, test procedures, test results and test report. It applies to the determination of the total content of magnetic impurities (iron, cobalt, chromium, and nickel) which can be attracted by magnet more than 0,02 mg/kg. A Second Committee Draft was circulated in the 4th quarter of 2017. Comments will be resolved at the next TC 113 WG11 meeting in May, 2018 in Ottawa.

IEC TS 62607-5-2 ED1

Nanomanufacturing - Key control characteristics - Part 5-2: Thin-film organic/nano electronic devices - Measuring Alternating Current characteristics

This Technical Specification specifies a standard procedure for measuring AC characteristics as a stability test based on the measurement of frequency-dependent hysteresis in current-voltage characteristics of OTFTs. Circulation of the first Committee Draft is being prepared.

IEC TS 62607-5-3 ED1

Nanomanufacturing – Key control characteristics - Part 5-3: Thin-film organic/nano electronic devices – Measurements of charge carrier concentration

This Technical Specification, specifies a standard procedure for measuring a wide range of charge carrier concentration in organic/nano materials. The standardized procedure is based on both Hall-effect measurement with van der Pauw configuration and capacitance-voltage (C-V) measurement in metal/insulator/semiconductor stacking structures. Circulation of the first Committee Draft is expected around May, 2018.

IEC TS 62607-6-1 ED1

Nanomanufacturing - Key control characteristics - Part 6-1: Graphene - Measurement of sheet resistance of commercial graphene powders by the Four Probe Method

This Technical Specification establishes a method for conductivity measurements of graphene powders. Circulation of the first Committee Draft is expected around May, 2018.

IEC TS 62607-6-2 ED1

Nanomanufacturing – Key control characteristics – Part 6-2: Graphene – Evaluation of the number of layers of graphene

This Technical Specification describes methods for counting the number of layers of graphene such as atomic force microscope (AFM), transmission electron microscope (TEM), light transmittance, and Raman scattering. Circulation of the first Committee Draft is expected around May, 2018.

IEC TS 62607-6-3 ED1

Nanomanufacturing - Key control characteristics - Part 6-3: Graphene-Characterization of CVD graphene domains

This Technical Specification will provide the evaluation method of determining graphene domains in order to understand the effect of graphene domain size and distribution of defects on properties of graphene, and enhancing the performance of high speed, flexible, and transparent devices using CVD graphene. It is a joint project with ISO TC 229. Circulation of a second Committee Draft is expected around May, 2018.

IEC TS 62607-6-5 ED1

Nanomanufacturing - Key control characteristics Part 6-5: Graphene - Sheet resistance and contact resistance of two-dimensional materials including graphene

This Technical Specification provides a proper definition of sheet resistivity measurement and a unit for the electrical characterization of two-dimensional materials. It includes recommended conditions for a sample preparation and the comparison of sheet resistivity unit between two-dimensional materials and conventional materials under test in the referenced background research results. Circulation of the first Committee Draft is expected around May, 2018.

IEC TS 62607-6-6 ED1

Nanomanufacturing - Key control characteristics - Part 6-6: Graphene - Uniformity of strain analyzed by spatially-resolved Raman spectroscopy

This Technical Specification establishes a standardized method to determine the key control characteristic “strain uniformity” for graphene by an analysis of the width of the 2D-peak in the Raman spectrum. Strain uniformity is a figure of merit to quantify the influence of nano-scale strain variations on the electronic properties of the layer. The classification should help manufacturers to classify their material quality and customers to provide an expectation of the electronic performance of the classified graphene and more specifically to decide whether or not the graphene material quality is potentially suitable for various applications. Circulation of a second Committee Draft is expected around May, 2018.

IEC TS 62607-6-9 ED1

Nanomanufacturing - Key control Characteristics - Part 6-9: Graphene - Measurement of sheet resistance by the non-contact Eddy current method

This Technical Specification establishes a method for contactless measurement of the sheet resistance of large area graphene layers on non-conductive substrates for electrical characterization and quality control. The comment period for the first Committee Draft will close shortly. A revised CD based on comments received is expected to be circulated around May, 2018.

IEC TS 62607-6-13 ED1

Nanomanufacturing – Key control characteristics – Part 6-13: Determination of Oxygen Functional Groups Content of Graphene Materials with Boehm titration method

This Technical Specification provides a standardized method for determining surface oxygen functional groups on graphene materials using the Boehm titration method, in order to quantify the surface acidic oxides of graphene materials, including carboxyl groups (also in the form of their cyclic anhydrides), lactone groups, hydroxyl groups and reactive carbonyl groups. It provides a standardized method that is suitable to graphene materials prepared by oxidation-reduction method, solution-phase exfoliation, micro mechanical exfoliation and organic synthesis. Circulation of the first Committee Draft is expected around May, 2018.

IEC TS 62607-6-14 ED1

Nanomanufacturing – Key control characteristics – Part 6-14: Graphene –Defect level analysis in graphene powder using Raman spectroscopy

This Technical Specification sets guidelines to evaluate the defect level in graphene powder by the intensity ratio of the D+D' band and 2D band in Raman spectrum, which helps graphene manufacturers classify their material quality. Circulation of the first Committee Draft is expected around May, 2018.

IEC TS 62876-3-1 ED1

Nanomanufacturing - Reliability assessment - Part 3.1: Graphene - Stability test: Temperature and humidity

This Technical Specification establishes a general reliability qualification methodology for graphene layers on a substrate to demonstrate that these layers fulfil a minimum level of reliability. The described methodology will not provide full reliability data which allow the estimation of product lifetimes. A Committee Draft was circulated in October, 2017 with the comment date closing shortly.

IEC TS 62607-8-1 ED1

IEC TS 62607-8-1: Nanomanufacturing - Key Control Characteristics - Part 8-1: Nano-enabled metal-oxide interfacial devices - Test method for defect states by thermally stimulated current

This Technical Specification specifies the measurement method for determining defect states of nano-enabled material and devices as generated by the de-trapping of charges. Circulation of the first Committee Draft is expected in August, 2018.

ISO/TC 229 *Nanotechnologies* Recent Publications and approved work items

ISO has recently published the following deliverables developed under ISO/TC 229 *Nanotechnologies*:

- **ISO/TR 19057:2017 - *Nanotechnologies — Use and application of acellular in vitro tests and methodologies to assess nanomaterial biodurability*** - reviews the use and application of acellular *in vitro* tests and methodologies implemented in the assessment of the biodurability of

nanomaterials and their ligands in simulated biological and environmental media. It focuses more on acellular *in vitro* methodologies implemented to assess biodurability and, therefore, excludes the general review of relevant literature on *in vitro* cellular or animal biodurability tests.

- **ISO/TS 13278:2017 – *Nanotechnologies – Determination of metal impurities in samples of carbon nanotubes using inductively coupled plasma mass*** *spectrometry* **[Replaces ISO/TS 13278:2011]. This updated ISO Technical Specification p**rovides methods for the determination of residual elements other than carbon in samples of single-wall carbon nanotubes (SWCNTs) and multiwall carbon nanotubes (MWCNTs) using inductively coupled plasma mass spectrometry (ICP-MS). It provides optimized digestion and preparation procedures for SWCNT and MWCNT samples in order to enable accurate and quantitative determinations of elemental impurities using ICP-MS.

- **ISO/TS 20787:2017 - *Nanotechnologies -- Aquatic toxicity assessment of nanomaterials in saltwater lakes using Artemia sp*.** - specifies a test method, aiming to maximize repeatability and reliability of testing, to determine whether MNMs are toxic to aquatic organisms, specifically *Artemia sp*. nauplius. It is intended to be used by ecotoxicological laboratories that are capable in the hatching and culturing of *Artemia sp*. and the evaluation of toxicity of nanomaterials using *Artemia sp*. nauplius. This method uses *Artemia sp*. nauplii in a simulated environment, artificial seawater, to assess effects of nanomaterials.

  ISO/TS 20787:2017 is applicable to MNMs that consist of nano-objects such as nanoparticles, nanopowders, nanofibres, nanotubes, nanowires, as well as aggregates and agglomerates of such MNMs.

More information regarding the documents above, or any published ISO Standards or other deliverables, can be reviewed after publication using the ISO Online Browsing Platform (https://www.iso.org/obp/ui/). All ISO published documents are available for purchase via ANSI's Webstore.

ISO/TC 229 has recently added the following projects to their work programme:

- **ISO/DTS 21346 -- *Nanotechnologies –Characterization of cellulose elementary samples*** *(under development by JWG 2, Measurement and characterization)*
- **ISO/DTR 22293** -- ***Evaluation of methods for assessing the release of nanomaterials from commercial, nanomaterial containing polymer composites*** (*under development by WG 3, Health, safety and environment*)
- **ISO/DTR 22455 – *Nanotechnologies - High throughput screening method for nanoparticles toxicity using 3D cells*** (*under development by WG 3, Health, safety and environment*)
- **ISO/DTS 23034 – *Nanotechnologies -- Method to estimate cellular uptake of carbon nanomaterials using optical absorption*** (*under development by WG 3, Health, safety and environment*)

More information regarding the work items above, or any other work items included in ISO/TC 229's work programme is available via your country's ISO Member Body. In the U.S., please contact ANSI: hbenko@ansi.org

The American National Standards Institute's Nanotechnology Standards Panel (ANSI-NSP) serves as the cross-sector coordinating body for the purposes of facilitating the development of standards in the area of nanotechnology, including, but not limited to: nomenclature/terminology; health, safety and environmental aspects; materials properties; and testing, measurement, and characterization procedures.

For more information about the NSP, please contact hbenko@ansi.org