ANSI-NSP Newsletter

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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

Recent articles have focused on how nanotechnology applications such as sensors and drug delivery systems could be utilized to help diagnose and treat diseases such as Ebola and cancer. While testing of these potential diagnostic and therapeutic tools is underway, it will be necessary to understand how such technological approaches could impact the patient beyond treatment of the disease itself and other potential effects such as to the environment.

In his guest column "The Molecule Rules," Dr. Richard Pleus discusses molecular modification and the identification and standardization of physico-chemical parameters that can predict nanoparticle toxicity. Such modifications could ensure not only more effective treatments, but also mitigate potential impacts on overall human health and the environment.

GUEST COLUMNIST: Richard Pleus, Ph.D.

The Molecule Rules
By Richard Pleus, Ph.D

Technological innovation can greatly improve our lives including improvements in energy efficiency and generation, medicines, crop yields, and the like. These innovations may find uses in many applications and standards can be used to promote gaining from the benefits of the applications. But in any application there can be implications and these implications can inadvertently hurt our health and environment. Nanotechnology allows us to make new substances by engineering matter at the atomic and molecular scale. Before we expose ourselves to these new molecules, scientists are working together to understand how they may cause harm—and how to build them so that they don't. Standards can help here, too.

Can we engineer molecules to be less hazardous to humans and the environment? We have been modifying molecules in medicine for decades for health. As a pharmacologist, I have conducted tests on drugs in which I have found that adding or removing an element, or slightly changing its shape, can improve their effectiveness, neutralize adverse effects, or even make them more toxic.

The same process can be used to reduce the possible hazards presented by nanotechnology. We know that a nano-object's physical and chemical makeup can dictate its behavior. A group of international experts at ISO TC 229 came to consensus on a list of eight physical-chemical factors that best predict how a molecule might be hazardous. These parameters, including a molecule's shape, size, surface chemistry, and surface charge, can be tweaked to minimize its potential harm.

ANSI serves as the US's liaison to ISO. Its assistance was instrumental in TC 229's work on chemical-physical characteristics. Standards organizations like ANSI, in conjunction with industry, regulators, and the scientific community, must continue to investigate how to engineer molecular rules, and use that knowledge to develop standards—and new materials—that will help make our planet healthier, safer, and more sustainable.

RICHARD C. PLEUS, PH.D., is director and toxicologist of INTERTOX, INC. He's an expert in neurological and reproductive toxicology with over 25 years' experience assessing the risk posed to humans exposed to chemical and biological agents. His recent work focuses on developing EHS standards for nanomaterials, and evaluating EHS risks from exposure to intentionally and non-intentionally derived nanoparticles. He's a member of ANSI, and was a US delegate at ISO TC-229 on nanotechnologies. Dr. Pleus' credentials include a Ph.D. in Environmental Toxicology and an M.S. in Environmental Health from the University of Minnesota, and postdoctoral research in neuropharmacology at the University of Nebraska Medical Center.

NEWS & INFORMATION

ASTM E56 Committee on Nanotechnology

At the April 2016 meeting of ASTM Committee E56 on Nanotechnology, a new Subcommittee E56.07 on Education and Workforce Development was formed. This initiative is the first of its kind for ASTM, as the

committee looks forward to educating the existing and future professionals working in the field of nanotechnology. Two education standards have already been published, and will now be housed within this subcommittee, with five additional standards in various stages of the standards development process.

The two existing published standards will help to develop and refine curricula at the undergraduate level. At the same time, industries and businesses may use the standards as a basis for hiring new graduates as well as for upgrading skills of current employees. These standards are E2996, Guide for Workforce Education in Nanotechnology Health and Safety, and E3001, Practice for Workforce Education in Nanotechnology Characterization. These two standards are flexible enough to be tailored to regional industry needs while retaining a high degree of equivalency in educational depth and breadth across geographical boundaries.

A third standard, E3034 Standard Guide for Workforce Education in Nanotechnology Pattern Generation, was recently approved and will be published and available for purchase shortly.

All interested parties may join Subcommittee E56.07 for a nominal ASTM membership fee of $75. This fee includes membership in as many other ASTM committees and their subcommittees that you have interest in, as well as a free ASTM Volume of your choice.

IEC TC 113 Year-End Review of Work Items

2015 has been an active year for IEC TC 113, with a number of documents either published or under development. Below is a review of all projects under the domain of this IEC Technical Committee. All IEC published documents are available for purchase via ANSI's Webstore:

Published in 2015:

- **IEC/IEEE 62659: Nanomanufacturing - Large scale manufacturing for nanoelectronics**
  This standard provides a framework for introducing nanoelectronics into large scale, high volume production in semiconductor manufacturing facilities through the incorporation of nanomaterials (e.g. carbon nanotubes, graphene, quantum dots, etc.). A USNC-led project, it is the first nano-electrotechnology standard jointly published by IEC and IEEE.
- **IEC/TS 62607-4-1: Nanomanufacturing - Key control characteristics - Part 4-1: Cathode nanomaterials for nano-enabled electrical energy storage - Electrochemical characterisation, 2-electrode cell method**
  This TS provides a standardized method for the determination of electrochemical properties of cathode nanomaterials of, for example, lithium-ion batteries utilizing lithium iron phosphate to enable customers to decide whether or not a cathode nanomaterial is usable, and select a cathode nanomaterial suitable for their application.
- **IEC/TS 62607-4-3: Nanomanufacturing - Key control characteristics - Part 4-3: Nano-enabled electrical energy storage - Contact and coating resistivity measurements for nanomaterials**
  This TS provides a standardized test method for the measurement of contact and coating resistivity of nano-enabled electrode materials, enabling customers to decide whether or not a coating composite material is usable, and to select the best combinations of coating composite material with fabrication technologies suitable for their application.

Awaiting publication:

- **IEC/TS 62607-3-2: Nanomanufacturing - Key control characteristics - Part 3-2: Luminescent nanoparticles - Determination of mass of quantum dot dispersion**
  This TS, 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 62844: Guidelines for quality and risk assessment for nano-enabled electrotechnical products**
  This TS provides a recommended methodology for identifying relevant parameters of nanomaterials and generic guidelines on implementation of quality assessment and environment/health/safety assessment for nano-enabled/nano-enhanced electrotechnical products.

<u>In development</u>:

- **IEC 62565-3-1: 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. Circulation of the second Committee Draft is planned for December, 2015.
- **IEC/TS 62565-4-2: 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. The first Committee Draft was recently circulated with a January 15, 2016 closing date.
- **IEC/TS 62607-6-3: Nanomanufacturing - Key control characteristics - Part 6-4: Graphene - Characterization of graphene domains and defects**
  This TS provides the evaluation method of determining graphene domains and defects 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. Circulation of the first Committee Draft is planned for December, 2015.
- **IEC/TS 62607-6-4: Nanomanufacturing - Key control characteristics - Part 6-4: Graphene - Conductance measurements using resonant cavity**
  This TS, a USNC-led project, will establish a non-contact method for determining the surface conductance of 2D single-layer or multi-layer atomically thin nano-carbon graphene structures. Circulation of the second Committee Draft is planned for November, 2015
- **IEC/TS 80004-9: Nanotechnologies - Vocabulary - Part 9: Nano-enabled electrotechnical products and systems**
  This TS 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. Circulation of the third Committee Draft is planned for December, 2015.

<u>To be proposed</u>:

- **IEC 62565-1: Nanomanufacturing - Material specifications, Part 1 - Basic concepts**

This standard will provide a standardized blank template for the ordering of raw materials for nanomanufacturing processes by specifying the key control characteristics (e.g. chemical, electrical) of the materials and the measurement techniques for each. The standard will also provide a foundation for detail specifications. Circulation of the New Work Item Proposal is planned for December, 2015.

- **IEC/TS 62565-2-1: Nanomanufacturing – Material specifications – Part 2-1: Single-wall carbon nanotubes – Blank detail specification**
  This new work is intended to replace IEC/PAS 62565-2-1.
- **IEC/TS 62876-1-1: Nanomanufacturing – Reliability Assessment – Part 1-1: Basic reliability qualification**
  This TS will provide a general reliability qualification method for all nano-enabled electrotechnical products by defining a series of stress tests, test severity, test sequences, quantity of samples, acceptance criteria and reporting requirements.

ISO/TC 229 Awaits publication of Nanotechnology Terminology documents

ISO/TC 229 members are anticipating the publication of a number of documents within the area of nanotechnology terminology:

- **ISO/TS 80004-1, *Nanotechnologies – Vocabulary – Part 1: Core terms*,** defines those terms that are central to ensuring the effective communication between buyers and sellers, and relevant regulatory authorities. This updated document includes revisions to terms such as nanoscience and nanotechnology, as well as the introduction of new terms, such as nanoscale phenomena. This document is anticipated for publication on 1 December 2015.
- **ISO/TR 17302, *Framework for identifying vocabulary development for nanotechnology applications in human healthcare***, does not provide definitions, but instead identifies those categories within the clinical value chain most likely to be advanced by nanotechnologies and describes some of the promising technologies being developed and utilized within the clinical workflow. This document is anticipated for publication on 15 December 2015.
- **ISO/TS 80004-12, *Nanotechnologies – Vocabulary – Part 12: Quantum phenomena*,** focuses on the relationship of terms in nanotechnology and quantum effects, which will be important for the identification of nano-enabled products and for the development of nanotechnology. This document is expected to be published in 2016.

More information regarding the documents above, including the revised definitions, 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:

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