

For Good Measure: Standards for Nanotechnology Measurement and Characterization

This fourth article in a series on standards for the nanotechnology community addresses the development of specifications for measurement, characterization, and test methods that will provide a common reference point for material manufacturers and their customers.

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Measurement and characterization standards fly under the radar, affecting our lives in innumerable ways – from the number of miles driven to work to the paper loaded in the office printer. To imagine daily activities without these concepts would be nearly impossible, but that is exactly the challenge faced by scientists and manufacturers in the nanotechnology community.

For the growing number of industries that work with or are affected by nano-materials, consistent and globally accepted methods for testing, measurement, and characterization will provide a common reference point. By establishing a baseline to determine the starting properties of materials, these standards can facilitate meaningful comparisons of manufacturing and research results from different organizations and labs, and help to form a basis for the measurement of additional material properties.

When the American National Standards Institute (ANSI) Nanotechnology Standards Panel (NSP) first convened in September of 2004 to discuss priority recommendations for nanotechnology standardization, participants earmarked metrology, methods of analysis, and test methods as areas needing urgent attention. In particular, guidelines for particle size and shape, as well as particle number and distribution, were considered critical.

These needs are being addressed by the International Organization for Standardization (ISO) through its Technical Committee (TC) 229, *Nanotechnologies*, Working Group (WG) 2, *Measurement and Characterization*. Convened by Japan under the Japanese Industrial Standards Committee (JISC), WG 2 focuses on the development of standards for consistent descriptions, assessment, and test methods for nanotechnologies, taking into consideration the need for metrology and reference materials.

U.S. participation in ISO/TC 229 WG 2

U.S. participation in ISO/TC 229 and its Working Groups is centered in the U.S. Technical Advisory Group (TAG) to ISO/TC 229, chaired by Clayton Teague, director of the National Nanotechnology Coordination Office. The TAG, which is administered by



ANSI, is organized into Working Groups that mirror their efforts on the scope of each TC 229 WG.

The U.S. mirror group for WG 2 is led by Dr. Ray Tsui of Motorola. The TAG WG plays an important role in establishing ANSI's positions on the issues addressed in the group with the help of experts from the industry, government, and academia.

Several other U.S. organizations actively participate in the both the international and domestic WG 2 work efforts, including the National Institute of Standards and Technology (NIST) and the National Aeronautics and Space Administration (NASA), as well as Honeywell, Hyperion Catalysis, and others.

Guidance Documents in Progress

Representative of its efforts over the past three years, WG 2 is currently developing 10 work items; most involve single-walled or multi-walled carbon nanotubes, and how to characterize them using specific instrumentation methods. Four of these work items are led or co-led by the United States:

- ISO/Approved Work Item (AWI) Technical Specification (TS) 10797, *Nanotubes – Use of transmission electron microscopy in walled carbon nanotubes* (co-led by the U.S. and Japan)
- ISO/AWI TS 10798, *Nanotubes – Scanning electron microscopy and energy dispersive X-ray analysis in the characterization of single walled carbon nanotubes* (led by the U.S.)
- ISO/New Work Item Proposal (NP) TS 10812, *Nanotechnologies – Use of Raman spectroscopy in the characterization of single-walled carbon nanotubes* (led by the U.S.)
- ISO/AWI TS 11308, *Nanotechnologies – Use of thermo gravimetric analysis in the purity evaluation of single-walled nanotubes* (co-led by the U.S. and Korea)

“The activities in WG 2 are strongly coupled to the other efforts within ISO/TC 229,” said Dr. Tsui. “The work of WG 1, *Terminology and Nomenclature*, defines the materials being measured, while the output from WG2 provides important information regarding intrinsic material properties and measurement methods that can be used by WG 3, *Health, Safety, and Environment*, and WG 4, *Material Specifications*.”

This overlap is apparent in one work item that is currently in the domain of WG 3: *Guidance on physico-chemical characterization of engineered nano-objects for toxicologic assessment*. This document, being developed under U.S. leadership, will serve as a reference for characterizing nano-objects to be used in toxicology testing. WG

3 is presently creating toxicology guidelines as they relate to health and safety; WG 2 may join the effort to assist in the development of methods used to characterize toxicity.

Getting Involved in ISO/TC 229 WG 2

Participation in the U.S. TAG ISO/TC 229 Working Group is open to all nationally interested stakeholders. The TAG actively seeks participants who have expert knowledge in all aspects of nanotechnology measurement and characterization. To join the ANSI-accredited U.S. TAG for ISO/TC 229 or any of its WGs, contact Heather Benko (hbenko@ansi.org; 212.642.4912).

For more information on the U.S. TAG for ISO/TC 229, visit <http://www.ansi.org/isotc229tag>.

Stay Tuned: The next article in this series will introduce ISO/TC 229/WG 4, *Material Specifications*.