Thought Starter

SDO's should expand their scope beyond Nanotechnologies to include Advanced Materials

The Changing Landscape:

In the early part of the 21st century, nanomaterials were the highlighted 'advanced material' class thought to potentially revolutionize society, providing new opportunities and posing new risks. Numerous standards activities (including ISO/TC 229, ASTM E56, IEC/TC 113, IEEE, IEST and others) were initiated followed by other standards development organizations (SDO's) recognizing the need from stakeholders (industry, regulators, civil society organizations, and academia) to address multifaceted issues related to emerging nanotechnologies. Today, there is a growing international transition for organizations originally focused on nanomaterials to focus on advanced materials and emerging materials.

Are those standards organizations working on nanotechnology-specific standards the appropriate place to address advanced and emerging materials?

The Benefit of Utilizing the Experience of the existing nano SDO's.

SDOs focused on nanotechnologies tend to have significant multidisciplinary participation and have experienced the challenges associated with standardization of a developing class of advanced materials (i.e., nanomaterials). However, concerns may be raised that advanced materials span further than "nanomaterials" and that even broader skillsets are required to appropriately address this issue. This, however, would be true for any existing group to address a broad area such as emerging/advanced materials.

Existing Horizontal Committees and Multidisciplinary/Interdisciplinary Experience. While many SDO Committees are narrowly focused on one specific application space with specific industrial stakeholders (e.g., paint and coating manufactures and users, or lawnmower technologies), some SDOs have been organized horizontally to facilitate commercialization of nanotechnologies across the broader spectrum of inclusive areas (paints, coatings, microelectronics, composites, regulatory needs etc.). These horizontal committees necessitate the participation of diverse disciplinary and interdisciplinary contributors and commensurate with this, address a wider range of activities spanning from terminology, health and safety, material specifications and characterization.

Current activities within existing organizations:

Within ISO TC229, Joint Working Group 1 on Terminology has formed a study group to consider the needs to develop consistent practices for advanced materials and Working Group 3 is also considering if it is appropriate to include some advanced materials within its purview. It is reasonable to believe that other SDO's are also considering issues pertaining to AM. WG3 has updated its "roadmap" to include advanced/emerging materials.

Beyond standards, the OECD Working Party on Manufactured Nanomaterial has discussed whether it should include AM in its activities. This could make sense for the WPMN as its members have the legal responsibility to provide oversight to materials generally within their

respective delegations. The German delegation is hosting a series of three workshops to collect perspectives from interested stakeholders with two workshops completed so far.

Where are we now?

Over the last 15 years much has been learned about nanotechnologies and focused SDOs have been helpful for addressing complex nanomaterials integrating contributions from diverse international stakeholder groups. While it has always been understood that nanotechnologies were originally defined to encourage research and development of ultra-small systems arbitrarily limited to 1-100 nm, it is apparent today that this size-based definition may no longer be an appropriate umbrella for dealing with the spirit and challenges originally raised. Many parallel governmental, industrial, research and development, and regulatory bodies are transitioning from a focus on "nanomaterials" to other more complex emerging materials. In many discussions the terms "advanced materials" or "emerging materials technologies" are being used.

Currently, there is a growing recognition among some practitioners that size alone does not fully define the unique properties of a material nor the need to develop new terminology, characterization methods, health and safety standards, nor new material or product specifications. For example, within ISO TC 229 there have also been challenges regarding deciding when an item should be addressed within TC229 or within another ISO committee focused on the end use activity. Not all nanomaterials and not all nanotechnologies offer new challenges. As many nanotechnologies (or advanced materials in general) move from being 'advanced and emerging' to 'established', how should the standards be maintained and handled? For instance, should they simply be dealt with by the respective related vertical committee groups, e.g., Paints and coatings. Is the intent of Nanotechnology SDOs to address complex emerging technologies related only to nanotechnologies? Are the bounds of nanotechnology too limiting or sufficiently broad? While past efforts under the umbrella of nanotechnologies made useful and timely contributions to trade and commerce, future emerging technologies—though potentially related to nanotechnologies—may not have a clear home in the standardization world. Is this an area that the expertise in SDOs developing standards in nanotechnologies can address?

Why use existing approaches for NM for AM:

The issues that have been presented pertaining to nanomaterials and nanotechnology are the same as those pertaining to Advanced Materials and Emerging Material Technologies. For example:

Terminology

- What is an advanced material? What is an emerging material? Are these even the right terms to use? (e.g., should a new term be created or is there a better alternative)
- What are the terms pertaining to advanced materials that are ambiguous and that require clarification?
    - Consider "advanced materials" from the perspective of different industries or from different stake holders.
    - Consider different points in time. When is an advance material not an advanced material?

- Are there terms that are used incorrectly and their use leads to confusion or erroneous conclusions?

Metrology

- What are the important properties regarding advanced materials? Emerging materials? For nanomaterials a fundamental property is size but for advanced materials there could be other distinguishing properties.
- Are there applicable methods to obtain measurement of these properties?
- Are the measurements mature enough for standardization? If not, can they be further developed or does new metrology need to be developed?

EHS

- Do advanced materials and emerging materials potentially present new hazards? Could these hazards be foreseen using the existing paradigm?
- What are the potential hazards and are their tools to evaluate them?
- Are the potential hazards sufficiently different that new standard methods are needed and that existing methods are not adequate?
- How do new intersections between societal use of advance materials or emerging materials present new challenges and considerations?

Materials specification and applications

- For many materials standardization is not desired as uniqueness provides a commercial advantage to the supplier. Are there materials for which standardization would provide a commercial benefit to many manufacturers?
- Are there manufacturing methods that require standardization or for which there are commercial benefits?
- Are there any performance characteristics of advanced materials requiring standardization?

The list above is not complete but mirrors the issues addressed by ISO TC229 and other Nanotechnology SDOs. The expertise to address these issues is already present in many SDOs making it more likely that the issues can be addressed efficiently without creating a new group. It seems likely that other groups that have been addressing nanotechnology will also consider including advanced materials, including industry associations and the OECD WPMN.

Why not:

One argument would be that the “advanced and emerging materials” broadens the scope to infathomable limits. But is this true? Is there a meaningful way to focus work? Another reason may be bandwidth. There could be concerns that Nanotechnology SDOs already have enough work to do and the resources are limited. However, considering advanced and emerging materials could bring in new resources and others see that TC229 and other SDOs could capitalize on to help address issues before they become concerns.

The Benefit of Utilizing the Experience of a Horizontal Committee Structure and Multidisciplinary Nature:

Existing SDO's have over 15 years of unique experience in proactively addressing standardization needs of new materials. Are these groups the appropriate places to address advanced materials and emerging technologies? Will remaining in the status quo "nanotechnologies" justify a horizontal structure in the future?

Questions for sharing before the meeting

- Do you have a personal definition of *advanced material*? Related emerging material technologies?
- Does your organization have a definition of *advanced material*? Emerging material technologies?
- Are you aware of topics pertaining to advanced materials and related emerging material technologies that are unique from nanotechnology?
- Are you aware of organizations that are addressing issues pertaining to advanced materials and related emerging technologies? Who are they?
- Are you aware of regulatory/government organizations who are addressing advanced materials and related emerging technologies? Which ones?
- What developments in advanced materials and related emerging technologies are you seeing that will provide significant societal benefits?
- What developments in advanced materials and related emerging technologies are you seeing that have created concerns?
- Please provide specific examples of advanced materials and related emerging technologies?
- What applications will benefit the most from advanced materials and related emerging technologies?
- What do you think of the thought starter recommendation to include advanced materials and related emerging technologies? Did this thought starter recommendation miss anything?
- Early in their life cycle, materials may be considered to be *advanced* but eventually the properties become routine and new *advanced* materials come along. Should nano SDO's consider modifying their scopes to cover emerging materials/technologies to provide a consistent structure to evaluate new materials and technologies?