

Preface

Globalization has unleashed economic forces that are affecting knowledge generation, commercial trade in goods and services, and the manufacturing of products. Global economic forces are also leading to a greater role in both commerce and science for international standards. Increasingly, standards are serving an important role in promoting the international development and commercialization of emerging technologies. Standards aid economic globalization by providing a common means to define technical nomenclature, standardize analytical methods, determine whether harmful exposures exist, and provide for ways to control many of the risks associated with international technology commercialization. Also, the development of standards in the twenty-first century to control risks to workers, consumers and the environment is becoming as pivotal to the success of globalization as free trade agreements were in the twentieth century. And, the use of standards in the governance of risk has only increased since nanotechnology has emerged as a global technology which promises to reshape the way we live and work.

Nanotechnology is a rapidly evolving and potentially transformative technology, which has the potential to greatly improve many areas of human life. Nanotechnology promises stronger and lighter materials, more efficacious pharmaceuticals, novel energy sources, more nutritious and longer-lasting foods, more sophisticated national security equipment, and revolutionary cancer treatments. As potentially transformative as nanotechnology may be, however, successful acceptance of any new technology, and its widespread commercial dissemination, requires strict attention to controlling potential risks, especially in countries with robust product liability and personal injury systems. International standards can serve to protect both product users and product manufacturers.

Historically, international standards that have been incorporated into international trade agreements or adopted into national laws have been developed by only a limited number of public and private organizations. For instance, the Organization for Economic Cooperation and Development (OECD), various United Nations organizations, and a number of private organizations, such as the International Organization for Standardization (ISO) and the International Electro-technical Commission have served throughout the twentieth century as the primary route for the development of international standards through a formal national membership

requirement. In addition, there also exist a large number of voluntary international standards which are often developed by private organizations without national body memberships, such as ASTM International and the Institute of Electrical and Electronics Engineers.

Existing standards developing organizations or SDOs, both public and private, organize their work through groups of experts focused on specific application areas. With nanotechnology, however, technical groups spanning the entire technology, or very broad aspects of the technology such as environmental safety and health issues, have been formed to coordinate standard setting activities and to allow for sufficient flexibility to accommodate rapidly evolving knowledge about nanotechnology and its potential risks and benefits.

In the last 5 years, almost all major SDOs established such technical groups. For example, ISO established a technical committee for nanotechnologies, TC 229 in 2005, while OECD established Working Party on Manufactured Nanomaterials in 2006. Many of the existing technical groups working in the field of nanotechnology standards development have a number of projects in parallel. Some are aimed at developing a basic terminology for nanotechnology and nanomaterials, some are working to develop specific measurement techniques for nanomaterials, and others are developing occupational and environmental health and safety guidelines.

Nanotechnology Standards reflects this new way of developing international standards for nanotechnology and is organized around broad application areas similar to existing technical groups in various SDOs. An *Introduction* chapter describes history of standards development process, discusses the roles of different standards development bodies active in nanotechnology, outlines the context of national and international standards development for nanotechnology, highlights the use of knowledge management systems in twenty-first century standards development, and discusses the unique challenges of “proactive” standards development, such as how to reach consensus under the conditions of limited knowledge. Next, there are chapters providing state-of-the-art reviews on developments in topical areas of *Nomenclature & Terminology*; *Reference Materials*; *Metrology*; *Performance Standards*; *Application Measurements*; *Implication Measurements*; *Biological Activity Testing*; and *Health and Safety*. Each of these chapters summarizes the active areas of national and international standards development and describes the knowledge base to support current nanotechnology standards and future directions in nanotechnology standards development. Finally, the chapter on *Legal Considerations* puts standards development in the context of international legal requirements and application of international standards to national governance structures.

Nanotechnology Standards is the first comprehensive collection of state-of-the-art reviews of twenty-first century nanotechnology standards development written by an international team of experts representing both the international SDO community and the nanosciences community. The authors reflect a diversity of intellectual views and global geographies. The book captures the most recent developments and outlines future directions in the dynamic field of international and national nanotechnology standards development. This book is an

essential reference for a broad range of nanotechnology and materials scientists, engineers, lawyers, regulators and students in academic, industrial and government settings who are dealing directly with developing nanotechnology products or with managing the risks of nanotechnology or who just want to learn more about how to manage such risks using nanotechnology standards.

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