Nano-Manufacturing Topical Conference
Room 2018 - Session NM+IPF-TuM

Nanotechnology and Society

Moderator: J. Murday, Naval Research Laboratory

8:40am **NM+IPF-TuM3 Nanotechnology Oversight - Managing Potential Risk in an Uncertain World**, ***A.D. Maynard,*** Woodrow Wilson International Center for Scholars **INVITED**

Nanotechnology has been described as a transformative technology, an enabling technology and the next technological revolution. Even accounting for a certain level of hype, a heady combination of investment, rapid scientific progress and exponentially increasing commercialization, point towards nanotechnology having a fundamental impact on society over the coming decades. However, enthusiasm over the rate of progress is increasingly being tempered by concerns over possible downsides of the technology. Real and perceived adverse consequences in areas such as asbestos, nuclear power and genetically modified organisms have engendered skepticism over the ability of scientists, industry and governments to ensure the safety of new technologies. As nanotechnology moves towards widespread commercialization, not only is the debate over preventing adverse consequences occurring at an unusually early stage in the development cycle; it is also expanding beyond traditional science-based risk management to incorporate public perception, trust and acceptance. Having appropriate oversight frameworks in place will be essential to the sustained development of nanotechnologies. These will need to address potentially new risks presented by engineered nanomaterials, and be responsive to the rapidity with which nanotechnologies are being discovered, developed and used. Existing oversight frameworks may be sufficiently robust to address new technologies with little modification, although some commentators suggest that this is unlikely. Either way, too little oversight could be as damaging to fledgling nanotechnologies as too much oversight.

9:20am **NM+IPF-TuM5 Nanoparticle Occupational Safety and Health Consortium**, ***M.L. Ostraat,*** DuPont Engineering Research and Technology; *K.A. Swain,* DuPont Central Research and Development; *J.J. Krajewski,* DuPont Engineering Research and Technology **INVITED**

The Nanoparticle Occupational Safety and Health (NOSH) consortium of international industrial, government and non-governmental organizations has focused research upon obtaining information on occupational safety and health associated with aerosol nanoparticles and workplace exposure monitoring and protocols. The technical goals of the consortium include 1) generating well-characterized aerosols of solid nanoparticles and measuring aerosol behavior as a function of time; 2) developing an air sampling method that can be used to conduct worker exposure assessments in workplace settings; and 3) measuring barrier efficiency of filter media to specific engineered aerosol nanoparticles. To accomplish these objectives, multiple aerosol synthesis and characterization systems have been designed to generate well-characterized aerosol nanoparticles of various chemistries < 100 nm. These aerosol nanoparticles are transported to aerosol chambers to examine aerosol behavior as a function of time, including rate of dispersion, aggregation, and particle loss for charged and uncharged aerosol nanoparticles. These aerosol nanoparticle studies form the basis for the development of a portable aerosol nanoparticle monitoring instrument which will be field tested in a wide variety of workplace environments. Through this effort, the consortium has developed instrumentation and protocols required to assess barrier effectiveness of filter media to charged and uncharged aerosol nanoparticles as a function of particle chemistry, particle size distribution, and number concentration. Work continues on identifying appropriate filter media that can be used as effective barriers for aerosol nanoparticles and establishing a knowledge base on determining specifications for using those filter media given a set of known properties about a specific nanoparticle aerosol.

10:40am **NM+IPF-TuM9 Nanotech for Environment Renaissance - Soil and Groundwater Cleanup using Reactive Nanoparticles**, ***W.-X. Zhang,*** Lehigh University **INVITED**

Zero-valent iron nanoparticle technology is quickly becoming a popular choice for remediation and treatment of a wide variety of common environmental contaminants in soil and groundwater. Over the three years, there are more than 30 completed and ongoing applications in North America and Europe. Nanoparticles have small sizes for effective in situ injection and dispersion and large surface areas and high surface reactivity for rapid contaminant transformation. Recent innovation in the technology and increasing supplies of nanoparticles have substantially reduced the cost of this technology for large scale applications. In this lecture, fundamental principles on nanoparticle synthesis and characterization will be highlighted. Applications of the iron nanoparticles for treatment of chlorinated organic solvents, organochlorine pesticides, PCBs, perchlorate, and hexavalent chromium will be presented. In addition, key issues related to field applications such as cost, fate/transport, and potential environmental impact will be discussed.

11:20am **NM+IPF-TuM11 Ethics between Nanoscience and Nanotechnology: Making Space for a Discussion**, ***A. Johnson,*** University of South Carolina **INVITED**

Much of the work in the ethical implications of science and technology is rooted in a concern over the potential and already occurring societal effects of research and the products of research. But science and technology can have profoundly different underlying assumptions about their societal interactions. Technology, or perhaps more specifically engineering, has developed a robust space for ethical discussion - a fact which underlies the recent re-orientation of engineering curriculum in the US (ABET 2000) to provide curricular support for ethics in engineering education. The ethical landscape of technology is rooted in the fact engineers unquestioning acknowledge that they produce goods for society and that those goods often have societally-transforming effects (both for good and for bad). Science has no such assumption (though individuals' beliefs may obviously differ). Many scientists believe that science can be important without any societal implications - science can be simply about knowing the unknown, without that knowledge having any societal effect. Some scientists, in their pursuit of disinterestedness, have explicitly denied the societal interactions of their work. Science, ideally in their minds, stands outside society. This strongly limits the space for ethical discussion. This position is one which has its own long history, but can be detected in Rowland's "Plea for Pure Science" to Vannevar Bush's (ironically, an engineer!) Endless Frontier to the efforts of Cold War nuclear physicists to distinguish bomb design from basic research to the Science Wars debate of the 1990s. Rather than simply cursing this position, I will address the question here of how this effects today's work at the border of science and technology, by presenting a case study on the way that researchers in nanotechnology, a field with explicit societally-transformative goals, is struggling with the pure-applied/science-technology distinction once again.

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