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

Examples of Nanotechnology Manufacturing

Moderator: J. Randall, Zyvex Corporation

8:00am **NM+IPF-MoM1 The Economics of Matter: Nanotechnology & Scale of Manufacturing**, ***J. Wolfe,*** Lux Capital **INVITED**

My venture partners invest in, write about, and live in the realm of mesoscale physics, or, by its more popular nomenclature, nanotechnology. Once poorly understood as an ill-defined amalgamation of disparate, atomic-level sciences, nanotechnology is now a young media darling whose time has come. Sophisticated investors and corporate executives grasp that this is no passing fad. Five years ago, we saw salient advances in materials science being neglected as the herds stampeded toward enterprise hardware and software and optical networking. We were convinced that Nicholas Negroponte would have it wrong, and that soon enough people would be trading in their bits for atoms. When our research arm, Lux Research, released its first annual "Nanotech Report" in 2001, 98 percent of Fortune 1000 executives were unable to define "nanotechnology." Today, nanotechnology has become a presidential priority, has taken center stage on CNBC, and has even surfaced as a subject of activist chatter and environmental concern. Just as plastics revolutionized the structural properties of matter - entering into industries as various as communications, electronics, food and beverage, and entertainment - now, nanoscale advances offer the ability to control the structural and functional properties of matter. This includes electric, thermal, magnetic, and optical properties, which are applicable to every industry imaginable.

8:40am **NM+IPF-MoM3 Colloidal Nanocrystals of Complex Shape: Synthesis, Properties, Applications**, ***A.P. Alivisatos,*** Lawrence Berkeley National Laboratory and University of California, Berkeley **INVITED**

Over the last decade, there have been significant advances in the ability to prepare colloidal inorganic nanocrystals with controlled size, shape, and even interconnection (branching) and topology (hollow and nested). These materials exhibit strongly size dependent properties, but they also share many of the characteristics of inorganic solids, in terms of stability and range of properties. They can be processed in solution like polymers. They thus make attractive candidates for incorporation into a wide range of technologies, from biological labels to components in solar cells and catalysts.

9:20am **NM+IPF-MoM5 Manufacturing Nanoparticles for Applications in Society**, ***R.W. Siegel,*** Rensselaer Polytechnic Institute **INVITED**

The past decade has seen an explosive growth worldwide in the physical, chemical, and biological synthesis and study of a wide range of nanoscale building blocks with unique properties in laboratory settings. However, before these nanoscale building blocks can significantly impact society through a wide range of novel applications, the manufacture of them needs to be scaled up to commercially viable quantities at an affordable cost. This talk will describe how one such type of nanoscale building blocks, nanoparticles, has moved from the laboratory to the marketplace, and milligrams to tons, over the past 17 years. We began making metal oxide nanoparticles via a gas-condensation physical process at Argonne National Laboratory in 1985 and in 1989 founded a company, Nanophase Technologies Corporation, to scale up production and eventually market products. Since that time, a publicly held (since 1997) business has been developed that produces commercial quantities of a variety of nanoparticles and dispersions that have found applications that benefit society in sunscreens and other health care products, polishing media for microelectronics, and nanoscale fillers for a number of plastics, among others. Nevertheless, fundamental research continues with these commercially available nanoparticles that could expand the horizons of their application space in society. Some examples from this research in our own laboratories in the National Science Foundation funded Center for Directed Assembly of Nanostructures at Rensselaer to create materials that possess enhanced mechanical, electrical, optical, and bioactive properties, and multifunctional combinations thereof, will also be presented.

10:20am **NM+IPF-MoM8 Nanotechnology and High-Efficiency Automobiles**, ***M.W. Verbrugge,*** General Motors Research and Development Center **INVITED**

We overview a variety of nanotechnologies and associated opportunities relevant to automotive applications. A significant challenge for the automotive industry is to produce vehicles of higher energy efficiency while continuing to improve vehicle functionality. One can divide the vehicle system into body and powertrain subsystems. This talk overviews recent developments and open questions associated with (1) structural materials for body subsystems and (2) electronic materials for energy storage and transfer. Emphasis is given to nanocomposites and surface analysis methods within the context of structural subsystems. Batteries, thermoelectric devices, and hydrogen storage media are addressed in relation to advanced propulsion subsystems.

11:00am **NM+IPF-MoM10 DNA-linked Dendrimer Nanoparticle Systems for Cancer Diagnosis and Treatment**, ***J.R. Baker, Jr.,*** University of Michigan **INVITED**

Dendritic polymer architecture allows for the development of new therapeutics that directly target cancer cells and largely bypass healthy cells. Clusters of these polymers can be combined into more complex structures with several different subunits, each with its own function, be it targeting, imaging or therapeutics. This technology can be expanded by developing single-function dendrimer modules linked by complimentary oligonucleotides. Thus, producing multifunctional therapeutics that can be customized to a specific patient's needs.

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