The IMS Associates Program Annual Meeting will be held on Wednesday, May 16, 2007. Representatives from all member companies and invited guests are encouraged to attend.

This year we have several new faculty members at the Institute. Many of the new faculty members will be making presentations describing their research interests as detailed below. We have also asked several students to make brief presentations regarding their work at IMS.

Members and invited guests should contact Laura Pinatti by May 9, 2007 (earlier preferred) to let us know who will be representing your company (tel. 860-486-4075, fax 860-486-4745, lpinatti@ims.uconn.edu). The meeting will begin at 9 AM and conclude by 2:15 PM.

At the conclusion of the meeting there will be an optional tour of IMS. If you are interested in joining this tour please be certain to let Laura know when you register for the annual meeting.

We look forward to seeing you at the meeting this year.

The program for this year's meeting follows.

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Associates Program Annual Meeting
Wednesday, May 16, 2007

8:30 Arrival, refreshments, informal discussions

IMS 20

9:00 Welcome - Fiona Leek, Associate Director of the IMS Associates Program

9:10 **Rajeswari Kas**i, Assistant Professor, Chemistry, "Self Assembled Amphiphilic Polymers in Bio- and Nanomaterials"

Actuators are devices that convert electrical input to mechanical work. However, new electromechanical actuators that are compatible with biological system or able to integrate into very small dimensional devices are becoming increasing important. In this regard, polymer actuators or artificial muscles have particularly received greater attention than other materials due to their characteristic features; operational similarity to biological muscles, especially their large strains and elasticity, and light weight. Homo- or random copolymers have been used for electromechanical actuation, however, majority of block copolymers use either thermal or chemical actuation. In this talk, design of a new class of homo-, random, and block copolymer comprising liquid crystalline and ionic moieties as candidates for electromechanical actuation will be discussed. These polymers can self-assemble at the nanometer regime either in the neat state or in solution state. The changes to the polymer domains at the nanometer scale are expected to scale to macroscopic proportions, generating advanced electromechanical actuators.

9:35 **Puxian Gao**, Assistant Professor, CMBE, "Hierarchical and Multi-functional Nanomaterials: Synthesis, Characterization and Potential Applications"

Nanoscale materials such as nanowires, nanoribbons and nanotubes have been demonstrated as building blocks for nanocircuits, nanosystems and nano-optoelectronics. Based on these individual nanoelements, field effect transistors and ultrasensitive nano-size gas sensors, nanoresonators and nanocantilevers have been fabricated. This presentation will focus on the recent progress towards hierarchical assembly of these nanoelements through precisely controlled synthesis, nano-scale property measurements and nano-size device fabrication using oxide nanostructures that are semiconducting and piezoelectric.

10:00 **Rainer Hebert**, Assistant Professor, CMBE, "Synthesis and microstructure control of bulk nanostructured metallic materials"

Microstructural length scales of conventional metallic materials, for example, grain sizes, most often range from tens to hundreds of micrometers. Over the last years novel synthesis methods have been developed that now enable the processing of bulk metallic materials with nanoscale and even amorphous atomic arrangements. The change towards nanoscale microstructures entails new deformation mechanisms that significantly enhance the strength levels of nanostructured materials. Recent advances in the synthesis and microstructure control of bulk nanolaminate and amorphous metallic materials will be highlighted. While nanolaminate materials could be used as high-strength sheet materials, the research efforts to identify the deformation behavior of metallic thin films are applicable, for example, to micro-electronics and micro-medical devices. Amorphous alloys are now considered mostly for micro-machine parts such as gears and as coating materials. Current research efforts aim at an improved understanding of the deformation mechanisms in amorphous alloys and the identification of structural heterogeneities in amorphous alloys. Nanostructured and amorphous metallic materials thus not only offer outstanding academic challenges, but are useful for real-world structural and functional applications.

10:25 Break

10:45 **Jeff Stuart**, Associate Research Professor, "Progress Toward Optimized Biologically-Based Photonic Materials"

Biologically-based materials offer a toolbox of novel properties available to the applied scientist to utilize in device architectures. Often these new properties are characterized by high efficiency, unique transduction mechanisms, and high degrees of both flexibility and specificity. At present, photoactive proteins remain a central focus in to the application of biological materials to a variety of technologies. Bacteriorhodopsin acts as a light to chemical energy transducer in its native organism. The complex way in which this protein interacts with light has led to applications that include optical binary and holographic memories, spatial light modulators, associative memories, artificial retinas, and chemical sensors. DNA is receiving considerable attention for its material properties, quite separate from its biological properties. DNA's usefulness as a photonic material stems from two sources, its unusual physical and biological properties. Possibilities include chemical sensing and filtration schemes.

11:10 **Alevtina Smirnova**, Research Assistant Professor, "Fuel Cells and Fuel Cell Materials"

A survey of existing technologies related to energy sustainability and various types of fuel cells with emphasis on polymer electrolyte membrane (PEM), solid oxide fuel cells (SOFCs), and Bio-fuel cells will be presented. New trends in development of promising electrolyte, anode, and cathode materials for fuel cells will be discussed in regard to their portable, stationary, residential, and auto-motive applications. In regard to PEMFCs, new carbon supported catalysts based on carbon aerogels possessing reproducible and scalable nanostructure that allow obtaining high performance at low catalyst loading (ca. 0.1 mg/cm^2) at room temperature will be presented. Considering SOFCs, new technical designs that allow obtaining high SOFC power output at intermediate temperatures in the range of 500^oC-600^oC will be highlighted.

11:35 **Harris Marcus**, Professor & Director, Institute of Materials Science, "Overview of IMS Activities"

12:10 Lunch - Jorgensen

1:00 **Ed Kurz**, Director, IMS Associates Program, “Status of the Associates Program”

1:15 **Harold Brody**, Distinguished Professor, MSE, “Capstone Design Projects”

1:30 Student Presentations

Shan Zhong "Ferroelectric Multilayer Heterostructures for Tunable Microwave Communication Devices Applications"

Ferroelectric multilayers and superlattices have gained interest for many applications in the telecommunications industry. Multilayered Ba1-xSrxTiO3 (BST) films were deposited on Pt coated Si substrates via metal-organic solution deposition. The multilayer heterostructures consisted of three distinct layers of ~220 nm nominal thickness with compositions corresponding to BST 63/37, BST 78/22, and BST 88/12. At room temperature, the heterostructure has a small-signal dielectric permittivity of 360 with a dissipation factor of 0.012 and a dielectric tunability of 65% at 444 kV/cm. These properties exhibited minimal dispersion as a function of temperature ranging from 90 to -10°C. These results are explained via a thermodynamic model that incorporates electrical, mechanical, and electromechanical interactions between BST layers.

Robin Bright "Characterization of Laser Drilled Nickel-Based Superalloys"

Pulsed laser drilling has become of increasing importance to the aerospace industry as a method of creating cooling holes in a variety of high temperature gas turbine engine components. The potential for improved processing speed, accuracy, and reproducibility compared to conventional machining methods make laser drilling attractive from both an economic and product quality standpoint. This presentation summarizes research associated with laser drilling of nickel-based superalloys that is currently being performed at the UConn Institute of Materials Science (IMS). This work is being funded by the Connecticut Center for Advanced Technology (CCAT).

Zhengtang Luo "The Optoelectronic Properties of Single Walled Carbon Nanotubes And Their Aggregates"

2:15 Tour of IMS