



IMECHE CCB Programme 2004/2005

NANOTECHNOLOGY

The Science, Applications, Economic Impact, Way Forward

Overview

We have chosen a theme for next seasons technical programme. Nanotechnology is the science and technology at the atomic and molecular level - nanometric or 10^{-9} m. Nano science and technology covers many fields, from biology and medicine to material sciences and nano machines. It opens the opportunity for a new range of materials, huge advances in sensors, and a generation of more powerful computing capability. Nanotechnology is predicted to be the technology of the 21st century, and be even more pervasive than the development of computers. Many billions of dollars are being spent on development around the world. The US National Science Foundation estimates that by 2015 there will be a \$1trillion global market for nanotechnology. This programme is aimed at cutting through the hype and presenting a useful introduction to nanotechnology for engineers, technologists, and scientists of all disciplines (Mechanical, Electrical, Chemical, Civil, Manufacturing, Industrial, Building, Aerospace, etc).

Programme Outline		
Date	Subject	Location
21 Sep 2004	Overview – The underlying science, applications, trends, economic impact	Toronto Board of Trade, Dixon Road, Airport
19 Oct 2004	Energy – Nano Composite in Power Transmission & Distribution Systems	Toronto Board of Trade, Airport
16 Nov 2004	Transportation (space flight, commercial, military)	University of Toronto Aerospace Institute
03 Dec 2004	Computing applications – Photonics	Toronto Board of Trade, Airport
18 Jan 2005	Lubrication for machines	Toronto Board of Trade, Airport
15 Feb 2005	Materials technology	Toronto Board of Trade, Airport
18 Mar 2005	Medical applications and the engineering connections	Toronto Board of Trade, Airport
19 Apr 2005	Environment (soil, pollution control etc.)	Toronto Board of Trade, Airport
17 May 2005	The Way Forward – A Road Map for the Next 50 Years	Toronto Board of Trade, Airport

Why Should You Attend The Nanotechnology Lectures?

There are three reasons:

- First the subject is fascinating.
- Second, all the talks are by knowledgeable experts in their field. As a result attendance at the talks should qualify as meeting requirements for Continuing Professional Development (CPD). IMechE will be issuing a certificate to people who attend more than 7 meetings.
- And third, scientists and engineers have an obligation to ensure that the benefits of Nanotechnology are available in a timely manner to society, and that at the same time we do not descend into the nanohell that some worry about. This requires us to knowledgeably participate in the public debate to ensure that facts and logic prevail.

Programme open to Directors, Managers, Engineers, Scientists, Technologists and Government

Flyers will be created for each lecture and will be posted at www.imeche-ccb.org

To register for the lecture series or for individual lectures, email: imechec@attglobal.net

IMechE 2004/2005 Detailed Programme Outline

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Date	Subject	Speaker(s)	Speaker(s) Background
21 Sep 04	<p>Overview – The Underlying Science, Applications, Trends, Economic Impact.</p> <p>From a perspective of commercialization, nanotechnology or "Small Tech" is not an industry in itself, but rather a series of enabling technologies that can improve end-products and services in many mainstream industries. The biggest opportunities for nanotechnology are expected to be in medical, aerospace and defence, automotive, information and communication technologies, energy, and chemicals sectors.</p>	<p>Dr Uri Sagman Director Canadian NanoBusiness Alliance</p>	<p>Dr.Sagman is the co-founder and Executive Director of the Canadian NanoBusiness Alliance, an association dedicated to the promotion of the nanotechnology sector in Canada. Dr. Sagman is a medical oncologist, a fellow of the Royal College of Physicians and Surgeons of Canada, and a fellowship recipient of the Medical Research Council of Canada..</p>
19 Oct 04	<p>Energy – Nano Composite in Power Transmission & Distribution Systems</p> <p>The impact of line and power apparatus insulation on Energy conservation will be discussed in the particular context of nanocomposites for insulators. Nanotechnology is also impacting the development of fuel cells for the generation of Energy.</p>	<p>Dr. Shesha Jayaram and Dr. Leonardo Simon</p>	<p>Dr. Shesha Jayaram is Professor in the Department of Electrical and Computer Engineering at the University of Waterloo. Her current nanotechnology research is in high field pulse sterilization of microbial cells. She is also engaged in the development of nanoengineered insulating materials.</p> <p>Dr. Leonardo Simon is Asst. Professor in The Department of Chemical Engineering at the University of Waterloo. His current nanotechnology research is in the areas of polymer and hybrid nanocomposite materials and also polymer electrolyte membranes.</p>
16 Nov 04	<p>Transportation (Space Flight, Commercial, Military)</p> <p>Carbon nanotubes are very unique in the sense that they have extraordinary mechanical properties. For example, compared to steel, nanotubes have a strength-to-weight ratio of 500. At the same time, nanotubes can be used to make a computer chip, because in addition to these wonderful mechanical properties they also have very exciting electrical properties. What is unique about this material is that historically, all the materials we used for computer chip applications were impractical for construction of an aircraft. The same with aluminum or stainless steel; these metals could be used to manufacture an automobile, but they could never be used to make a computer chip. This unique material, which is still emerging, can be used for both fine applications like computer chips and sensors, and for massive applications in the aerospace and automotive industries.</p>	<p>Dr. Meyya Meyyappan NASA, AMES</p>	<p>Dr Meyyaappan has a Ph. D in Chemical Engineering from Clarkson University. He received his undergraduate degree in Chemical Engineering from the Regional Engineering College in Trichi. He has been at NASA for the last six years as the Director of the Nano Center. His group, consisting of 60 scientists, has been engaged in carbon nanotube (CNT) based nanotechnology, protein nanotubes, Bacteriorhodopsin based data storage, biosensor development, molecular electronics, quantum computing, computational electronics, computational optoelectronics, and computational nanotechnology. He is a member of IEEE, AIChE, AVS, ECS, and MRS. He is the IEEE Distinguished Lecturer on Nanotechnology and ASME's Distinguished Lecturer on Nanotechnology.</p>
03 Dec 04	<p>Computing Applications – Photonics (Joint Meeting with the Institute of Electrical Engineers)</p> <p>Nanomaterials and nanostructures have a major role to play in the field of computer applications and photonics. Examples will be discussed and some structural and behavioural aspects will be considered.</p>	<p>Dr Harry Ruda U of T</p>	<p>Prof. Harry Ruda is the Energenius Chair of Advanced Nanotechnology and the Director of the Electronic-Photonic Materials Group at the University of Toronto. He has over twenty years of experience in nanotechnology.</p>

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18 Jan 05	<p>Tribology/Lubrication for Machines</p> <p>Surface energy is an important parameter that determines the frictional performance of a metal. Nanostructured metals and alloys possess a large fraction of grain boundary atoms that confer special properties to their tribological performance, including the coefficient of friction. The wear and lubrication contexts will be considered.</p>	<p>Dr Daehyun Jeong Integran Technologies.</p>	<p>Dr. Daehyun Jeong received his Ph.D. in Materials Science and Engineering at the University of Toronto in 2003. He is presently Research Scientist at Integran Technologies, working on electrodeposited nanocrystalline materials with particular emphasis on lubrication and wear properties. He has authored several research papers.</p>
15 Feb 05	<p>Materials Technology</p> <p>A particularly exciting field of nanotechnology deals with nanostructured materials produced by electrodeposition. Many applications have grown in recent years from laboratory investigations to being economically viable technologies. Examples will be discussed.</p>	<p>Prof Uwe Erb U of T</p>	<p>Dr. Uwe Erb is Chair in Microengineered Materials at the University of Toronto, and is regarded as world leader in the field of electrodeplated nanostructures. He is the author of numerous highly significant publications and holds several patents.</p>
18 Mar 05	<p>Medical Applications and the Engineering Connections (Annual meeting)</p> <p>The advent of Nanotechnology has created many research opportunities in the field of medicine and health care. While true clinical applications of Nanotechnology are do not exist today many promising medical projects are at the advanced experimental stage. The goal of the Canadian Institute of Health Research is to integrate knowledge from diverse backgrounds – physics, chemistry, biology, engineering, computational science, and ethics. The goal is to ensure a multidisciplinary strategy is taken to Nanomedicine developments</p>	<p>Dr Eric Marcotte Canadian Institute of Health Research</p>	<p>Dr Marcotte holds a PhD in Medical Sciences, Physiology & Pharmacology, from McMaster University. His PhD thesis was on the role of G-proteins in mediating dopamine receptor supersensitivity in Parkinson's disease. He did Post-Doctoral work on schizophrenia at the Douglas Hospital Research Centre, McGill University. His research focused on the role of synaptic plasticity markers during development, and examining gene expression profiles (using DNA microarrays) in various models of schizophrenia. This work was sponsored by the Canadian Institutes of Health Research (CIHR) and the Schizophrenia Society of Canada. He is currently employed as a Consultant for Galileo Equity Management, and a Sessional Lecturer at McMaster University. His area of expertise involves modern biotechnology, and its relevance for medical and pharmaceutical development.</p>
19 Apr 05	<p>Environment (Soil, Pollution Control etc.)</p> <p>The development of high field pulsed power techniques for the sterilization of microbial cells will be discussed. This technology has wide application in pollution control and enhancement of the environment, while the use of pulsed power also conserves energy, again benefiting the environment.</p>	<p>Dr. Shesha Jayaram University of Waterloo</p>	<p>Dr. Shesha Jayaram is Professor in the Department of Electrical and Computer Engineering at the University of Waterloo. Her current nanotechnology research is in high field pulse sterilization of microbial cells. She is also engaged in the development of nanoengineered insulating materials.</p>
17 May 05	<p>The Way Forward – A Road Map for the Future</p> <p>The presentation will first recall relevant aspects of nanotechnology that are already in place or very near implementation. Based on these and on present research and technology trends, future developments and concepts will be presented which may range from the single electron transistor to fully effective solar screens. The impact of present nanotechnology funding trends on future developments will be discussed as well as the potential effect on industrial production and general economic.</p>	<p>Dr. Paco Gonzalez Integran Technologies.</p>	<p>Dr. Francisco "Paco" Gonzalez is the Vice President of Process and Product Development at Integran Technologies, and has many years of experience in several areas of nanotechnology. He holds four patents in the field and has published numerous research papers.</p>