

Nanotechnology Engineering Symposium
Friday, March 25, 2010, at the William G. Davis Computer Research Centre
Presentations Schedule

I. Nanofluidics and Nano Bio Applications (Session 1) Room:DC-1301

<i>Time</i>	<i>Project Title, Design Group, Abstract</i>	<i>Project No.</i>
9:30	Functionalized Graphene Field-effect Transistor for Disease Diagnosis <i>Peter Jones, Trevor LeBel, Mark Beeler, Matt McDonald</i>	NE_2011_01
9:50	Alginate Hydrogel for Burn Wound Dressings <i>Kent Brockman, Mathieu Guenette, Shaun Smith, Jeff Wang</i>	NE_2011_06
10:10	MEMS-Based Alcohol Sensor <i>Daniel Au, Mikhail Hanewich-Hollatz, Sarah Reinholt, Abdullah Syed</i>	NE_2011_07
10:30	TRENCH: A Thermally Responsive Nano-Composite Hydrogel Valve and Filter for Microfluidics <i>Yifan Kong, Maria Jimena Loureiro, Cameron Postnikoff, Colin Zamecnik</i>	NE_2011_12

I. Nanofluidics and Nano Bio Applications (Session 2) Room:DC-1301

<i>Time</i>	<i>Project Title, Design Group, Abstract</i>	<i>Project No.</i>
11:00	Gold Nanoparticle Based Fluorescence Quenching Technique for Biochemical Fingerprinting <i>Daniel Lewis, Erin Bedford, Hershel Macaulay and Russell Sterrett</i>	NE_2011_13
11:20	Inductively Actuated Biocompatible Shape Memory Polymers <i>Nathan Dyck, Graham Jackson, Corey Schreiber, Dallas Willms</i>	NE_2011_15
11:40	Multi-layer Membrane for Cell Migration Assays <i>Arthur Ching, Alex Chortos, Luye (Mary) Mu, Veronica Tsou</i>	NE_2011_16
12:00	Quantum Dot Magnetophoresis Enhanced Detection (Qdmed) <i>Farnaz Niroui, Arash Farhadi, Blake Farrow, Shrey Sindhwani</i>	NE_2011_18

II. Nanophotonics and Electronics Room:DC-1301

<i>Time</i>	<i>Project Title, Design Group, Abstract</i>	<i>Project No.</i>
1:00	Light Management Structures for Silicon Photovoltaic Devices <i>Harlan Kuntz, TJ Robotham, Victor Chabot, Yang Gao</i>	NE_2011_02
1:20	QCode: Quantum Dots for Counterfeit Detection <i>Hansen Lau, Simon Lee, Brian Wong, Matthew Wong</i>	NE_2011_04
1:40	GenStep <i>Edgar Cao, Uzair Chutani, David Moon, Keith Peiris</i>	NE_2011_05
2:00	Smart Paint System for Automated Vehicle Guidance <i>Andrew Kaikai, Michal Mleczko, Lily Lai Chi So, Samantha Stambula</i>	NE_2011_10

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Presentations Schedule (cont'd)

III. Nano Functional Materials (Session 1)		Room:DC-1301
<i>Time</i>	<i>Project Title, Design Group, Abstract</i>	<i>Project No.</i>
2:30	MANPES: Multi Array Nanopillar Exoskeletons <i>Andrea Schoeller, Jon Medwig, Si Jia Zhang, John Maier</i>	NE_2011_03
2:50	Clarity <i>Eva Yung, Imran Khimji, Ivan Law, Ken Chan</i>	NE_2011_08
3:10	CellWrap: The Next Generation Food Wrap <i>Patrick J. Lee, Jisung Kim, Hao-Nhon (TD) Nguyen, Alexander Chi Fai Ip</i>	NE_2011_09
3:30	C*5 Autosintering Nanotape <i>Damon Aboud, Nicole Weckman, Sean O'Neill, Steven Chen</i>	NE_2011_11
3:50	Electrospun Carbon Nanofibers <i>Jason Kuo, Yi-Hsien Chung, Lathankan Rasenthiram, Justin Chen</i>	NE_2011_14
III. Nano Functional Materials (Session 2)		Room:DC-1301
<i>Time</i>	<i>Project Title, Design Group, Abstract</i>	<i>Project No.</i>
4:20	WATICE: Icephobic Nanocoating for Power Transmission Lines <i>Drew Davidson, Adam Dobri, Calvin Hung, Fei Hua Li</i>	NE_2011_17
4:40	Air-Jewel, a Solid Silica Aerogel Cube Containing Fragrance Oil for Cosmetic Use <i>Sean (Sungyun) Seol, Erica (Eunji) Lee, Mary (Songmi) Lee, Joseph Tse</i>	NE_2011_19
5:00	Frost Aegis: Transcending the Lotus <i>Alvina Chau, Yvonne Cheng, Mandric Leung, Andrew Shum</i>	NE_2011_20
5:20	Nanoengineered Self-Cleaning Ultrafilter <i>Prasahnt Sivarajah, Brendan McDonald, Andrew Ward, Peter Lin, Prashant Shekhar</i>	NE_2011_21

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Project Briefs

I. Nanofluidics and Nano Bio Applications

Project No. Project Title, Design Group, Abstract

NE_2011_01 Functionalized Graphene Field-effect Transistor for Disease Diagnosis

Peter Jones, Trevor LeBel, Mark Beeler, Matt McDonald

In today's globalized world, diseases are transmitted at unprecedented rates. Rapid diagnosis is critical for accurate treatment, saving lives and containing further outbreaks. We have developed an inexpensive and reusable device, based on the Nobel Prize-winning material graphene, enabling the instantaneous and inexpensive diagnosis of multiple diseases simultaneously. This device will revolutionize medical diagnostics and save lives everywhere from first-class hospitals to disaster zones.

NE_2011_06 Alginate Hydrogel for Burn Wound Dressings

Kent Brockman, Mathieu Guenette, Shaun Smith, Jeff Wang

Hydrogels are setting a new standard in wound care and burn treatment over traditional bandages. Hydrogels by their nature automatically clean wounds, are safer to apply and remove from a patient and are made out of a renewable and easily processed material. On top of this, healing ingredients can be incorporated into the hydrogel which diffuse out into the wound for faster and more efficient healing.

NE_2011_07 MEMS-Based Alcohol Sensor

Daniel Au, Mikhail Hanewich-Hollatz, Sarah Reinholt, Abdullah Syed

Every year, thousands of preventable accidents occur due to drivers under the influence of alcohol. Key to the prevention of repeat impaired driving offenses is the use of ignition interlock devices, which prevent drivers from starting their engines if their blood alcohol concentration is above the legal limit. Current devices are expensive, inaccurate and difficult to use, limiting their effectiveness. With a microelectromechanical system (MEMS) design, all of these problems can be eliminated, increasing the accuracy and lifetime of the ignition interlock device, and decreasing cost.

NE_2011_12 TRENCH: A Thermally Responsive Nano-Composite Hydrogel Valve and Filter for Microfluidics

Yifan Kong, Maria Jimena Loureiro, Cameron Postnikoff, Colin Zamecnik

Isn't it ironic that when things get smaller, space comes at a premium? Tiny microfluidic devices are sometimes used for medical diagnostics and to achieve this goal, various parts of blood need to be separated. Valves and filters are two of the main components used for this purpose but can take up a lot of room. We have designed a component that consolidates both of these functions for microfluidic systems; it's basically a filter that opens and closes. Fabricated using a special polymer, this component can be controlled using magnetic heat. Control the holes, dig TRENCH membranes.

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Project Briefs

I. Nanofluidics and Nano Bio Applications (Cont'd)

Project No. Project Title, Design Group, Abstract

NE_2011_13 **Gold Nanoparticle Based Fluorescence Quenching Technique for Biochemical Fingerprinting**

Daniel Lewis, Erin Bedford, Hershel Macaulay and Russell Sterrett

Ensuring that our everyday environments are free of harmful toxins requires a variety of time-consuming tests, each looking for a different type of toxin. What if all of these tests could be combined into one simple measurement? We've developed a biochemical sensing technique in which each specific toxin generates its own unique "fingerprint" based on interactions between gold nanoparticles and fluorescent molecules. Using this technique, a wide variety of toxins could be identified using one simple test.

NE_2011_15 **Inductively Actuated Biocompatible Shape Memory Polymers**

Nathan Dyck, Graham Jackson, Corey Schreiber, Dallas Willms

Traditional medical stents serve as reinforcement structures used to open restricted passageways in the human body, such as arteries blocked by plaque. Using shape memory polymer technology, along with ferromagnetic nanoparticles, an improved stent will be displayed that takes advantage of the unique polymer-nanoparticle material properties. The new material allows the stent to be expanded using a magnetic field, which allows for minimally-invasive surgery, and also offers the additional benefit of natural biodegradation, eliminating the need for a removal procedure.

NE_2011_16 **Multi-layer Membrane for Cell Migration Assays**

Arthur Ching, Alex Chortos, Luye (Mary) Mu, Veronica Tsou

Who says stripping can't be both fun and scientific? Cell migration assays are an important part of medical research, including the fight against cancer, yet existing designs are cumbersome and yield ambiguous results. Our improved design is a multi-layer separable membrane that allows users to swiftly strip off one of the layers to get rid of all extraneous cells effortlessly and reliably, making it easier to analyze the results. A combination of surface science, engineering savvy, and stripping can truly improve your data and make your work a lot easier.

NE_2011_18 **Quantum Dot Magnetophoresis Enhanced Detection (Qdmed)**

Farnaz Niroui, Arash Farhadi, Blake Farrow, Shrey Sindhwani

The key to early stage cancer detection lies in the blood. Qdmed uses special nanoengineered locks crafted from DNA which release nanoflares in the presence of cancer biomarkers. Our technology captures and separates these flares from the blood using magnetic confinement, drastically increasing the signal and lowering the noise compared to competing approaches. Nanotechnology can bring a paradigm-changing impact on how cancer is detected in its early stages; let Qdmed show you how.

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Project Briefs

II. Nanophotonics and Electronics

Project No. Project Title, Design Group, Abstract

NE_2011_02 **Light Management Structures for Silicon Photovoltaic Devices**

Harlan Kuntz, TJ Robotham, Victor Chabot, Yang Gao

The potential efficiency of silicon photovoltaic cells remains limited by the amount of light that avoids conversion and escapes the cell, unharnessed. Our design aims to improve the control of this light as it bounces through the device, using inspiration from a common household material... glossy white paint! The high reflectivity of white paint will be enhanced with a designed suspension of nanoparticles and powders, in order to scatter the rays and shift the colour of escaping light, for an improved chance of conversion compared to conventional metal reflectors. Silicon photovoltaic devices are an increasingly important factor in the pursuit of affordable clean energy, and a fresh coat of paint may be just what the industry needs...

NE_2011_04 **QCode: Quantum Dots for Counterfeit Detection**

Hansen Lau, Simon Lee, Brian Wong, Matthew Wong

Imagine two luxury products placed side by side. One is authentic and one is fake, but they look almost exactly the same. How do we tell which one is authentic? This project provides an innovative counterfeit detection feature by using unique colour combinations of quantum dots, identifiable under UV light, which can be used to authenticate the real product.

NE_2011_05 **GenStep**

Edgar Cao, Uzair Chutani, David Moon, Keith Peiris

The average person takes about 3.7 million steps a year. If we measured all of the energy used, how many light bulbs could we power? Imagine if we could take that energy and use it to power everything around us. Using high efficiency piezoelectric materials integrated within conventional flooring systems, GenStep's solution instantly captures kinetic energy from motion and converts it to available power on the grid. Come and see how we're taking a new approach to sustainability, one step at a time.

NE_2011_10 **Smart Paint System for Automated Vehicle Guidance**

Andrew Kaikai, Michal Mleczko, Lily Lai Chi So, Samantha Stambula

Imagine being able to "see" and "feel" snow-covered traffic lanes. Imagine such information as road construction and speed limits being available at your fingertips. Using the special properties of superparamagnetic nanoparticles, this can be done. Patterned information in road paint can be detected and translated, based simply on nanoparticle concentrations and their induced magnetic fields. With a smart paint system that combines simple chemistry with the intricacy of electromagnetic induction and detection, this science-fiction concept may soon be a reality.

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Project Briefs

III. Nano Functional Materials

Project No. Project Title, Design Group, Abstract

NE_2011_03 **MANPES: Multi Array Nanopillar Exoskeletons**

Andrea Schoeller, Jon Medwig, Si Jia Zhang, John Maier

A micro-thin array of nanoscopic metal pillars, aligned on a surface like a vast network of reinforcement columns. Too small to be seen with the eye, these nanopillars have been shown to be extraordinarily strong and they offer the potential to greatly increase the compression strength and impact resistance of virtually any material with almost no increase in weight.

NE_2011_08 **Clarity**

Eva Yung, Imran Khimji, Ivan Law, Ken Chan

Clarity represents a new way of looking at the way we create optical coatings. In the past, a pursuit of high performance led to the proliferation of fluorinated compounds that remain in the environment far beyond their useful lives. Clarity is a silica-based hydrophobic, antifogging, and scratch-resistant coating for protective eyewear that provides clear vision both to the wearer, and to the cradle to grave lifecycle of the product.

NE_2011_09 **CellWrap: The Next Generation Food Wrap**

Patrick J. Lee, Jisung Kim, Hao-Nhon (TD) Nguyen, Alexander Chi Fai Ip

Have you ever wished the salad you made in the morning for lunch tastes as crisp and fresh as if you just made it? Current commercial food packaging methods are largely ineffective in preventing food spoilage. Using nano-sized cellulose fillers, we present a new wrap which can be used to preserve freshness, while strengthening the wrap and making it more resistant to damage and tear. This wrap will revolutionize the way you look at leftovers!

NE_2011_11 **C*5 Autosintering Nanotape**

Damon Aboud, Nicole Weckman, Sean O'Neill, Steven Chen

Electrical failure caused by fire can cause property damage and the loss of lives. Current high-temperature electrical fire-proofing coatings lack easy adaptability to many situations. The proposed coating on wire systems comprises a silica tape with nanoclay which will be flexible for easy installation, and sinter to a ceramic refractory in extreme thermal situations delaying or preventing critical system failure.

NE_2011_14 **Electrospun Carbon Nanofibers**

Jason Kuo, Yi-Hsien Chung, Lathankan Rasenthiram, Justin Chen

Stronger. Lighter. Cheaper. Carbon Nanofibers are nanostructured materials that help amplify properties of existing materials used largely in the automotive and aerospace industry. Using technology analogous to a cotton candy machine these fibers are spun to compete with existing industry standard fibers at a fraction of the price.

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Project Briefs

III. Nano Functional Materials (Cont'd)

Project No. Project Title, Design Group, Abstract

NE_2011_17 **WATICE: Icephobic Nanocoating for Power Transmission Lines**

Drew Davidson, Adam Dobri, Calvin Hung, Fei Hua Li

Think for a moment about how much you depend on a constant source of electricity in your day-to-day life. Over four million North Americans faced days or weeks without this resource during the Great Ice Storm of 1998. In addition to leaving thousands of homes without power, storms like these can cause billions of dollars in damages. One of the major causes of blackouts is the accumulation of ice on overhead power lines. WATICE is working on a novel coating system designed to reduce and eliminate ice accumulation on transmission lines in order to provide continuous power to those who need it, even in the most severe winter conditions.

NE_2011_19 **Air-Jewel, a Solid Silica Aerogel Cube Containing Fragrance Oil for Cosmetic Use**

Sean (Sungyun) Seol, Erica (Eunji) Lee, Mary (Songmi) Lee, Joseph Tse

Here is the aerogel based fragrance carrier that satisfies the three senses: sight, touch, and smell. The translucent nature of silica aerogel fulfills the sense of sight, the catastrophic shattering of aerogel cube fulfills the sense of touch, and finally the dispersion of fragrance satisfies the sense of smell with pleasant scent. We call it Air-Jewel.

NE_2011_20 **Frost Aegis: Transcending the Lotus**

Alvina Chau, Yvonne Cheng, Mandric Leung, Andrew Shum

The lotus flower has long been revered by the arts for its elegance and beauty. Recently, its natural design has even enamored the scientific community. Based on the inherent properties of the lotus leaf, we have developed a coating that impedes ice accumulation on a number of different surfaces. When this anti-ice coating is applied to freezer coils, it can greatly reduce household energy consumption. And by adapting this solution into industry standards, we can help our future generations bloom a little greener.

NE_2011_21 **Nanoengineered Self-Cleaning Ultrafilter**

Prasahnt Sivarajah, Brendan McDonald, Andrew Ward, Peter Lin, Prashant Shekhar

Water water everywhere but not a drop to drink! This is the reality for over 1.3 billion people living in 3rd world countries, where contamination and viruses plague nearly all fresh water sources. But there's hope! Combining nanotechnology, materials science, and UV optics, our design team has engineered a portable device that is able to provide clean drinking water to those in need. But this isn't your regular "needs to be replaced" water filter – no – our self cleaning and robust design will provide a device that will last a lifetime!