



Nanotechnology Engineering Symposium

Friday, March 22, 2013, 9:30am to 6:00pm, at the William G.
Davis Computer Research Centre

Projects Presentations

(Room: DC-1304)

I. Nano Fluidics & Biotechnology

Time	Project Title, Design Group, Abstract	Project No.
9:40	Multi-Surface Antimicrobial Coating <i>Philippe Gagnon, Craig Langford, Cameron Stewart, Josh Borovoy</i>	NE_2013_02
10:00	MEND - Modifiable Epidermal Nanogel Dressing (TM) <i>Yih Yang Chen, Francis Li, Carmen Nguyen, Jennifer Wong</i>	NE_2013_08
10:20	Biosynthesis of Metallic Nanoparticles <i>Michael Kreder, Stephen Lawes, Geoff Hollett, Adam Riese</i>	NE_2013_11
10:40-10:50 Break		
10:50	Nanoparticle Formulation via Microfluidic Platform <i>Louis Cheung, Jinhe Liu, Alvin Qian, Chong Shen</i>	NE_2013_14
11:10	NanoSense Flexible Glucose Sensor <i>Pedram Esmaeilzade, Huayi Gao, Maryam Nasirpour, Xin Qu</i>	NE_2013_20
11:30	Engineered Nanoparticle-LOVE (EN-LOVE) Sensor <i>Doo Hwan Oh, Jun Goo Kim, Yong Jae Hyun</i>	NE_2013_21

II. Nano-Electronics & Photonics

Time	Project Title, Design Group, Abstract	Project No.
12:00	ArchiTiles <i>Dante Di Domenicantonio, David Josey, Mickael Orlando, Galina Voloshin, Andrew Weng</i>	NE_2013_04
12:20	REAC: Reflective Environmentally Adaptive Camouflage <i>Brock Bearss, Nathan Hilker, Nicholas Lanigan, Spencer Yim</i>	NE_2013_05
12:40	Nanocrystalline Cellulose and Optical Security <i>Alfred Chung, Michael Choi, Owen Crookston, Wylee Co</i>	NE_2013_07
1:00-1:30 Break		
1:30	PRISM: Particle Retroreflectors for the Improvement of Safety Measures <i>Mina Labib, Sarah LeBlanc, Gabriel Moreno-Bautista, Duncan Strathearn</i>	NE_2013_10
1:50	Lumotune^(TM) <i>Matin Esfahani, Hooman Safaee, Shafi Siddiqi, Mike Vlascov</i>	NE_2013_12
2:10	Novelly-Designed Rechargeable Zinc-Air Batteries <i>Ainan Ameen, Babak Baradaran Shokouhi, Keval Shah, Matthew Liem, Raihan Ahmed</i>	NE_2013_15
2:30	Silver Nanowire Coating for Flexible Solar Cells <i>Nolan Beanlands, Sean Lee, Brandon Smith, Brendan Smith</i>	NE_2013_18

III. Nano Functional Materials

<i>Time</i>	<i>Project Title, Design Group, Abstract</i>	<i>Project No.</i>
3:00	High Performance Composites for Snowsport Bases <i>Derek Bennewies, Matt Davis, Khanjan Desai, George Gritsouk</i>	NE_2013_01
3:20	Nano6PAC: Integration of Bio-Renewable Nano-Crystalline Cellulose into Polyamides <i>Anastasia Pasche, Grigory Chugunov, Grigoriy Kimaev, Mitchell Sinclair</i>	NE_2013_03
3:40	NanoDext: A Fuller Protection <i>Danielle Charron, Morag Clark-Heptinstall, Nathaniel Hamelin, Joanna Piórkowska</i>	NE_2013_06
4:00	Robust Hydrophobic Coating <i>Aleksander Cholewinski, Toyin Jibowu, Ching Chi Kwan, Josh Trinidad</i>	NE_2013_09
4:20-4:30 Break		
4:30	NeveFrost <i>Lynna Chen, Benson Fan, Abhinay Kondamreddy, Tim Leshuk</i>	NE_2013_13
4:50	Forward Osmosis Water Filtration Using Functionalized Nanoparticles <i>Alexia Blake, Katarina Ilic, Stephanie Kedzior, Ron Makovoz</i>	NE_2013_16
5:10	Water Disinfection via TiO₂ Advanced Oxidation Processes <i>Justin Hwang, Sumin Jin, Michael Klein, Eun Sun Song</i>	NE_2013_17
5:30	Silent Blue, Silica Aerogel in Hearing Protection <i>Alex Yang, Jason Vickress, Michael Hoang, Pranav Madhikar and Kirushanth Sakthivetpillai</i>	NE_2013_19

Projects Abstracts

I. Nano Fluidics & Biotechnology

Project No. Project Title, Design Group, Abstract

NE_2013_02 **Multi-Surface Antimicrobial Coating**

Philippe Gagnon, Craig Langford, Cameron Stewart, Josh Borovoy

Controlling the spread of bacteria born infections is increasingly a top priority of hospitals as well as the food handling industry. Our group is developing a novel nanoparticle based antimicrobial coating, safe for surfaces in frequent contact with humans and food products. The developed product will be comparable to current surface coatings but will have an added antimicrobial agent without sacrificing ease of application.

NE_2013_08 **MEND - Modifiable Epidermal Nanogel Dressing (TM)**

Yih Yang Chen, Francis Li, Carmen Nguyen, Jennifer Wong

Our product is a biocompatible wound dressing that is intimately combined with a unique nano-scaled gel system. It provides a versatile platform that facilitates the topical delivery of multiple drugs in a healing-conductive environment. The novelty of this platform lies in its drug-independent design, which enables it to be tailored to treat specific medical conditions.

NE_2013_11 **Biosynthesis of Metallic Nanoparticles**

Michael Kreder, Stephen Lawes, Geoff Hollett, Adam Riese

Metallic nanoparticles have shown great promise in a number of applications, including use as catalysts, antibacterial agents, and in biomedical devices; however, current methods of nanoparticle synthesis can involve toxic compounds, explosive gases or expose workers to hazardous conditions. We have developed a safe process that uses biological reagents in order to synthesize various high quality metal nanoparticles with the flexibility to address the needs of any customer.

NE_2013_14 **Nanoparticle Formulation via Microfluidic Platform**

Louis Cheung, Jinhe Liu, Alvin Qian, Chong Shen

Polymeric materials have been widely explored as a novel method of drug delivery by encapsulating therapeutics in particles on the nanoscale. The advantages of preparing dosage forms using nanotechnological methods are highly attractive, although there are challenges that curtail its proliferation. The design team has proposed an innovative solution using microfluidics to improve the production throughput and reproducibility of nanoparticle properties to meet the stringent requirements of commercialization.

NE_2013_20 **NanoSense Flexible Glucose Sensor**

Pedram Esmaeilzade, Huayi Gao, Maryam Nasirpour, Xin Qu

The NanoSense Flexible Glucose Sensor will combine modern day nanotechnology with polymer science in order to create a highly efficient and flexible glucose sensor. The NanoSense Flexible Glucose Sensor can be used to monitor blood glucose levels through a traditional method, requiring a drop of blood, or through a more novel method of using tears. The flexible nature of the sensor allows for it to be incorporated into contact lenses, which would provide 24 hour glucose level monitoring. The sensor can further be attached to an LED in order to signal to the user whenever their blood glucose level has gone above or below regular levels.

NE_2013_21 **Engineered Nanoparticle-LOVE (EN-LOVE) Sensor**

Doo Hwan Oh, Jun Goo Kim, Yong Jae Hyun

Health effect and toxicity of nano-scale material is receiving more attention from public every year. The particle separator pipe with a SAW device is designed to target the market on nanoparticle aerosol alert device. Nanoparticle trajectory in a bent pipe is used to separate nanoparticles within a specific range. The presence of nanoparticles can be captured and detected by a highly sensitive, quartz-based SAW detector and alert users for any possible danger. Furthermore, the captured nanoparticles can be collected from the SAW device for further toxicological analysis.

II. Nano-Electronics & Photonics

Project No. Project Title, Design Group, Abstract

NE_2013_04

ArchiTiles

Dante Di Domenicantonio, David Josey, Mickael Orlando, Galina Voloshin, Andrew Weng

ArchiTiles are modular design elements that change color in order to alter the ambience of a space. The tiles respond to their environment using electrochromism – the material property of changing colour when electric charge is applied. Integrated with pressure sensing technology, ArchiTiles leave a blaze of colour behind your footsteps. ArchiTiles are vibrant, interactive, low power, and scalable. Made for architects and interior designers, ArchiTiles may completely revolutionize the way fundamental building blocks are perceived.

NE_2013_05

REAC: Reflective Environmentally Adaptive Camouflage

Brock Bearss, Nathan Hilker, Nicholas Lanigan, Spencer Yim

Current applications of visual camouflage are static in nature, vaguely matching specific environments (for example, desert, arctic, or forest terrain) in colour, pattern and texture. Reflective Environmentally Adaptive Camouflage (REAC) is a novel, electrochromic system designed specifically to mimic its environment, changing its colour in accordance to its surroundings. The electrochromic material is housed inside two transparent electrodes. Upon application of a DC potential bias to the electrodes, the material, through an electrochemical redox reaction, will change colour with respect to the magnitude of the applied bias.

NE_2013_07

Nanocrystalline Cellulose and Optical Security

Alfred Chung, Michael Choi, Owen Crookston, Wylee Co

Nanocrystalline cellulose (NCC) is a relatively new material with a variety of applications such as a food thickener, or as reinforcements for various kinds of plastics. NCC also has a variety of special optical properties when made into thin films, such as reflecting different colours based on the thickness of the film. Our project aims to leverage this unique property to create enhanced security features for the purpose of increasing document security.

NE_2013_10

PRISM: Particle Retroreflectors for the Improvement of Safety Measures

Mina Labib, Sarah LeBlanc, Gabriel Moreno-Bautista, Duncan Strathearn

When driving, your safety can be reliant on the visibility of road markings, especially at night. Currently, glass beads are embedded into road paint to reflect headlights, making road markings more visible to the driver. The aim of this project is to create particles capable of focusing reflected light in the driver's direction. These particles are to be used as a supplement or replacement to glass beads, further enhancing road marking visibility.

NE_2013_12

Lumotune^(TM)

Matin Esfahani, Hooman Safaee, Shafi Siddiqi, Mike Vlasov

Futuristic smart glass advertisements are within reach of today's technology. LumotuneTM is a flexible, transparent display that makes use of ambient light to show an image, and thus consumes very little power. It has the versatility to be incorporated on a large variety of surfaces. LumotuneTM can be used for small or large scale dynamic window advertisements and decorations.

NE_2013_15

Novelly-Designed Rechargeable Zinc-Air Batteries

Ainan Ameen, Babak Baradaran Shokouhi, Keval Shah, Matthew Liem, Raihan Ahmed

As society strives towards greener solutions each day, there is a need to research and innovate for smarter, safer and productive ways to store energy. To this day, lithium-ion batteries have been the standard, however, progress towards finding the ideal rechargeable battery has been a challenge. Imagine a living battery that utilizes air as a fuel source, is cheaper to fabricate, and has the potential to have a longer lifetime with ten times the energy density of lithium-ion batteries - all in a novel design. Zinc-air batteries are the perfect candidates to fill this void, while remaining safe and environmentally friendly. This project intends to harness the power of nanotechnology to push the boundaries of zinc-air battery research.

NE_2013_18 **Silver Nanowire Coating for Flexible Solar Cells**
Nolan Beanlands, Sean Lee, Brandon Smith, Brendan Smith

The constantly increasing demand for green energy has driven interest in solar technology. Flexible solar cells show promise for their low cost, conformity to a wide variety of surfaces, and ability to be massed produced. Our design utilizes silver nanowires as a transparent conductive layer, which is essential for the operation of the cell. The silver nanowire coating possesses excellent conductivity, as well as a low temperature, non-toxic, scalable fabrication process. The performance of the device is also improved by increasing the moisture and damage resistance of the surface.

III. Nano Functional Materials

Project No. Project Title, Design Group, Abstract

NE_2013_01 **High Performance Composites for Snowsport Bases**
Derek Bennewies, Matt Davis, Khanjan Desai, George Gritsouk

This product is designed for skiers and snowboarders who want to go faster. We are developing a composite material to be used in the running surface (i.e. the “base”) of skis and boards. It combines conventional plastics with a variety of advanced metallic and polymeric nanostructures to reduce sliding friction and increase speed, without sacrificing durability.

NE_2013_03 **Nano6PAC: Integration of Bio-Renewable Nano-Crystalline Cellulose into Polyamides**
Anastasia Pasche, Grigory Chugunov, Grigoriy Kimaev, Mitchell Sinclair

This 4th year design project involves reinforcing both conventional nylon and “green” nylon with Nano Crystalline Cellulose. Its goal is to produce, via electro-spinning, an opaque non-woven mat, which can subsequently be processed and integrated into transparent composite products to improve their material strength. Applications of this project include: snowboarding goggles, riot masks, visors for aircraft flight helmets and extremely large substrates for Liquid Crystal Displays larger than 106 in.

NE_2013_06 **NanoDext: A Fuller Protection**
Danielle Charron, Morag Clark-Heptinstall, Nathaniel Hamelin, Joanna Piórkowska

Nanotechnology researchers risk dermal exposure to potentially toxic materials since standard laboratory gloves offer limited protection against nanoparticles. Current suggested practice is to double-glove, which limits dexterity and doubles the cost to the user. NanoDext are nitrile gloves with added nano-sized flakes of clay. The non-toxic flakes of clay inhibit nanoparticle permeation during typical use: protecting the user from exposure with minimal extra cost and similar dexterity to standard nitrile gloves.

NE_2013_09 **Robust Hydrophobic Coating**
Aleksander Cholewinski, Toyin Jibowu, Ching Chi Kwan, Josh Trinidad

The intent of this design project is to produce a superhydrophobic coating that is also mechanically robust, allowing it to resist wear and frequent use. This coating will be used on a game based on the ability of superhydrophobic layers to allow water to slide quickly while retaining a spherical shape. The coating will be applied to pieces in the game, which can be used as a puzzle to make paths for water to reach the goal.

NE_2013_13 **NeveFrost**
Lynna Chen, Benson Fan, Abhinay Kondamreddy, Tim Leshuk

Ever get tired of scraping off frost from your windshield in -20 °C weather on a frigid winter morning? Especially when you are already late on your way to an exciting work day? We made a simple spray-on solution designed to form an invisible thin film which prevents frost from forming on your car windshield. We are sure it will save you time and agony, and it’s less expensive than a scraper. Checkout Nevefrost at the symposium.

NE_2013_16 **Forward Osmosis Water Filtration Using Functionalized Nanoparticles**
Alexia Blake, Katarina Ilic, Stephanie Kedzior, Ron Makovoz

Drinkable water is a scarcity in many parts of the world, considering that over 96% of the world's water is saline. Our project involves the design of a functionalized nanoparticle to be used in forward osmosis water purification systems. By using nanoscale particles, we can fine-tune the filtration capabilities of these systems to enhance water filtration procedures while ultimately making clean water more available in a cost-effective manner.

NE_2013_17

Water Disinfection via TiO₂ Advanced Oxidation Processes

Justin Hwang, Sumin Jin, Michael Klein, Eun Sun Song

A water filtration and disinfection system using titanium dioxide nanowires has been designed and built for personal use with possibility of scaling up for industrial use. The system was designed to have reduced cost and power consumption, extended lifetime, safety, user-friendliness, and the most importantly maximized disinfection ability. Contaminated water samples were disinfected by the system and analyzed with UV-Vis spectroscopy.

NE_2013_19

Silent Blue, Silica Aerogel in Hearing Protection

Alex Yang, Jason Vickress, Michael Hoang, Pranav Madhikar and Kirushanth Sakthivetpillai

An advanced sound insulating material is being presented for applications in sound insulation and hearing protection. This material is made from Silica Aerogel, which has been selected for its superior sound insulating properties and extraordinary low weight. This material will be able to outperform existing materials, while maintaining reduced size and weight. The final product titled Silent Blue will be integrated within standard hearing protection devices.
