

Pulp Digest

October 2014

TEDx RenfrewCollingwood



Ata Sina, PPC researcher and current master's student in Mechanical Engineering, has been selected as one of the speakers at this year's TEDx RenfrewCollingwood Talks. The 2014 theme is "Rock, Paper, Scissors". The talks will present a diverse range of speakers who will relate to these topics in serious, fun and cutting-edge ways. Ata will be speaking on his "Origami Engineering", a novel method of creating complex self-folding 3-D paper products that have a potential to serve as a new, sustainable material for product design.

Acting as a hub of energy and inspiration, TEDx Renfrew-Collingwood is a day-long event that brings together creators, catalysts, designers and thinkers to share their ideas worth spreading on the TEDx stage. A day of listening that

invites thought, discussion and play, the TEDx Talks are interspersed with activities, performances, and food worth eating.

"It has been designed not only to share the ideas of some pretty amazing Vancouverites with the audience, locally and globally, but to continue to introduce the city to our community and to encourage people to come and see what this vibrant neighbourhood is all about," said organizer Niki Dun.

WHEN: Saturday October 25

WHERE: Windermere Secondary School - 3155 27th Ave E

TICKETS: \$60 general admission / \$40 students and seniors - [buy online](#)

WEBSITE: www.tedxrenfrewcollingwood.com



Please join us in welcoming some new faces to the Pulp and Paper Centre:



Xianzhong

Xianzhong Feng

MASc candidate in the Department of Chemical and Biological Engineering under the supervision of Professor Peter Englezos. Xianzhong received his BSc in Chemical Engineering and Bioengineering from Zhejiang University in China. His current research project focuses on fabrication of superhydrophobic cellulosic handsheets by functionalized microfibrillated cellulose. The main goal of this project is to render the surface of cellulosic paper hydrophobic by altering/modifying micro-fibrillated cellulose (MFC) particles.



Maysam

Maysam Saidi

Maysam is a visiting PhD candidate (Mechanical Engineering) from Amirkabir University of Technology, Iran. Maysam received his MSc from Sharif University of Technology and his BSc from Amirkabir University of Technology, both in Mechanical Engineering. He now joins the Fluidization Research Centre (FRC) and works with Professor John Grace and Professor Jim Lim. His research focuses on numerical simulation and experimental investigation of spouted fluidized beds at the FRC and at the Particle-Fluid System Laboratory at UBC.



Weiyin

Weiyin Li

MASc candidate in Mechanical Engineering under the supervision of Professor James Olson. Weiyin received his BSc in Mechanical Engineering from Xi'an Jiaotong University in China in 2009. His current research project will focus on developing a detailed CFD model of the complex flow at the slotted screen cylinder during the passage of the screen rotor. This model will provide insight into mechanisms of aperture plugging which limits the capacity of the pulp screen.

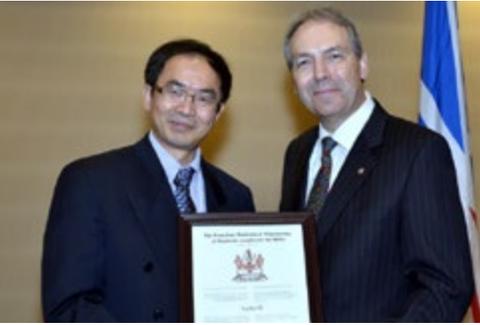
Journal of Pulp & Paper Science (JPPS)

The Pulp and Paper Technical Association of Canada - PAPTAC - with the help of students at the Pulp and Paper Centre at UBC as well as students from the University of New Brunswick, have completed the task of digitizing back issues of its previous journal JPPS. A wealth of information, research and knowledge can be found in these issues of the journal which were previously not available in digital format.*

Visit www.paptac.ca/en/publications/jppsbackissues

*Must be a member of PAPTAC to access online issues. Contact PAPTAC directly to become a member: www.paptac.ca/en/membership/become-a-member

Awards & Achievements



Fellow of the Canadian Academy of Engineering

PPC Faculty Associate Xiaotao Bi, Professor in Chemical and Biological Engineering, was one of 49 new Fellows inducted into the Canadian Academy of Engineering at a ceremony held on June 26, 2014 in Saint John's.

The Canadian Academy of Engineers is the national institution through which Canada's most distinguished and experienced engineers provide strategic advice on matters of critical importance to Canada.

PPC Safety Inspection Award

Leon Yuen, team leader for Professor Stoeber's group, received the PPC Safety Inspection Award on behalf of the entire Stoeber Group. Leon took the lead to complete and update SOP's, MSDS and the Chemical Inventory, all safety requirements at the Centre.

Technical Industry Training Courses

As part of the Pulp and Paper Centre's *Professional Development Series*, Engineering Co-op students now have an opportunity to enroll in a 3-day, hands-on course which will provide an orientation of the workshop, safety training, and an overview of:

- Safe Operation of Machine Shop Tools
- Hand tools
- Precision Measurement and Layout
- Pipe and Tube fittings
- Pumps and Valves
- Swagelok Fluid System Components

Comprised of theoretical lectures, demonstrations and videos, learning will be reinforced by building a project from start to finish using industry standard tools and methods. The course Instructor is a Certified Machinist and Engineering Technician.

Once completed you will have a competitive edge over others. Your employer will directly benefit from the focused, comprehensive safety and technical training you received from a reputable University. You now have hands-on experience using hand tools as well as technical skills and knowledge relevant to a career in industry.

November 24-26, 2014

Cost of 3-day course is \$300/student.

Limited availability

Register* at: www.ubcengcore.com

For more information visit:

www.ppc.ubc.ca/ProfessionalDevelopment

*Registration opens in October after final intake is complete

NOVEL CELLULOSIC FOAM MATERIAL AND MEMBRANE

Prepared by the PPC Biomaterial Research Team



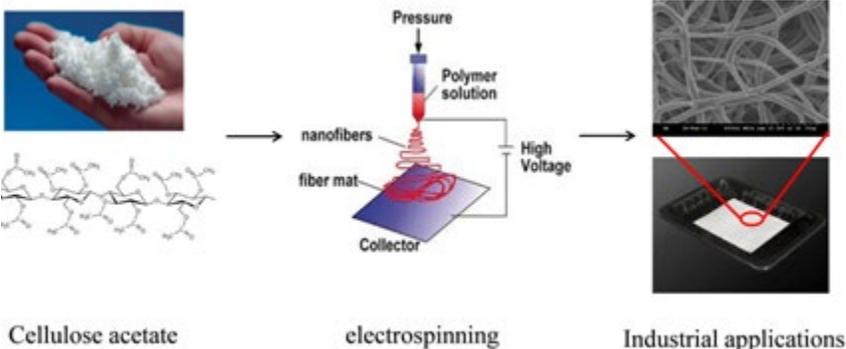
Above: Reza Korehei and Poyan Jahangiri displaying 3D bulky, lightweight foam

There is increasing interest in replacing non-renewable petroleum-based materials with products derived from renewable resources.

In theory, biorefineries of the future should be able to meet the energy and material needs of society by producing advanced biomaterials and biofuels from biomass such as wood and grass.

The lignocellulose substance from plants, which refers to biomass, is the most abundantly available raw material on earth for the production of renewable materials. The lignocellulose substances from wood are composed of carbohydrate polymers (cellulose, hemicellulose), and the aromatic polymer (lignin). Current main industrial use of lignocellulose compounds includes paperboard and other paper products for cellulose and surfactants or as binders for lignin. However, other higher value opportunities for cellulose and lignin utilization as a feedstock for chemicals and novel materials exist. Currently, a large body of research has been conducted in the area of chemical modification of cellulose and lignin for production of new advanced materials and for industrial applications such as filtration, drug delivery, tissue engineering, smart bioactive food packaging, nano-sensors and ultra-weight spacecraft materials.

Below: Illustrating the process of starting with cellulose to the industrial applications using the electrospinning process.



In recent research efforts, a green (solvent-free) and simple technique was established which can produce ultra-light, bulk cellulose foam material from pulp suspension. In this process, cellulose pulp slurry (with various consistencies ranging from 0.5 to 2%) is dispersed in aqueous/surfactant media followed by foam formation under applied shear forces. The resultant cellulose foam is dewatered under low vacuum pressure followed by overnight drying at room temperature. This process results in low density, highly porous 3-D cellulose foam materials. Morphological structure of cellulose foam is investigated using various advanced characterization techniques and low consistency pulp formed the most porous foam structure. Using this process, we are able to increase the capability and find many practical applications such as packaging, filtration and home insulation.

The chemical modification of cellulose has been widely employed to produce new cellulose derivatives to increase its solubility for further development. For example, esterified cellulose or cellulose acetate shows higher solubility in various organic solvents and therefore various tailored materials can be obtained from cellulose acetate. Cellulose acetate with good dimensional stability and low binding property is used as membrane (filter material) and it is also introduced for the manufacturing of separations and filtration. Due to biocompatibility and non-toxicity, the cellulose acetate membrane is suitable for sterile filtration of biological fluids, proteins, enzymes and other biomedical compounds. The critical issue was to produce cellulose acetate membrane with uniform pattern and pre-determined pore sizes (ranged from micro to nano pore sizes) where these membranes can be used for the specific filtration of certain

sizes of biological compounds. Conventionally, wet spinning and solvent-dry spinning (extrusion through spinneret) are used to process cellulose acetate into fibrous membrane material with average fibre diameter of above 10 microns. Advances in science and newly presented technology, named as electrospinning process, facilitate fibre formation and allows the researchers to produce nonwoven mat from polymer solution. In the electrospinning process, a continuous strand of a polymer solution is drawn through a spinneret by high electrostatic forces to deposit randomly on a grounded collector as a non-woven mat. In this process, electrospun fibre with average diameter of below one micron size could be readily produced. The electrospun fibers have several interesting characteristics, for example, a high surface area to mass or volume ratio, a small inter-fibrous pore size with high porosity, vast possibilities for surface functionalization, among others. Therefore, the electrospun fibre can have a broad range of applications including food packaging. The utility of antimicrobial electrospun fibrous

material with high available surface area would be a significant benefit for food preservation where it can also replace the traditional polymeric film packaging material.

A great deal of work remains to be done, but it appears that further investigation of the electrospinning process for development of lignin-based materials is another promising avenue for the realization of increased fundamental knowledge as well as commercial applications of lignin. Research at the Pulp and Paper Centre is underway to produce carbon materials from lignin electrospun fibre with the promising potential application such as reinforcement composite materials, transportation, adsorbents, catalyst substrates, electrodes, and chemically resistant materials. Bio-activated lignin electrospun fibre would be another great opportunity to explore the various biomedical applications including cell adhesion, proliferation in tissue scaffolding and drug delivery, something that no one else is doing at the moment.

Publications

Journal

R.Khan, R.Koreheji, H.J. Salem, N.Darychuk, J.A. Olson and D.M. Martinez, "Fabrication and Characterization of Microfibrillated Cellulose Reinforced Sodium Alginate Based Biodegradable Films for Packaging Applications", *Journal of Science and Technology for Forest Products and Processes (J-FOR)*, accepted for publication.

Abstract: Microfibrillated cellulose (MFC) reinforced sodium alginate-based biodegradable films were prepared by solution casting. The MFC content in the alginate films varied from 3-20% by weight. The tensile strength, tensile modulus, stretch, and tear resistance of the neat alginate films were found to be 52 MPa, 2.15 GPa, 6.8%, and 243 mN respectively. It was found that for 10% loading of MFC in alginate films, the strength of the films increased by 57.7% but kept the inherent transparency of the alginate films. Surface morphologies of the prepared films were investigated using scanning electron microscopy (SEM) and suggested homogeneous mixing of MFC with sodium alginate in aqueous media. Results revealed that MFC acted as a strong reinforcing agent for sodium alginate-based biodegradable films for packaging applications.

N. Sella Kapu, H.L. Trajano, "Review of hemicellulose hydrolysis in softwoods and bamboo", *Biofuels, Bioproducts and Biorefining Journal*, accepted for publication.

Abstract: Hydrolysis to remove hemicellulose and/or generate saccharides is an integral unit operation for the production of chemicals, fuels, and materials from lignocellulosic biomass. Softwoods and bamboo are both widely available but comparatively understudied feedstocks. This paper first reviews the unique hemicellulose chemistry of these feedstocks and the fundamental mechanism of polysaccharide hydrolysis. The influence of temperature, time, acid concentration, particle size, and reactor configuration on water-only hydrolysis, or autohydrolysis, and dilute acid hydrolysis are summarized. The composition, molecular weight, and yields of saccharides and degradation products generated during hydrolysis are presented. Finally, the types, strengths, and weaknesses of current hemicellulose hydrolysis kinetic models are reviewed.

Available online [{here}](#).

Call for Nominations

Engineering Excellence Celebration 2015 - Call for Nominations

The University of British Columbia's Faculty of Applied Science is proud to announce the annual call for nominations for the UBC Engineering Alumni Awards to be held on April 9, 2015.

Do you know an outstanding UBC Engineering alumnus who should be recognized for their contributions to the profession, the community, or society? Do you know a UBC Engineering alumnus who is making a world of difference? Is one of the faculty members in your department deserving of recognition? We invite you to identify nominees for the UBC Engineering Alumni Awards before November 14, 2014.

Awards are presented to the UBC Engineering community in the following categories:

- Lifetime Achievement (alumni)
- Community Service (alumni)
- Young Alumnus (alumni under 35 years)
- Future Alumnus (current UBC Engineering student)
- Emeriti Faculty (retired or emeriti)

You are invited to nominate your accomplished colleagues and peers and attend the celebration. We know our alumni are serving the global community and achieving great things and we appreciate your support in acknowledging and celebrating them! This year's nomination deadline is November 14, 2014.

Nominate someone [{here}](#)

UBC United Way

The [UBC United Way Campaign](#) is an annual workplace campaign that runs in the fall and creates a great opportunity for students, staff and faculty on campus to connect, network and raise funds for a great cause.

Mark your calendars for the UBC United Way Campaign Kick Off week on October 6-10. **The 2nd annual Applied Science Turkey 2k Trot is taking place October 8th at Noon at the E-cairn.** Dean Parlange has challenged deans across campus to a 'participation race'. *What's that* you ask? Our APSC dean will donate \$1 for each registrant from other faculties that exceed the number of participants from Applied Science, so come out and support your faculty!

To register, and for more information, visit : unitedway.apsc.ubc.ca/turkey-2k-trot/

ILLEGAL PAPER

by Chrissy Saville

PPC Sustainability Coordinator

The World Wildlife Fund (WWF) is making massive efforts to expunge the pulp and paper industry of illegally harvested wood.

Paper plays a critical role in the development of civilizations around the world: it brings literacy, education, news, entertainment and carries history. Despite what you may hear in popular media, it is still a much needed industry, globally, that is not going to die off any time soon. The pulp and paper industry uses over 40% of all wood traded globally. Unfortunately, while some of the sources are harvested responsibly, some are not. Once a tree has been cut it is impossible to determine if that wood was cut illegally or not. Because of this, millions of cubic meters of illegally harvested wood gets pushed through unsecure borders to be marked as legal, made into products and then shipped to North America and beyond.

Literally millions of acres of forests are harvested illegally. This behavior can be found all around the world, but it is most often found in countries associated with severe social unrest. Illegal logging results in the conversion of beautiful, productive lands into barren, empty wastelands. It causes human rights issues, social conflicts and countless murders. These lands are most often converted to mono-cultured plantations, guaranteeing that these lands will never be naturally forested or inhabited by wildlife again. This behavior is playing a massive contributing role to the near extinction of important wildlife species such as Orangutans, Elephants, Tigers and countless others. The WWF is making efforts to educate the masses. Next time you buy paper, or any wood product for that matter, make sure it has been certified sustainable with an FSC stamp. To see how the World Wildlife Fund is making an impact, and how you can make an impact too, visit:

www.worldwildlife.org/industries/pulp-and-paper



ENERGY EFFICIENCY AND PERFORMANCE GAP IN GREEN BUILDINGS: THE CASE STUDY OF CIRS BUILDING

Speaker: M. Mahdi Salehi, PhD, Post-Doctoral Fellow

Department of Mechanical Engineering, UBC

Friday, October 3, 1:00-2:00 pm in Policy Lab, CIRS building, 2260 West Mall

ABSTRACT:

More than 40% of world's total energy consumption comes from the building sector. According to the United Nations Environment Program, almost 80% of this energy is due to the operational energy of the building over its life span. Therefore, energy efficient buildings can greatly contribute to the sustainable development of the world. Over the past decades, many building energy modeling tools have been developed to assist in designing new green buildings and retrofitting the existing ones. In practice, a building energy model provides an estimate of the annual energy consumption of the building that is often far from reality - a difference that is referred to as the "Energy Performance Gap". The Center for Interactive Research on Sustainability (CIRS) building is a LEED Platinum-certified building on the UBC campus which has more than 60% higher energy consumption compared to the design prediction. The focus of this talk is on the identification of the sources of the energy performance gap in this building through an extensive modeling and measurement plan. CIRS is advertised to be net-positive; this aspect of the building will also be discussed in this talk.

DO WE WANT THEM OR NOT? GAS HYDRATE INHIBITION AND PROMOTION IN PRACTICE

Speaker: Nicolas von Solms, Associate Professor

Department of Chemical and Biochemical Engineering, Technical University of Denmark (DTU).

Friday, October 17, 12:00 - 1:00 pm in Room 202, CHBE building, 2360 East Mall

ABSTRACT:

Gas hydrates are best known as a flow-assurance issue in oil and gas production. In order to prevent gas hydrate formation at conditions of low temperature and moderate pressure, vast amounts of inhibitors such as methanol and glycol are typically added to the production stream to lower the temperature of hydrate formation to below the production temperature. In order to design on- and offshore processes which handle hydrocarbon streams it is thus necessary to understand (measure and model) phase equilibrium in these multiphase (gas/liquid hydrocarbon/aqueous) systems.

In an effort to reduce the usage of these thermodynamic inhibitors, so-called low-dosage inhibitors have been studied and are in use, where the required amounts are orders of magnitude less. Usually these are polymers which have biodegradability issues, prompting the search for more environmentally friendly inhibitors, perhaps inspired by antifreeze proteins found in nature.

On the other end of the scale, hydrates are being explored as separation agents for power plant flue gas in carbon capture applications, since hydrates are selective for carbon dioxide. Here the formation of hydrates is desirable and research into so-called promoters is underway, looking for substances that lower the pressure of hydrate formation.

Finally, naturally occurring hydrates in the earth may provide an energy source for the future - a resource which might be produced by replacing the methane in the hydrate with carbon dioxide in a so-called "swapping" process, thereby producing potentially carbon-neutral fossil energy.

This talk gives an overview of current research at the Technical University of Denmark addressing these various aspects of gas hydrates.

Upcoming Events

13th TAPPI Advanced Coating Fundamentals Symposium October 7-9, Minneapolis, USA

Bridge the gap between coating research and commercialization by hearing the latest research in advanced understanding of paper and board surface characterization; fundamental coating processes and structures; and more! Reserve your seat today at www.tappi.org/14acfs

CHBE Speaker Series

October 8, 1:00-2:00 pm, room 202, 2360 East Mall

Lorenz (Larry) Biegler, Professor and Head of Chemical Engineering at Carnegie Mellon University will be visiting CHBE to give a seminar. Title and abstract not available at this time, check www.chbe.ubc.ca for updates.

TEDx RenfrewCollingwood

October 25, Windermere Secondary School - 3155 27th Ave E, Vancouver

TEDx is a local event that brings people together to share a TED-like experience. At the TEDxRenfrewCollingwood event, TEDTalks video and live speakers will combine to spark deep discussion and connection in a small group.

Visit tedxrenfrewcollingwood.com for more information

Celebrate Learning Week

October 25-Nov. 1, events across campus

UBC *Celebrate Learning Week* returns for a seventh year! UBC will host a number of events across campus that celebrate teaching and learning. Events will feature open lectures, information sessions, student advising activities, poster sessions, workshops, and more.

List of 2014 events at: celebratelearning.ubc.ca

Social Media



Follow us on Twitter @[ubcPPC](https://twitter.com/ubcPPC)



Like us on Facebook [/ubcPPC](https://www.facebook.com/ubcPPC)

Visit us online: www.ppc.ubc.ca

Thanks for all your TWITTER support. Below we share a few of our recent tweets:

UBC Applied Science @ubcappsience 29 SEP

"We in BC are better equipped than anyone to start the bio-revolution and innovate" - James Olson #innovate2014

UBC Pulp & Paper Centre @ubcPPC 15 SEP

Have you registered for @ResearchDay2014 ? It's not too late, do it today! @ubcengineering @ubcappsience

UBC Engineering@ubcengineering 2 SEP

Engineering Dean Marc Parlange gives sound advice: "Inspire and inspire... and dare to dream" #IAMUBC (photo)

UBC Pulp & Paper Centre @ubcPPC 2 SEP

Happy first day of school! Wishing you a successful 2014-15 academic year.

Contact

To submit items to *PPC's Pulp Digest* or to join our mailing list, please contact Anna Jamroz, PPC Communications Coordinator at: anna.jamroz@ubc.ca

