



a place of mind

FACULTY OF
APPLIED SCIENCE

ADVANCED PAPERMAKING INITIATIVE (API)

ANNUAL REPORT

for the period April 1, 2015 - March 31, 2016

Prepared for API

Dr. Mark Martinez, Director

Professor in Chemical and Biological Engineering

Director of the Pulp and Paper Centre

Your support continues to
make a vast difference to
our students, faculty and
community.

Thank you.

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Introduction

The mission of the Advanced Papermaking Initiative (API) is to enhance postsecondary education and research for the paper industry of British Columbia. The Initiative supported the creation of two faculty positions at UBC (Professors James Olson in Mechanical Engineering and Mark Martinez in Chemical and Biological Engineering) and one at BCIT (Dr. Rodger Beatson). Professor Peter Englezos, a faculty member and Head of the Department of Chemical and Biological Engineering at UBC, is also a member of the API.

This 18th Annual Report describes the activities of the API-funded faculty as well as the Director's for the period 1 April 2015 to 31 March 2016. Leading edge and industrially relevant research is carried out at UBC's Pulp and Paper Centre. I invite you to contact Professors Beatson, Englezos, Martinez and Olson directly to learn more about their exciting research projects.

Over the last year, the **Masters of Engineering Leadership (MEL) in Green Bio-Products** program was successfully launched in January 2016. A cohort of 5 students is currently enrolled in this professional program focused on producing future leaders of the industry. In addition to classes and assignments, students have an opportunity to meet with the program director on a monthly basis to discuss progress, and have had several professional development opportunities such as Industry Nights and tours of BC mills and local companies focused on sustainability initiatives.

API faculty has also been developing a unique and complimentary teaching package that will address the current educational needs of the industry. The **Green Bio-Products Accelerate Partnership** proposal was developed to address current educational needs of industry and has since been finalized and gone out to industry for their consideration. We are now waiting for decisions and commitments to come through. Each of these two initiatives will function as a partnership between UBC and industry with the end goal of ensuring that the forestry sector in BC, Canada and globally has the HQP it needs to transition from the traditional pulp and paper manufacturing into the new bio-economy.

API Structure



Mark Martinez
Director, API

The Initiative is led by a Director, appointed by the Dean, and advised by a Management Committee consisting of API faculty. An industrial Advisory Group provides advice to the Director and Dean on the API’s activities in meeting its mandate.

The key personnel are:

Dean, <i>Applied Science</i> :	Marc Parlange
Director of API:	Mark Martinez

Management Committee:

This committee consists of the faculty associate with the API

- Rodger Beatson
- Peter Englezos
- Mark Martinez
- James Olson

Advisory Group:

- Mr. Paul Bicho, *Canfor Pulp Ltd. Partnership*
- Ms. Shannon Huntley, *FPInnovations*
- Mr. Carol Lapointe, *Domtar*
- Mr. George Milosevich, *Catalyst Paper*
- Mr. Tobias Ziegenbein, *Mercer International*

API Faculty - Biographies

Rodger Beatson Rodger Beatson holds a B.Sc. Honours (1968) in Chemistry from the University of Exeter, Devon, England. He obtained his Ph.D. (1975) in Organic Chemistry from the University of Western Ontario, London, ON. In 1976 he joined Consolidated-Bathurst subsequently becoming Group Leader Product Development in the Packaging Division. Rodger joined Paprican in 1979 holding research positions in mechanical pulping and fibre and paper physics. He also served as the Director of the Papricourse. Rodger joined Canadian Forest Products as a Senior Research Scientist in 1990 before joining the API in 1999 as a Faculty member at BCIT. Rodger served as the Chairman of the PAPTAC Research committee in 1994 and has been an Adjunct Professor in the Faculty of Forestry at UBC since 1995. Dr. Beatson's current research interests are dissolving pulp production, the use chemicals to reduce energy consumption in refining and the recovery of hemicellulose from mill residues for use in improving beatability and enhancing paper strength.

Peter Englezos holds a Ph.D. in Chemical Engineering from the University of Calgary (1990). During his Ph.D. studies, Peter was the recipient of an Izaak Walton Killam Memorial Scholarship. In September 1990, he joined the Department of Chemical Engineering at UBC as an Assistant Professor. He was awarded a UBC Izaak Walton Killam Memorial Faculty Research Fellowship for the period 1997-98. In 1999, he was named Fellow of the Tokyo Electric Power Company Endowed Chair at the Faculty of Science and Technology of Keio University in Japan. He served as Coordinator of the non-thesis Pulp and Paper Master of Engineering Program for the period 1992-1999. Peter served as the Director of the Advanced Papermaking Initiative between July 1, 2005 and August 2011. On December 1, 2007 he became the inaugural holder of the Advanced Papermaking Professorship. In July 2009 Peter was appointed Head of the Department of Chemical and Biological Engineering. He is a registered Professional Engineer in British Columbia and a member of the Canadian Academy of Engineering (2009). His current research interests are in the fields of papermaking chemistry, natural gas hydrates, thermodynamics, and carbon dioxide capture.

Mark Martinez holds a Ph.D. in Chemical Engineering from The University of British Columbia (1995) and a Docent in Paper Technology from the Royal Institute of Technology (1999). He joined the Chemical Engineering Department at UBC in 1999 after four years at the Swedish Pulp and Paper Research Institute, where he was group manager for the paper technology group. Mark was appointed Director of the UBC Pulp and Paper Centre as of January 1, 2014, and has been the Director of the Advanced Papermaking Initiative since 2011. His research focuses on the fluid mechanics of fibre suspensions, and has been awarded numerous awards including the 2009 BCIC Lieutenant Governors Award for Innovation. He is a registered Professional Engineer in BC.

James A. Olson holds a B.A.Sc. in Engineering Physics (1991) and a Ph.D. in Chemical Engineering from The University of British Columbia (1996). He worked at the Pulp and Paper Research Institute of Canada from 1995 to 1999 to lead a research project on fibre fractionation and contaminant control. He joined the Mechanical Engineering Department in July 1999 as an Assistant Professor. James was appointed as the Director of the UBC Pulp and Paper Centre from 2011 to the end of 2013 and has been since been appointed as the Associate Dean of Research for Applied Science. His research is in the areas of advanced pulp processing, screening, LC refining, fibre and paper properties, and the fluid mechanics of fibre suspensions. He continues to leads a \$4M research program to reduce electrical energy in mechanical pulping. In recognition of his of research he has been awarded two NSERC Synergy awards for industry collaboration, 2 I.H. Weldon awards for best papers, the Van den Akker medal from the Fundamental Research Committee, and the 2009 BCIC Lieutenant Governors Award for Innovation, as well as several best paper awards. He is a registered Professional Engineer in BC.

API Faculty - Teaching

The API presents a number of courses at three different post-secondary institutes in BC.

This year Professor Martinez delivered CHBE 251, *Transport Phenomena I*, to 147 students with 39 hours of lectures and 6 tutorials.

Professor Englezos delivered *Introduction to Chemical and Biological Engineering Process and Technology* for 12 hours to 120 second year students; and was a guest lecturer in the *Chemical, Biological and Environmental Laboratory* course for two hours with 100 students.

Professor Beatson delivered three BCIT diploma courses in the past year:

Paper and Chemicals from Renewable Resources: 90 hours of lectures and labs to 16 students. Covered the production of pulp, paper, extractives, dissolving pulps, biopolymers and ethanol from wood.

Research Projects: 60 hours with 16 students. Student groups were guided in a laboratory based research projects. The group conducts a literature search and develops a program of experimentation, in consultation with the instructor and the industry sponsor when applicable.

Process Simulation: 60 hours of tutorials to 16 students. In this course, students worked with computer simulations of chemical processes (CADSim) to develop an understanding of the impact of manipulating process variables on the products from the process.

UBC Instructor Dr. Barbara Dalpke delivered 37.5 hours of instruction for MECH 450, *Pulping and Papermaking* to 12 UVic students. Dr. Nuwan Sella Kapu delivered 42 hours of CHBE 402, *Chemical Pulping Technology* to 7 students. Dr. Sella Kapu was also recruited to teach in the new MEL Green Bio-Products professional program, *GBPR 500: Building Blocks of Forest Biomass* for 84 hours to 5 students.

API Faculty - Teaching

Masters of Engineering Leadership (MEL) in Green Bio-Products

The Faculty of Applied Science offers a suite of new Masters of Engineering Leadership (MEL) programs that focus on sustainability and industry. The eight new post-secondary degree programs commenced in January 2016, including the **Green Bio-Products** program championed by Dr. Mark Martinez. The program accepted 5 full-time students for the 2016 academic year.

Offered by Applied Science in collaboration with the Faculty of Forestry and the Sauder School of Business, the one-year, full-time program is designed for practicing professionals who want to invest in their careers, broaden their technical perspectives and gain new business and leadership skills.

Unique in North America, each MEL degree has been developed in close collaboration with industry and is designed to equip participants with a suite of practical, hands-on skills in demand by top employers. In addition to advancing participants' technical skills, the programs offer co-op work placements, professional development workshops and individual coaching to enhance leadership skills.

GREEN BIO-PRODUCTS

BECOME A GREEN BIO-PRODUCTS ENGINEERING EXPERT

If you're thinking about concentrating your career in the green bio-products sector, think about the difference a year at UBC can make. Build knowledge. Cross disciplines and boundaries. Gain confidence. Master the leadership skills that will take you to the next level. Invest in yourself, and in the growing bio-economy, at UBC.

mel.ubc.ca

MEL

Master of
Engineering
Leadership

API Faculty - Research

The research contributions of the API faculty members are quite broad. API faculty members currently conduct research in the following areas:

- Mechanical pulping
- Stock preparation
- Papermaking and papermaking chemistry
- Chemical pulping
- Novel materials

Over this year, API members have supervised a combination of over 32 graduate students, research assistants and postdoctoral research fellows. They published 23 scientific journals, and participated in and/or contributed to 11 conference proceedings.

The following projects are just a sample of the research that API faculty have been involved in over the past year:

Energy Reduction in Mechanical Pulping

Dr. James Olson (UBC), Dr. Mark Martinez (UBC), Dr. Rodger Beatson (BCIT), Dr. Boris Stoeber (UBC), Dr. Bhushan Gopaluni (UBC), Dr. Peter Wild (UVic), Dr. Ramin Farnood (UofT)

James Olson is the Program Leader for this UBC-led university-industry consortium, which involves 4 universities and 16 industry partners (mechanical pulping mills, pulp and paper suppliers, government and utility). The program aims to demonstrate significant electrical energy savings through improvements to the traditional thermomechanical pulping process, with focus on advanced controls, process optimization, and new products.

The program includes the following academic projects: compression screw feed optimization and energy savings in high consistency (HC) refining; optimization of chemical charge distribution; advanced fractionation and low consistency (LC) refining; optimization and control of integrated HC and LC refining; LC refiner bar force sensor based control strategies; advanced pump performance monitoring system; and LC refined pulp for packaging papers. Staff researchers are also working on pilot scale refining trials in collaboration with the industrial partners; these trials are performed in the UBC Pulp and Paper Centre LC refining pilot plant facility.

The program has now completed Year 2 of a 5-year Phase 2 (Phase 1 was 2007-2012), and over the past year the group has had two consortium-wide Steering Committee meetings, at PacWest in Whistler and at UBC. The program's Master's and PhD students, and Post-Doctoral Fellows, have made significant progress in their research and began to present materials at international conferences including IEEE Sensors, PyCon Canada, and PaperWeek Canada. In the past year they have also published papers in Nordic Pulp and Paper Journal and BioResources.

This past year the group has also released reports to their partners regarding trials conducted at partner Andritz's R&D Center in Ohio, as well as pilot LC refining trials performed at UBC's Pulp and

Paper Centre.

The 2014 Andritz trials studied the impact of chemical treatment on HC refined pulp (see also Rodger Beatson' summary regarding chemical treatments below), as well as the effect of varying the HC-LC refining energy ratio among chemically treated samples. Results confirmed the energy savings potential of LC refining compared to HC refining as a secondary refining stage in a TMP process; they also informed how to distribute the specific refining energy between HC and LC refining stages. For a desired tensile index or freeness, results showed a benefit of adding more of the specific energy in LC refining than in HC refining. When the LCR was done at high specific edge load, tensile development was not sensitive to HC refining extent, so this suggests the ability to lower the energy input during HC refining and to add more energy in LCR at a higher efficiency. If the LCR is done at low edge load, then there is a clear pulp property benefit of adding more energy in the LCR stage. Confirming previous work on LCR, fibre length reduction was sensitive to LCR intensity, with faster and increased fibre cutting at higher specific edge load.

Energy Reduction in Mechanical Pulping –

Application of Chemical and Enzymatic Treatments in Low Consistency Refining

Dr. R.P. Beatson (BCIT), Post-Doctoral Fellow Yu Sun, Research Associate Harry Chang

This is part of the collaborative effort on energy reduction in refining, Phase II, headed by James Olson (see above).

Reducing electrical energy consumption in mechanical pulping is strategically important for cost reduction and the sustainability of the pulp and paper industry. In Phase I of the program we demonstrated energy savings of 1000 kWh/t through the treatment of primary stage pulp with alkaline peroxide prior to low consistency refining. One of the goals of Phase II is to determine the best position to apply various chemical treatments in the mechanical pulping process to obtain the desired pulp properties at the lowest energy. To this end, a trial was conducted at the Andritz pilot plant in October 2014 in which spruce and spruce/pine/fir chips were treated with alkaline peroxide, alkali and sulphite, prior to first stage refining. The primary stage pulps produced served as feedstock for further chemical treatment and low consistency refining. For the primary stage pulps it was found that the energy required to achieve a given tensile decrease by around 280 kWh/t for alkaline peroxide treatments and tear at a given tensile was significantly increased for both alkali and alkaline peroxide treatments. Shive content was reduced for all the chemical treatments. However, the alkali and alkaline peroxide treatments caused a drop in brightness which couldn't be recovered efficiently in subsequent brightening steps. The gains in strength properties were retained during low consistency refining to higher tensile levels and brightness was improved as a result of increased scattering coefficient.

Recovery of hemicellulose from mill residues and their use to enhance paper strength

Dr. R.P. Beatson (BCIT), Prof. H. Trajano (UBC)

Mill residues such as hog fuel are generally burnt in boilers to provide a source of heat and steam. These residues contain high-value chemicals such as extractives and hemicelluloses. If the hemicelluloses could be successfully extracted from hog fuel their addition to pulp might promote pulp strength and beatability. This project is funded by a NSERC Collaborative Research and Development Grant with Canfor as the industrial partner.

Hydrolysis of three different softwood residues, chip fines, hog fuels and primary sludge, have been investigated as a mean of producing hemicellulose polysaccharides for use as strength additives. The influence of hydrolysis temperature, time, and consistency on the production of polysaccharides from chip fines was determined. Hemicellulose polysaccharides degraded into monomers at higher temperature or with increased residence time. Polysaccharide yield decreased with increasing consistency. A maximum polysaccharide yield, 19% of initial hemicellulose in dried chip fines was achieved 80% of which was in the oligomeric form. Addition of the model hemicellulose, locust bean gum, to kraft pulp has demonstrated gains in tensile strength and burst.

Production of Dissolving Pulp from Bamboo

Dr. R.P. Beatson (BCIT), Prof. M. Martinez (UBC)

As a fast-growing species, bamboo has been widely used for industrial applications, and recently has been demonstrated to be an attractive alternative feedstock for dissolving pulp. However, the high silica content in bamboo is a major obstacle in using bamboo as a raw material. In pulping applications, silica precipitation causes scaling problems in multiple effect evaporators. In addition, residual silica in pulp deteriorates viscose filterability and interferes with the spinning process. Our research has determined the silica content and distribution in bamboo and developed methods of reducing the silica content in bamboo chips and recovering the removed silica for potential use in other products. Other work has focussed on producing higher quality dissolving pulp from bamboo by reducing the hemicellulose content. Kinetic expressions have been developed for hemicellulose removal during the pre-hydrolysis step and the application of enzymes to remove residual hemicellulose has been explored.

API Faculty - Selected Publications

- A.Elahimehr, J.A.Olson, and D.M.Martinez, "Low consistency refining of mechanical pulp: how plate pattern and refiner operating conditions change the final properties of pulp", Nordic Pulp and Paper Journal 30(4) 2016
- D.R. .Hewitt, D. Patterson, N.J. Balmforth & D.M. Martinez, "Dewatering of fibre suspensions", submitted to Phys Fluids. (2016)
- D.R. .Hewitt, M. Daneshi, N.J. Balmforth & D.M. Martinez, "Obstructed and channelized flow in a Hele-Shaw cell", J. Fluid Mech. Vol 790 173-204 (2016)
- F. Saville, D.M. Martinez & J.A. Olson, "Energy and paper recycling: Modelling the time and energy requirements of low consistency batch repulping", Can. J. Chem. Eng 94(3): 446-453 (2016)
- H.J. Salem, R.W. Gooding, and J.A. Olson, 'The Effect of Foil Rotor Design on Some Aspects of Pulp Screen Performance' NPPRJ 31(1) 2016
- J.Gao, D.M. Martinez, J.A. Olson, "Characterizing latency removal in mechanical pulping processes part 1: Kinetics", TAPPI Journal, Vol 15, no (2) February 2016
- J.Sha, S.Mitra, A.Nikbakht, H.Zhang, and J.A.Olson, "The effect of blending ratio and crowding number on the yield stress of mixed hardwood and softwood pulp fibre suspensions", Nordic Pulp and Paper Journal 30(4) 2016
- P. Jahangiri, B.Logawa, R.Korehei, M.Hodgson, D.M.Martinez and J.A.Olson, "On acoustical properties of novel foam-formed cellulose-based material", Nordic Pulp and Paper Journal, 31 (1) 2016
- R. Harirforoush, P.Wild, and J.A.Olson, "The relation between net power, gap, and forces on bars in low consistency refining" Nordic Pulp & Paper Research Journal Vol 31 no (1) 2016
- R.Korehei, P.Jahangiri, A. Nikbakht, D. M. Martinez and J.A. Olson, "Effects of Drying Strategies and Microfibrillated Cellulose Fiber Content on the Properties of Foam-Formed Paper", accepted J. Wood Chem Tech (2016)
- X.F.Chang, A.Luukkonen, J.A.Olson, R.P. Beatson, "Pilot-Scale Investigation into the Effects of Alkaline Peroxide Pre-Treatments on Low-Consistency Refining of Primary Refined Softwood TMP" Bioresources 11 (1), 2030-2042, 2016
- A. Nikbakht, J.A. Olson & D.M. Martinez, "Observation of Transition from Laminar Plug to Well-Mixed Flow of Fibre Suspensions in Hagen-Poiseuille Flow in the Presence of Drag Reducing Polymers", submitted to Phys Fluids (2015)
- C. Lindsay, J. Kumlin, D.M. Martinez, A Jirasek, & C Hoehr, "Design and application of 3D-printed stepless beam modulators in proton therapy", submitted to Phys. Med. Biol (2015)
- J. Qazi, D.M. Martinez & J.A. Olson, "Multistage fibre fractionation of softwood chemical pulp through smooth-holed screen cylinder and its effects on paper properties", TAPPI J. 14(4): 259-267 (2015)
- P. Jahangiri, N. Zacchia, K. Buckley, F. Benard, P. Schaffer, D. M. Martinez, C. Hoehr "An analytical approach for the understanding of thermodynamic behaviour in a gas target system on a medical cyclotron", accepted Appl Rad Isotopes (2015)

API Faculty - Selected Publications

R. A. Khan, H. J. Salem, R. Korehei, D. M. Martinez & J. A. Olson " Fractionation and Characterization of Bleached Pulp Fibres: Application on Sodium Alginate Films, submitted to Can J Chem Eng (2015)

R.A. Khan, R. Korehei, H.J. Salem, N.Darychuck, D.M. Martinez, J.A. Olson, Fabrication and characterization of microfibrillated cellulose reinforced sodium Alginate-based biodegradable films for packaging. Journal of Science & Technology for Forest Products and Processes (J-FOR), Volume 4, Number 1, Pages 10-16 (2015)

R.Korehei, J.A.Olson, F.Ko, and J.Kadla, Influence of Solvent and Non-solvent Composition on Electrospinning of Cellulose Acetate Ternary System, Journal of Applied Polymer Science, (Accepted August 2015)

R.Korehei, P.Jahangiri, A.Nikbakht, D.M.Martinez and J.A.Olson, Effects of Drying Strategies and Microfibrillated Cellulose Fiber Content on the Properties of Foam-Formed Paper, Journal of Wood Chemistry (Accepted- 2015)

S.M.M.N. Mirvakili, P. Englezos, J.D.W. Madden, I.W. Hunter, "High-Performance Supercapacitors from Niobium Nanowires", ACS Applied Materials & Interfaces 7(25), 13882-8, 2015

S.S. Siadat, D.M. Martinez & J.A. Olson, "Shear Rheology of Micro-Fibrillar Cellulose Aqueous Suspensions", submitted Cellulose (2015)

V. Gunka, P. Soltani, G. Astrakianakis, D. M. Martinez, A Dube, A.Albert & T. Kavanagh, An Estimate of ChloroPrep Drying Time before Neuraxial Anesthesia in Elective Cesarean Delivery Patients. Prospective Observational Study. Submitted to Anesthesia (2015)

Y. Sharma, A.B. Phillion & D.M. Martinez "Automated segmentation of wood fibres in micro CT images of paper", J. Microscopy 260: 400-410. doi:10.1111/jmi.12308 (2015)

API Faculty - Conference Proceedings

C. Lindsay, C. Dunning, N Unick, V. Sossi, D.M. Martinez & C. Hoehr, "A 3D printed eye phantom for proton therapy", PCTOG 55th Annual Conference, Prague (2016)

F. Golkhosh, M.Targhagh, Y. Sharma, A. Phillion, D.M. Martinez, W. Tsai, L. Courtois, D. Eastwood, P. Lee, "Three dimensional structure and strength characterization of northern bleached softwood kraft pulp", Progress in Paper Physics, Darmstadt (2016)

Y.Sun, XF Chang, JA Olson, RP Beatson, "Alkaline oxygen treatment of high freeness TMP pulp followed by lab-scale Low-consistency Refining" Paperweek 2016, Montreal, Canada, February 2016.

D.R. .Hewitt, M. Daneshi, N.J. Balmforth & D.M. Martinez, "Obstructed and channelized flow in a Hele-Shaw cell", Viscoplasticity -from Theory to Application, Banff International Research Station, Banff AB (2015)

J.Chen, X.Chen, RP Beatson, XF Chang, HL Trajano, "Production of pulp strength additives from pulp mill residues" 2015 PacWest conference, Whistler, Canada, June 2015.

J.Chen, X.Chen, RP Beatson, XF Chang, HL Trajano, "Optimization and modeling of hemicellulose oligomers removal from pulp mill residues for use as pulp strength additives" 5th International Conference on Biorefinery - towards Bioenergy, Vancouver, Canada, August 2015.

J.Chen, X.Chen, RP Beatson, XF Chang, HL Trajano, "Optimization and modeling of hemicellulose oligomers production from pulp mill residues for use as pulp strength additives" 65th Canadian Chemical Engineering Conference, Calgary, Canada, October 2015.

MN Mirvakili, P.Englezos, SG. Hatzikiriakos, "Surface Engineering of Wood Fibre/Filler Networks", 5th International Colloid Conference, Amsterdam, June 2015

N. McIntosh, J.A.Olson, D.M. Martinez "Using Python to Characterize the Structure of Wood", PyCon Canada Conference, Toronto, ON, Nov. 7-9, 2015

R. Khoie, B. Gopaluni, J.A. Olson, B. Stoeber, "A Magnetic Sensor for Wear Detection in Centrifugal Pumps," 14th Annual IEEE Conference on Sensors, Busan, South Korea, Nov. 1-4, 2015.

Z.Yuan, N.S. Kapu, X. Chang, RP. Beatson, DM Martinez, "Removal of Silica from Bamboo for Biorefinery Applications" 5th International Conference on Biorefinery - towards Bioenergy, Vancouver, BC, August 10-12, 2015

Community Outreach

GBIO Accelerate Partnership

Over the last year, a 4-page proposal for the Green Bio-Products Accelerate Partnership has been developed and distributed to industry for consideration. The PPC currently provides a wide range of educational programs for people entering the sector as well as those who seek the leadership skills to move the sector to the next level. The GBIO Accelerate Partnership will give us the funds we need to expand these programs to ensure that the sector has the HQP it needs for the future – while at the same time providing for our partners special access to our graduates and to leading edge training for their employees, both technical and general.



Prof. James Olson delivers a lecture on "Future of bio-products and bio-economy".

Introduction to Pulp and Paper Technology - API Course

The API sponsored another successful course on "Introduction to Pulp and Paper Technology" delivered on April 13-15, 2015. 29 students from Howe Sound Pulp and Paper, Catalyst Paper Crofton Division, Alberta Newsprint, and Smith Cameron Process Solutions, among others, attended the hands-on course. Consisting of lectures in the mornings followed by lab exercises in the afternoons, the course is structured in a way to re-emphasize material and enhance understanding of the processes.

This year the course was increased from two to three days so that a new LC refining component could be added to the roster of units. Students received a refining lecture describing the principles of LC refiner operation and plate design, as well as an overview of the pilot plant setup and operation. The lecture was followed by a refining demonstration, during which kraft pulp was refined and pulp samples were collected for later testing.

Units of the course were taught by API faculty, along with Robert Gooding, VP Technology at Aikawa, and PPC research staff George Soong, Meaghan Miller and Emilia Jahangiri.

Community Outreach



R. Khan, D. Paterson, R. Korehei, H. Trajano (Session Chair), Q. Lu, J. Chen, S.S. Sabet

PacWest Conference

The PacWest Technical Conference symbolizes the interdependence of those who develop technology in the pulp and paper industry and the many suppliers of related materials and equipment. It provides an opportunity to network with peers, industry leaders and technical experts while enhancing professional development.

After a successful inaugural 2014 UBC Student Session, the Pulp and Paper Centre was invited back to showcase innovative research relating to the forestry and bio-economy industry. Six of UBC's brightest presented their technical papers and presentations to a large audience on June 12, 2015. The students and researchers used this platform to demonstrate how their research and vision has the potential to make lasting changes and advance these strategically important industries. Several presenters are co-supervised by API faculty.



Industry Night with Bill Adams

Industry Nights

The Master of Engineering Leadership (MEL) in Green Bio-Products is a new program to train the future leaders and professionals of the growing bio-products sector. To give students insight into this exciting field, Industry Nights are being arranged so experienced professionals can share their working experience with students. The inaugural Industry Night took place on February 29th with Bill Adams, Director of Sustainability and Technology at Canfor Pulp, and also a UBC alumnus. Bill gave a detailed presentation on his organization's history, and provided valuable insight into the current state of affairs and what the future holds. The session was extremely successful and attended by a large group including students, faculty and staff. An upcoming Industry Night is scheduled for April 12th with guest Dr. Robert Gooding.

Community Outreach

Professional Development Seminars

DAVE MCDONALD, President of JDMcD Consulting Inc. and former VP at FPIInnovations joined the Pulp and Paper Centre on November 18, 2015 to give a seminar on “Wood Mechanics and the implications for refining”.

DR. AMAR NEOGI, Director, Renewal Research at Weyerhaeuser joined the Centre on April 21, 2015 to give a seminar on “Innovations in Forest Products Industry and the Role of a Chemical Engineer”.

Professional Development Courses

PPC’s professional development courses continue to be popular among UBC Engineering students. The goal of the variety of technical courses is to enrich the undergraduate students experience by offering technical and hands-on training in focused areas of Introduction to Machine Shop, Fluid Systems, and a more comprehensive Technical Training Course. Corporate sponsorship was secured to provide toolkits for student projects. Over the last year, four 18-hour courses, and an additional two 9-hour courses were offered to 32 undergraduate students. All courses were instructed by a Certified Machinist and Engineering Technician.

TECHNICAL TRAINING COURSE
LEARN MORE
As part of the Pulp and Paper Centre's (PPC) Professional Development Series, Engineering 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
- Sewage 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 will have hands-on experience using hand tools as well as technical skills and knowledge relevant to a career in industry.
3-day Crash Course
May 3-5, 2015
8:30-4:30pm daily
OR
3-day Crash Course
June 8-10, 2015
8:30-4:30 pm daily
Cost is \$300/student.
Limited availability.
Register at: www.ppc.ubc.ca/Courses
To be added to the wait list, please email ppc.info@ubc.ca

DO MORE

INTRODUCTION TO MACHINE SHOP
LEARN MORE
As part of the Pulp and Paper Centre's (PPC) Professional Development Series, Engineering students now have an opportunity to enroll in a 9-hour, hands-on course.
Introduction to Machine Shop will teach participants the fundamental skills required for basic machine shop operations. Through a combination of lecture and project work, students will learn how to use precision measurement tools such as micrometers and vernier calipers, learn the exposure required for acute precision layout, setting speeds and feeds, Horizontal Band Saw operation, Sensitive Drill Press and drilling operations, threads types and thread cutting.
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.
3 Friday afternoons
Feb. 20, 27, March 6
1:00-4:00 pm
Cost of course is \$200/student.
Limited availability.
Register at: www.ppc.ubc.ca/Courses
To be added to the wait list, please email ppc.info@ubc.ca

DO MORE

FLUID SYSTEMS COURSE
LEARN MORE
As part of the Pulp and Paper Centre's (PPC) Professional Development Series, Engineering students now have an opportunity to enroll in a 9-hour, hands-on course.
Fluid Systems will teach participants the fundamental skills required for rudimentary pipe and tubing assemblies. This course focuses on pipe and tube, and an introduction to pumps and valves. Students will learn how to identify sealing thread types, the differences between pipe and tube, pipe fitting basics including pipe thread cutting and assembly, compression tube fitting and bending, and methods for fluid system leak testing. Learn how to identify and apply different types of pumps and valves.
Comprised of theoretical lectures, demonstrations and videos, learning will be reinforced by hands-on work using industry standard tools and methods. The course instructor is a Certified Machinist and Engineering Technician.
3 Friday afternoons
March 13, 20, 27
1:00-4:00 pm
Cost of course is \$200/student.
Limited availability.
Register at: www.ppc.ubc.ca/Courses
To be added to the wait list, please email ppc.info@ubc.ca

DO MORE

Fibre Arts Courses

The Centre opened its doors for a Winter Holiday Fibre Arts Course on November 18, 2015. Participants received a quick and easy guided tutorial on the basics of papermaking which they used to create beautiful holiday greeting cards and gorgeous handmade wrapping paper. Unique and fun tree ornaments, and plantable flower paper to give as gifts were also on the menu.

Papermaking at Music Festival

The Vancouver Folk Music Festival invited the Pulp and Paper Centre to host a papermaking station at their Little Folks Village. Over three days, hundreds of kids visited the station and PPC students and staff enjoyed teaching kids the magic of making handmade paper. Kids also got to learn about the process of recycling daily newspapers into pulp fibres and creating new paper.



2015 Vancouver Folk Music Festival Papermaking Station

Finances

The financial statement for Year XVIII is given in the table below.

(1 April 2015 - 31 March 2016)

2015-2016 Budget	\$277,886.00
Opening Balance (from 2014-2015)	\$1,874.31
Available Budget 2014-2015	\$279,760.31
TEACHING	
CHBE, MECH and BCIT API Faculty Appointments	\$258,602.77
	\$258,602.77
RESEARCH	
Instrutor & Res salary	\$3,440.00
	\$3,440.00
COMMUNITY OUTREACH	
Travel (Conferences)	\$1,944.18
Travel (General Expenses)	\$2,212.91
	\$4,157.09
API Course & Meetings	\$3,112.31
Misc. Charges	\$5,435.22
	\$8,547.53
OFFICE EXPENSES	\$4,352.52
TECHNICAL EXPENSES	\$3,055.30
TOTAL EXPENDITURES (2014-2015)	\$282,155.21
Uncommitted Balance (2016-2017)	-\$2,394.90

What's Next

The API Advisory Group will meet over the summer in 2016. The mandate of the Advisory Group is to provide advice to the University regarding the program, its purposes and funds. It is comprised of up to ten individuals representing the stakeholders of the province and members will normally be appointed for three year terms.

The "Introduction to Pulp and Paper Technology" course will be offered on April 13-15, 2016.

A delegation from the China National Pulp and Paper Research Institute will visit the Pulp and Paper Centre on May 13, 2016 to meet with API faculty and discuss common interests and potential opportunities, as well as touring the research facilities.

The Pulp and Paper Centre will celebrate its 30th Anniversary with an Open House on May 28, 2016, and an Alumni Dinner on May 27th. Keynote speeches, interactive lab tours, poster session, handsheet making for the whole family, machine shop demos and a light lunch will be available at the Open House open to all alumni, current students, industry partners, guests and the general public. The Open House coincides with the closing of UBC's Centennial.

Upcoming seminar on June 1, 2016 by distinguished guest Dr. Antti Oksanen, Senior Scientist at VTT Technical Research Centre of Finland will give a seminar on the exciting research currently underway at VTT - including Cellulose Nanofibril, bio-based fibre networks and more.

API will have a strong presence at the 2016 PacWest Conference in Whistler, BC. Six UBC students and researchers were invited back for a third year for the UBC Student Presentation session. There will also be a full-day Steering Committee meeting for the Energy Reduction in Mechanical Pulping research group which will consist of PI presentations and a roundtable discussion. James Olson will also be part of the "Embracing Technology" Conference Forum panel.