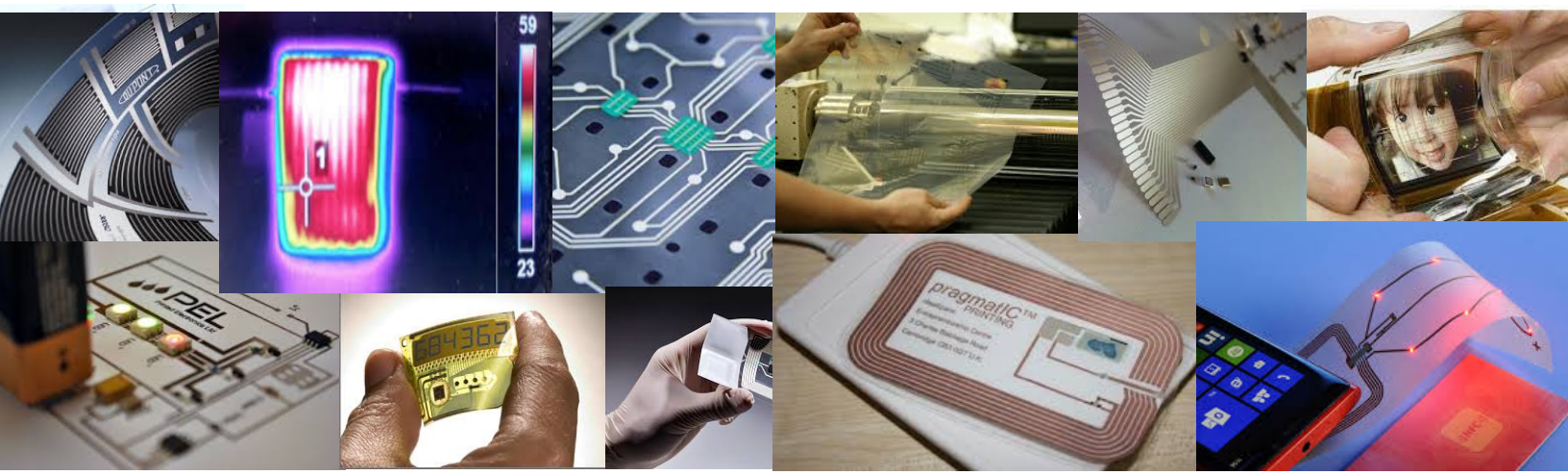
WIN 4.0 Symposium Series

Printed/Flexible Electronics Symposium

Co-organized by WIN 4.0 and CAMBR

Time: 9:00 AM - 5:30 PM, Sept. 14, 2017

Place: Spencer Engineering Building, Room 3102, Western University



Program Book

Western

Printed/Flexible Electronics Symposium
SEB 3102, Western University, Sept. 14, 2017

Program Schedule

Morning Session		
9:00	**Welcome & Breakfast**	
9:25	**Opening Remarks**	**Dr. Jun Yang, Professor** *Department of Mechanical and Materials Engineering, Western University, Canada*
9:30	Green printing technology by droplet manipulation for printed electronics	**Dr. Yanlin Song, Professor** *Institute of Chemistry, Chinese Academy of Science, China*
10:00	Printing Techniques for Li ion Batteries	**Dr. Xueliang(Andy) Sun, Professor** *Department of Mechanical and Materials Engineering, Western University, Canada*
10:30	Flexible Electrical Circuits Printed on Polymers using Graphene-Derivative Inks	**Dr. George Knopf, Professor** *Department of Mechanical and Materials Engineering, Western University, Canada*
11:00	Development of polymer materials for printed electronics	**Dr. Yuning Li, Professor** *Department of Chemical Engineering, University of Waterlo*
11:30	Printing Electronic Components and Circuits on Flexible Substrates	**Dr. Ye Tao, Principal Research Officer, Group Leader and Thrust Leader**, *National Research Council, Canada*
Afternoon Session		
12:00	**Lunch & Discussion**	
12:30	Printing nanomaterials for flexible stretchable wearable electronics	**Dr. Zheng Cui, Professor and Director** *Printable Electronics Research Center, Suzhou Institute of Nanotech, Chinese Academy of Sciences, China*
13:00	Membrane-Interface-Elastomer (MINE) Structures for Stretchable and Impermeable Electronics	**Dr. Tricia Breen Carmichael, Professor** *Department of Chemistry and Biochemistry, University of Windsor, Canada*

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13:30	Development of nanostructures for solar cell and photocatalysis applications	**Dr. Dongling Ma, Professor** *Énergie Matériaux Télécommunications, Research Centre, Institut national de la Recherche Scientifique, Canada*
14:00	New Approaches for the Design of Intrinsically Stretchable Semiconducting Polymers	**Dr. Simon Rondeau-Gagné, Assistant Professor** *Department of Chemistry and Biochemistry, University of Windsor, Canada*
14:30	Additive manufacturing methods for integration of electrodes in flexible devices	**Dr. Ravi Selvaganapathy, Professor** *Canada Research Chair in Bio-microfluidics, Department of Mechanical Engineering, McMaster University, Canada*
15:00	Solution processed nanostructures for organic optoelectronics	**Dr. Ayse Turak, Assistant Professor** *Department of Engineering Physics, McMaster University, Canada*
15:30	3D printing functional dielectric and metallodielectric structures with nonlinear light waves	**Dr. Kalai Saravanamuttu, Associate Professor** *Department of Chemistry and Chemical Biology, McMaster University, Canada*
16:00	4D Printed Electroactive Polymers: Specialized Additive Manufacturing Processes for Conjugated Polymer Actuators and Sensors	**Dr. Aaron Price, Assistant Professor** *Department of Mechanical and Materials Engineering, Western University, Canada*
16:30	Printing Functional Devices on Curved Surfaces	**Dr. Chad Smithson, PhD, Printed Electronics Research Scientist** *Xerox Research Centre of Canada*
17:00	**Closing Remarks**	

Sponsors

❖ Western University

❖ Faculty of Engineering, Western University

❖ Department of Mechanical and Materials Engineering, Western University

❖ WIN 4.0 (Western's Network for Industry 4.0), Western University

❖ Centre for Advanced Materials & Biomaterials Research, Western University

Presenters

Dr. Yanlin Song

Prof. Yanlin Song received Ph.D. degree from Department of Chemistry, Peking University in 1996, then worked as a post-doctor at Tsinghua University from 1996 to 1998. Now he is the director of Key Laboratory of Green Printing, Institute of Chemistry, Chinese Academy of Sciences. He has published about 300 papers with citations more than 10,000 times, as well as 1 book and 9 chapters, and has been granted more than 100 patents. He won the First Prize of Beijing Science and Technology Award in 2016, the Second Prize of National Natural Science Award in 2008 and 2005, the China Youth Science and Technology Award, the National Excellent Scientific and Technological Practitioner Award, etc.

Dr. Andy (Xueliang) Sun

Dr. Xueliang (andy) Sun is a Full Professor and Canada Research Chair (Tier I) for the development of nanomaterials for clean energy, at the University of Western Ontario, Canada. He is a Fellow of Royal Society of Canada and Fellow of the Canadian Academy of Engineering. Dr. Sun received his Ph.D degree in Materials Chemistry at the University of Manchester, UK, in 1999. Then, he worked as a post-doctoral fellow in the University of British Columbia, Canada, during 1999-2001. He was a Research Associate at the National Institut de la Recherche Scientifique (INRS), Quebec, Canada, during 2001-2004. Dr. Sun joined as an Assistant Professor the University of Western Ontario in 2004. He was awarded tenure and promoted Associate Professor in 2007 and Full Professor in 2012.

Dr. Sun's research is focused on advanced nanostructured materials for energy conversion and storage including fuel cells and Li batteries. Dr. Sun is an author and co-author of over 290 refereed-journals (e.g. Nature Communications, Advanced Materials, J. Am. Chem. Soc., Angew. Chem., Adv. Fun. Mat., Energy & Environmental Science) with citations of over 13,500 times and H-index of 61. He edited two books and published 15 book chapters as well as filed eleven US patents. He has given more than 100 plenary/keynote/invited talks in international conferences, symposia and workshops. Dr. Sun is actively collaborating with industries and government labs such as Ballard Power Systems, General Motors, Lithium Phostech Inc., and Canadian National Defense. He also serves as an Editor-in-Chief of "Electrochemical Energy Review" under Spring-Nature and an Associate Editor for Frontier of Energy Storage (2013-present). Dr. Sun received various awards such as Early Researcher Award (2006), Canada Research Chair (2007, 2013) and University Faculty Scholar Award (2010) and Western Engineering Prize for Achievement in Research (2013). Dr. Sun is a Vice-Chairman of our Board Committee in the International Academy of Electrochemical Energy Science (IAOEES).

Presenters

Dr. George K. Knopf

George K. Knopf is a Professor in the Department of Mechanical and Materials Engineering at the University of Western Ontario, London, Canada. His research interests include bioelectronics, biosensors, laser materials processing, and flexible optical light guides. Dr. Knopf's work involves the development of conductive graphene-based inks and novel fabrication processes for printing electronic and optoelectronic circuitry on a variety of mechanically flexible surfaces. Current applications involve flexible bioelectronic sensors and wearable electronics for patient health monitoring. He has also acted as a technical reviewer for numerous academic journals, conferences, and granting agencies and has co-chaired several international conferences. In addition, he has co-edited two CRC Press volumes entitled *Smart Biosensor Technology* and *Optical Nano and Micro Actuator Technology*, and recently co-authored a SPIE E-Book on Biofunctionalized Photoelectric Transducers for Sensing and Actuation.

Dr. Yuning Li

Dr. Yuning Li is Professor and Associate Chair of Graduate Studies in the Department of Chemical Engineering with affiliation to the Waterloo Institute for Nanotechnology (WIN) at University of Waterloo. He received his bachelor and master degrees in polymer materials from Dalian University of Technology in China in 1985 and 1988, respectively, and his Ph.D. in materials science from Japan Advanced Institute of Science and Technology (JAIST) in 1999. Prior to joining the University of Waterloo, he worked in the research labs at Simon Fraser University, the National Research Council Canada (NRC), Xerox Research Centre Canada (XRCC), and the Institute of Materials Research and Engineering (IMRE), the Agency for Science, Technology and Research (A*STAR) (Singapore). Since 1999, Dr. Li has been working on printed electronics including organic light emitting diodes, organic thin film transistors, and organic photovoltaics with an emphasis of his effort on the development of polymer semiconductors materials. He is a co-recipient of the 2nd Runner Up in Materials Category for "The Best and the Brightest New Technology for 2004" by Wall Street Journal and a co-recipient of the 3rd Annual NASA Nano 50™ Awards (2007) for Printed Organic Electronics. He has published 135 refereed journal articles with an h-index of 43 and > 6700 citations. He also holds 74 granted US patents, which have led to several commercialized products.

Presenters

Dr. Ye Tao

Dr. Ye Tao is a Principal Research Officer at the National Research Council (NRC) of Canada. He is the leader of the Organic Materials and Devices group at NRC's Information and Communication Technologies Portfolio, and the leader of the Functional Devices Thrust for NRC's Printable Electronics Flagship Program. Dr. Tao received his Ph.D. degree in 1993 in Solid State Physics from the École Polytechnique, l'université de Montreal (Canada). His research interest has been in the areas of organic semiconductor materials and devices, materials structure-property relationship, charge transport and recombination behaviour, surface and interface physics and chemistry. Current research focus is on printable/flexible/wearable electronic devices and circuits, smart surfaces, detectors, sensors, and development of low costs manufacturing processes.

Dr. Zheng Cui

Professor Zheng Cui had worked in the UK for 20 years from 1989 to 2009, first at Cambridge University and then at Rutherford Appleton Laboratory as a Principal Scientist and group leader. He returned to China in October 2009 and joined the Suzhou Institute of Nanotech and Nanobionics where he setup the first research center in China dedicated to printed electronics R&D. He and his research team have developed a wide range of printed electronics technologies and some have been transferred to industry and commercialized. He has authored and coauthored over 50 scientific journal publications, 4 books and 60 patents since he returned to China. He has been a Fellow of UK Institution of Engineering and Technology (IET) since 2004.

Presenters

Dr. Tricia Breen Carmichael

Tricia Breen Carmichael is a Professor in the Department of Chemistry and Biochemistry at the University of Windsor. After receiving her PhD in 1996 from the University of Windsor, she spent two years as an NSERC postdoctoral fellow in the lab of Professor George M. Whitesides at Harvard University. She then took up the position of Research Staff Member at the IBM T.J Watson Research Center in Yorktown Heights, New York from 1999-2005, where she developed soluble organic semiconductors and low-cost patterning methods for organic electronic devices. Her current research program at the University of Windsor focuses on new materials and methods for the fabrication of stretchable and wearable electronic devices. Dr. Carmichael has won numerous awards, including an Ontario Ministry of Innovation Early Researcher Award, an NSERC University Faculty Award, and the NSERC Doctoral Prize for her PhD work. She is an Editorial Board Member of the journal *Flexible and Printed Electronics* (Institute of Physics).

Dr. Dongling Ma

Prof. Dongling Ma joined Institut national de la recherche scientifique (INRS), Canada in 2006 as an assistant professor, and then she was promoted to associate professor, and further full professor in April 2014. Her research interest consists in the development of various nanoparticles and nanohybrids/nanocomposites for applications in energy, catalysis and biomedical sectors. Since 2011, she has published ~90 times on nanomaterials research in high quality journals (*J. Am. Chem. Soc.*, *Adv. Mater.*, *Adv. Energy Mater*., *ACS Nano, Adv. Funct. Mater.*, *Energy Environ. Sci.*, *Chem. Mater*., *Chem. Commun*., *Small*, *etc*.). She has been invited to talk at prestigious international conferences (such as ACS, ECS & MRS) and universities, with ~80 invited talks since 2011 (not including those she declined). She serves as an Editorial Advisory Board member of *ACS Energy Lett*., an Editorial Board member of *Sci. Rep*., an associate editor of *Rev. Nanosci. Nanotech.*, and a panel/ committee member for funding agencies (*e.g*., European Commission and FQRNT). She became Fellow of Institute of Nanotechnology (UK) in 2014 and is an active Member of the UNESCO Chair in Materials and Technologies for Energy Conversion, Saving and Storage.

Before joining INRS, she had worked as a Natural Sciences and Engineering Research Council (NSERC) Visiting Fellow at the Steacie Institute for Molecular Sciences, National Research Council of Canada for about two and half years (Feb 2004- June 2006). She received her Ph.D. in Materials Science and Engineering at Rensselaer Polytechnic Institute in Troy, New York (Sep 2000-Jan 2004).

Presenters

Dr. Simon Rondeau-Gagné

Simon Rondeau-Gagné received his PhD degree in 2014 under the supervision of Jean-François Morin from the Department of Chemistry at Université Laval, Québec. During the Ph.D, his research focused on the development of a novel strategy towards organic nanostructured materials via the topochemical photopolymerization of diacetylene-containing macromolecules. After completing his PhD, he joined the group of Zhenan Bao at Stanford University as a FRQNT postdoctoral fellow. At Stanford, his research mainly focused on the development and synthesis of new intrinsically stretchable materials for flexible organic field-effect transistors and e-skin electronics. Simon Rondeau-Gagné joined the Department of Chemistry and Biochemistry at the University of Windsor as an assistant professor in July 2016. His current research includes the design of novel conjugated polymers for stretchable electronics and the development of new strategies towards self-healing materials.

Dr. Ravi Selvaganapathy

Dr. P. Ravi Selvaganapathy is a Professor in mechanical and Biomedical engineering and the Canada Research Chair in Biomicrofluidics at McMaster University, Canada. His research interests are in the development of microfluidic devices for environmental and medical diagnostics, drug discovery and artificial organs. He has over 120 publications in journals and conferences, has written 5 invited book chapters and been issued 6 US patents related to MEMS/microfluidic devices. Two of his diagnostics technologies have been licensed for commercialization, including a free chlorine sensor for drinking water. He also received the Early Researchers Award from the ministry of research and innovation in 2010 and has been named as a Rising Star in Global Health by Grand Challenges Canada in 2012.

Presenters

Dr. Ayse Turak

Ayse Turak is an Assistant Professor in the Department of Engineering Physics at McMaster University. Her research focusses on growth of organic and hybrid organic-inorganic (perovskite) thin films and nanoparticles for optoelectronics. In 2016, she was awarded an Early Researcher Award (ERA) for her work using nanoparticles to improve organic photovoltaics. Prior to her appointment at McMaster, she was a Marie Curie Fellow at the Max-Planck-Institute for Metals Research (2008-2010), then a visiting professor at Sabanci University in Istanbul, Turkey (2011), with a European Reintegration Grant for interfacial engineering of organic solar cells. She received her doctorate from the Department of Materials Science and Engineering at the University of Toronto in 2006, where she was a Canada Graduate Scholar working on organic light emitting diodes (OLEDs). She is currently the co-chair for the Canadian chapter for the Society for Information Display. Her invited review article on interfacial degradation for OLEDs and OPVs (2013), in RSC Advances has been cited 50 times, and is considered one of the most comprehensive works on interface stability to date.

Dr. Kalai Saravanamuttu

Kalai Saravanamuttu received the B.Sc.(Hons.) and PhD degrees from McGill University and was a post-doctoral fellow at the University of Oxford (FCAR scholarship, Government of Quebec). She joined the Department of Chemistry and Chemical Biology at McMaster in 2003 with a NSERC University Faculty Award. Her research group works in a richly interdisciplinary environment that combines polymer chemistry, photochemistry, optical physics, photonics and materials engineering. Specifically, her research examines light induced perturbations and different forms of nonlinear light waves in a range of photoresponsive systems with a focus on soft matter. We harness these diverse behaviours to develop functional polymer microstructures, 3-D waveguide architectures, photoresponsive films, bio-inspired optics, 3-D printing techniques and new ways to micro-manipulate optical fields.

Presenters

Dr. Aaron Price

Dr. Price has been investigating smart materials for more than a decade, including the development of shape-memory alloy-based artificial muscle actuators, smart-material enabled prosthetics and robotics, and novel nanoscale electroactive-polymer actuator technologies for adaptive optics systems. As a Senior Scientist at the ABB Corporate Research Center in Germany, Dr. Price specialized in the technology development and knowledge translation of electroactive polymers, magnetic shape memory alloys, and piezo-transducers toward industrial sensing, energy harvesting, and actuation technologies. He joined the Department of Mechanical and Materials Engineering at Western in January of 2015, where he leads the Organic Mechatronics and Smart Materials Laboratory. His NSERC-funded research program develops 3D printing technologies for the fabrication of actuator and sensor arrays that are well-suited to biomedical devices. He is currently a member of Western's Biomedical Engineering Program, Western's Bone & Joint Institute, and the Western Cluster of Research Excellence in Musculoskeletal Health and is engaged in collaborative research projects ranging from active polymer cell scaffolds for regenerative medicine to instrumented orthopaedic implants. Dr. Price currently holds the Peter C. Maurice Research Fellowship in Biomedical Engineering to develop Smart Contact Lenses for the Early Detection of Glaucoma.

Organic Mechatronics and Smart Materials Laboratory: Directed by Dr. Aaron Price, this recently established NSERC-funded facility is equipped with a suite of 3D printing platforms and polymerization apparatus for the synthesis and fabrication of devices incorporating electrochemically active polymers. These soft materials can be employed in biomedical devices in the form of light-weight and conformable actuators, sensors, and energy harvesters.

To date, our group has successfully developed new materials and advanced manufacturing technologies to achieve the first-ever 3D printed polyaniline transducers realized through multi-material additive manufacturing and the first-ever microscale polypyrrole components realized through via digital light processing. We have harnessed these unique capabilities to fabricate previously unattainable smart devices such as the world's first-ever smart polymer based orthopaedic implant prototype having an array of embedded pressure sensors.

Dr. Chad Smithson

Chad Smithson is a member of the printed electronics research team at the Xerox Research Centre of Canada. His current research is focused on the development of inks and print process for hybrid electronic devices (devices with a mixture of printed and traditional silicon electronics). He is focused on utilizing inkjet printing and aerosol jet printing in conjunction with precision multi axis movement stages to print electronics onto 3-dimensional objects. He received his MSc from the University of Guelph chemistry department working on stable free radical materials for spintronics. He then obtained his PhD from the McMaster University Chem. Eng. Department working under Dr. Zhu developing printed organic UV sensors and printed CNT transistors.