Theme Seminar

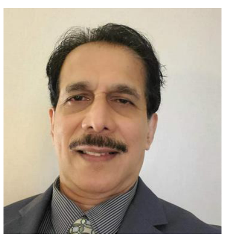
Solid Solutions for Fluid Challenges

Chandrasiri Jayakody

Director of Innovation and Product Development, Porex Technologies Corporation, Filtration Group, USA

In this presentation we will discuss how to use porous polymers, for example, open cell polyurethane foams, sintered plastics, and fibers, in many different applications to address fluid challenges. We will cover what to consider when designing new products and devices by unlocking the potential of using porous polymers to create functional components for absorption, diffusion, filtration, venting, application, wicking, controlled release applications etc. The presentation will focus on one of the main types of porous polymers, open cell polyurethane foam and discuss polyurethane chemistry, methods of manufacturing, material selections including sustainable developments, additives, and some end-use applications.

We will also cover foam characteristics for wound care and cosmetic applications such as pore size, absorption rate, free swell absorption capacity, fluid retention, volume expansion, moisture vapor transmission rate and physical properties of the foam.



Dr. Chandrasiri Jayakody *graduated with a BSc (Honors) in 1981, a Postgraduate Diploma in Applied Statistics in 1986 and an M.Phil. Degree in Natural Products Chemistry in 1990 from the University of Colombo. Sri Lanka. He received his Ph.D. Degree in Organic/Polymer Chemistry from Marquette University, Milwaukee, Wisconsin in 1994 followed by a postdoctoral training (1995-1999) at Florida Institute of Technology, Melbourne, Florida. Dr. Jayakody has been working with Porex Filtration Group as a Director of Innovation and Product Development.*

He has over 35 years of experience in polymer chemistry, particularly in the fields of polyurethane and has published/presented over 35 papers including three book chapters and holds four US patents. Dr. Jayakody is a member of the ASTM Committee F-04 on Medical and Surgical Materials and Devices and also a member of the Committee E-05 on Fire Standards.

Theme Seminar

From Nanopore to Nanowire Sensors: Can Our Health be in Our Hands?

Buddini I. Karawdeniya

Department of Electronic Materials Engineering, Research School of Physics, The Australian National University

Miniaturised and potable diagnostics for health care monitoring has gained lot of traction with the uproar of pandemics, rising numbers of various health conditions and challenges of supplying diagnostic devices to resource limited settings. My research has been focused on developing nanostructure based sensing platforms—spanning nanopores, metasurfaces and nanowires—to characterize and detect biomedically and pharmaceutically important molecules. Solid-state nanopore sensors have been one of the incredible platforms capable of doing single-molecule level sensing, that have demonstrated incredible potential in detecting and characterising biomolecules like DNA, proteins, polysaccharides and viruses. In addition, my research interests expand to meta optical systems for bio and gas sensing aimed at bio sample and exhaled breath analysis. Nanowire sensors are another platform that have shown exceptional gas sensing capabilities. This talk aims to discuss whether and how these nanostructured sensing platforms can attain the sensitivity and selectivity demanded by health care monitoring and can they be extended to portable and miniaturized sensing devices in the future: can Our Health be in Our Hands?

Dr. Buddini I. Karawdeniya *completed her undergraduate work from Institute of Chemistry Ceylon and University of Colombo in 2011. She was with the Institute of Chemistry Ceylon as a Teaching Assistant until 2012. Buddini earned her PhD in chemistry in 2018 from the University of Rhode Island. She joined School of Engineering in the Southern Methodist University, USA in 2018 as a Postdoctoral Fellow. Buddini joined the Research School of Physics of Australian National University, 'Our Health in Our Hands' (OHIOH) Grand Challenge as a Research Fellow in 2020 and currently leads the sensor developments efforts of OHIOH Physics and is the Program Coordinator who manages the collaborations of the OHIOH Sensors team. Her research interests include solid-state nanopore sensors, surface functionalization strategies, meta-optical systems and Raman spectroscopy.*

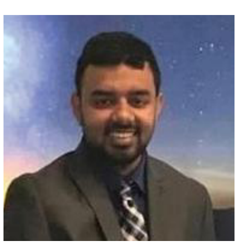
Theme Seminar

A nanoscale aperture with molecular-level fingerprinting prospects

Nuwan Bandara

Research Fellow, The Australian National University, Australia

A nanopore is a nanoscale aperture in an otherwise impervious membrane (solid state or biological) that functions as the sole fluidic pathway between two electrolyte reservoirs. The application of a suitable voltage bias to one of the reservoirs drives the target analyte through the nanopore predominantly through electrophoresis, electroosmosis, or diffusion perturbing the ionic current flow and generating resistive (or conductive in some instances) pulses stamping analyte-specific information. Molecules/particles are probed one at a time—single molecule sensing—with added benefits such as low-cost overhead, ostensibly simple operation, high throughput, and real-time analytics. In this talk, a broad scope pertaining to nanopore sensing would be discussed including single molecule translocations, fabrication of pores (*e.g.* conventional and chemically-tuned controlled breakdown), modification of their interior (*e.g.* photo hydrosilylation), characterization of pores (*e.g.* noise) and nanoscale transport phenomena (*e.g.* electrophoresis vs electroosmosis). A host of biological, biomedical, and pharmaceutically relevant molecules and/or particles such as, DNA, proteins, glycans, viruses, and liposomes have been investigated using this sensor class. Applications such as sequencing (more relevant to biological nanopores), benchmarking, quality control (contaminated vs acceptable samples), payload and maturity estimation of viruses, and folding-unfolding characteristics of proteins under an electric field have gained substantial traction over the last two decades. Nanopipettes, fundamentally similar to planar nanopores, have also gained tremendous attention over the last decade and are fabricated by laser-pulling glass/quartz capillaries. This leads to a tapered nanopore that has 3D axial freedom in movement (not stationary like their planar counterparts) which is advantageous to probing biological systems. A host of applications such as sensing in ultra-low electrolyte conditions (*i.e.* 10 mM KCl), development of methods for high bandwidth sensing, and investigation of directional dependency on the transport characteristics would be discussed in addition to unique signatures arising with DNA translocating through nanopipettes.



Dr Nuwan Bandara *stepped into the IChemC premises back in 2006, joining the 28th Batch as student. He graduated with a first class in 2011 upon completion of the GIC program at College of Chemical Sciences, Institute of Chemistry Ceylon. Simultaneously reading for a degree in the University of Colombo, he graduated with a Bachelors in Science in 2011. He served as a Teaching Assistant of College of Chemical Sciences, Institute of Chemistry Ceylon for a year, before gaining admission to the University of Rhode Island in 2012 to continue with his postgraduate studies. He obtained his PhD in chemistry from the University of Rhode Island in 2018. He has held two postdoctoral positions in the United States as a visiting scholar, and one postdoctoral position in Australia. His main interest in research is based on single molecule sensing. He is the author/co-author of 2 patents, 2 book chapters, 1 instrument chapter, 1 career article, and 30 peer-reviewed journal articles.*