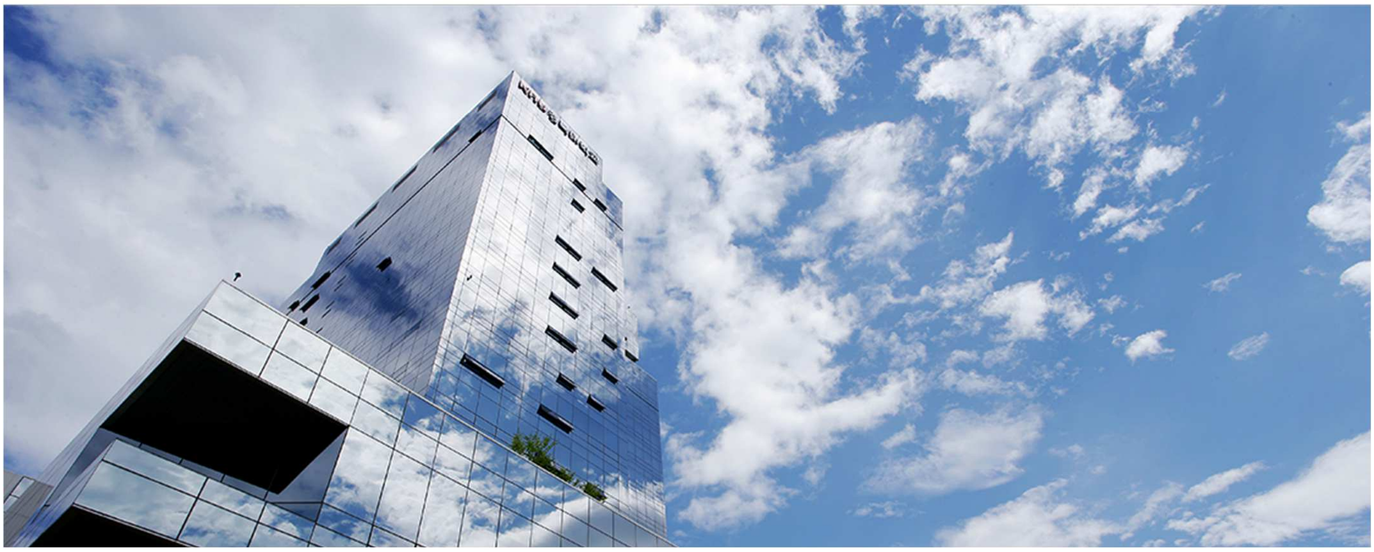
BrainKorea21 FOUR

KNU KYUNGPOOK NATIONAL UNIVERSITY



Welcome Message

Dear Colleagues,

On behalf of the organizing committee, it is my pleasure to welcome you at the 2nd International Seminar Series of **“New Frontiers in Polymeric Materials”** sponsored by the BK 21 Four program with online and at an on-site hybrid format, in Department of Polymer Science and Engineering at Kyungpook National University, South Korea, on **Thursday, December 8, 2022**.

We are proud to bring you a great experience of synergetic expertise from internationally renowned scientists and pioneers in polymer science, biosensing, and flexible electronics. The seminar program is targeted to provide a special opportunity for academic and research-institute scientists, and especially younger researchers and students to gain innovative knowledge and explore a perspective of next-generation polymeric materials.

In addition to the outstanding seminar topics, we hope that it will be an opportunity to get to know our department established in 1968 for the first time in South Korea and has a tradition and history of more than 50 years.

We look forward to interacting with all of you at this seminar!

Sincerely,

Prof. Soo-Young Park

BrainKorea21 FOUR
Educational Research Team for Smart Nanohybrid Polymeric Materials
Department of Polymer Science and Engineering
Kyungpook National University

Organized by Prof. Jaewon Choi, Prof. Dongchoon Hyun, and Prof. Soo-Young Park
Sponsored by Polymeric Nano Materials Laboratory, Kyungpook National University

BrainKorea21 FOUR

KNU KYUNGPOOK NATIONAL UNIVERSITY

The 2nd International Online Seminar Series

New Frontiers in Polymeric Materials

Thursday, December 8, 2022

Zoom Link:

https://us02web.zoom.us/j/5891964617?pwd=d2puMi9HZ3oyRlBEVnRRNUcvVDJsZz09

Meeting ID: 589 196 4617, **PW:** 482235

Korea Time	
8:45 AM – 9:00 AM	**Opening Remark** • **Prof. Soo-Young Park** (Director of BK 21 Four Educational Research Team, Department of Polymer Science and Engineering at KNU) • **Prof. Wonhwa Hong** (KNU President)
9:00 AM - 10:00 AM **Chair:** Prof. Dong Yun Lee	**Polyester Block Polymers as Sustainable High-Performance Thermoplastic Elastomers** Prof. Marc Hillmyer (University of Minnesota)
10:00 AM - 11:00 AM Prof. Dongchoon Hyun	**Micromotors Go In-Vivo: From Test Tubes to Live Animals** Prof. Joseph Wang (University of California San Diego)
11:00 AM - 12:00 PM Prof. Jaewon Choi	**Hope for Higher Ion Velocities in Polymer Electrolytes** Prof. Nitash P. Balsara (University of California Berkeley)
12:00 PM - 1:00 PM Prof. Jinyoung Park	**Electronic Skins for Medical Applications** Prof. Takao Someya (University of Tokyo)

9:00AM - 10:00AM

Polyester Block Polymers as Sustainable High-Performance Thermoplastic Elastomers

Professor Marc Hillmyer

Department of Chemistry

University of Minnesota

Abstract: Aliphatic polyester block polymers that behave as thermoplastic elastomers can be prepared from straightforward sequential ring-opening transesterification polymerizations of cyclic esters. Poly(lactide) is an attractive hard block for these materials because of its ready availability, renewable origins, relatively high glass transition temperature, ability to crystallize in the isotactic form, and the capacity to be industrially composted. We have focused our work on the development of suitable low glass transition temperature, non-crystalline, soft midblocks that can also be synthesized from renewable resources and that are compostable. To that end, we have focused our attention on poly(4-methyl caprolactone). The monomer, 4-methyl caprolactone, can be prepared from cresols, which in turn can come from renewable lignin, in an economical manner and the corresponding polymer is industrially compostable. In this presentation I will discuss our recent efforts to prepare block polymers from these hard and soft components and focus on architecture control (e.g., triblocks, star blocks, and graft blocks), the influence of tacticity in the poly(lactide) segments, the ultimate properties of these thermoplastic elastomers, and the environmental fate in soils and compost.

Biosketch: Marc Hillmyer received his B.S. in Chemistry from the University of Florida in 1989 and his Ph.D. in Chemistry from the California Institute of Technology in 1994. After completing a postdoctoral research position in the University of Minnesota's Department of Chemical Engineering and Materials Science he joined the Chemistry faculty at Minnesota in 1997. He is currently the McKnight Presidential Endowed Chair in Chemistry and leads a research group focused on the synthesis and self-assembly of multifunctional polymers. In addition to his teaching and research responsibilities, Marc served as an associate editor for the ACS journal Macromolecules from 2008-2017 and is currently the editor-in-chief of Macromolecules. He is also the director of the Center for Sustainable Polymers headquartered at the University of Minnesota, a National Science Foundation Center for Chemical Innovation.

10:00AM - 11:00AM

Micromotors Go In-Vivo: From Test Tubes to Live Animals

Professor Joseph Wang

Department of Nanoengineering

University of California San Diego

Abstract: Nanoscale robots that can effectively convert diverse energy sources into movement and forces represent a rapidly emerging and fascinating robotic research area. Such nanoscale robots offer impressive capabilities, including greatly enhanced power and cargo-towing forces, multi-functionality, easy surface functionalization, and versatility. The new capabilities of modern nanorobots indicate immense potential for a variety of biomedical applications, and should have major impact on disease diagnosis, treatment, and prevention. Recent in vivo applications using different types of biocompatible and biodegradable microrobots will be illustrated, including enhanced drug delivery towards enhanced treatment of stomach or infections, active vaccine delivery, autonomous gastric fluid neutralization, microrobot pills for oral delivery, or efficient intracellular delivery of functional proteins and nucleic acids.

Biosketch: Joseph Wang is Distinguished Professor, SAIC Endowed Chair, and former Chair of the Department of Nanoengineering at University of California, San Diego (UCSD). He is also the Director of the UCSD Center of Wearable Sensors and Co-Director of the UCSD Center of Mobile Health Systems and Applications (CMSA). He served as the director of Center for Bioelectronics and Biosensors of Arizona State University (ASU) before joining UCSD. Prof. Wang has published more than 1200 papers, 11 books and he holds 30 patents (H Index=190, >145,000 citations). He received 2 American Chemical Society National Awards in 1999 (Instrumentation) and 2006 (Electrochemistry), ECS Sensor Achievement Award (2018), the IUPAC Analytical Chemistry Medal (2021), IEEE Sensors Achievement Award (2021), Spiers Memorial Award (2013), the Breyer and Heyrovsky Medals from Australia and Czech Republic, respectively, and 6 Honorary Professors from Spain, Argentina, Czech Republic, Romania, China and Slovenia. Prof. Wang has been the Founding Editor of Electroanalysis (Wiley), is RSC, ECS and AIMBE Fellow and a Thomson Reuters Highly Cited Researcher (2015-2021). His scientific interests are concentrated in the areas of bioelectronics, wearable devices, biosensors, bionanotechnology, nanomachines and microrobots, flexible materials, and electroanalytical chemistry.

11:00AM - 12:00PM

Hope for Higher Ion Velocities in Polymer Electrolytes

Professor Nitash P. Balsara

Chemical and Biomolecular Engineering Department

University of California, Berkeley

and

Materials Sciences Division

Lawrence Berkeley National Laboratory

University of California, Berkeley

Abstract: The need for creating safe electrolytes for lithium batteries is significant given the continued safety problems associated with current lithium-ion batteries. Nonflammable polymer electrolytes, mixtures of polymers and salt, offer a possible solution but the rate of lithium ion transport is too low for practical applications. In this talk, I will discuss some of the fundamental factors that limit ion transport in polymers. The performance of electrolytes depends on the current of the working ion under an applied electric potential. Since the current is proportional to the product of the concentration and ion velocity, the velocity of the working ion is of paramount importance. We discuss approaches for predicting ion velocities based on Newman’s concentrated solution theory. The importance of the continuity equation in the presence of ionic current is discussed. We test our predictions on a standard polymer electrolyte based on poly(ethylene oxide) (PEO). To obtain a mechanically robust solid electrolyte, we use PEO-containing block copolymers wherein the other block is glassy (and rigid) polystyrene. Ion transport through these systems can also be described by concentrated solution theory. We conclude by describing our efforts to develop new polymers that exhibit higher ion velocities than PEO.

Biosketch: Nitash P. Balsara is a chemical engineer with a bachelor's degree from the Indian Institute of Technology in Kanpur, India in 1982. His graduate education began with a master's degree from Clarkson University. This was followed by PhD from RPI. After 2 post-docs at the University of Minnesota and Exxon, he joined the faculty of Department of Chemical Engineering at Polytechnic University in Brooklyn. In 2000 he accepted the job that he currently holds: a joint appointment as professor of Chemical Engineering at the University of California, Berkeley, where is currently the Charles W. Tobias Professor of Electrochemistry, and faculty scientist at Lawrence Berkeley National Laboratory. He has managed to hang on to both jobs. Along with his students and collaborators, he cofounded two battery start-ups, Seeo, Inc., and Blue Current.

12:00PM - 1:00PM

Electronic skins for medical applications

Professor Takao Someya

Department of Electrical Engineering and Information Systems

University of Tokyo

Abstract: The human skin is a large-area, multi-point, multi-modal, stretchable sensor, which has inspired the development of electronic skin for robots that simultaneously detect pressure and thermal distribution. By improving its conformability, the application of electronic skin has expanded from robots to next-generation wearables for human, reaching a point where ultrathin semiconductor membrane can be directly laminated onto the skin. Such intimate and conformal integration of electronics with the human skin allows continuous monitoring of health conditions for a long time, enabling personalization of medical care. The ultimate goal of the electronic skin is to non-invasively measure human activities under natural conditions, enabling electronic skin and human skin to interactively reinforce each other. In this talk, I will review recent progress in stretchable thin-film electronics for applications to robotics and next-generation wearables for medical applications and address issues and the future prospect of electronic skin.

Biosketch: Takao Someya was appointed dean of School of Engineering, the University of Tokyo in 2020, where he has been member of faculty since 1997 and professor since 2009. He also conducted research at Columbia University's Nanocenter and at Bell Labs. He served on the board of directors of the Material Research Society 2009-2011. He is also Chief Scientist at RIKEN and Team Leader at its Center for Emergent Matter Science since 2015. His expertise is stretchable and organic electronics, developing the world's first stretchable electronic skin for robotic application. He was awarded the 16th Leo Esaki Prize in 2019.