



**Department of
Polymer Engineering
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Biography: Kyu received Ph. D. in Polymer Chemistry, Faculty of Engineering, Kyoto University, Kyoto, Japan in 1980. Prior to joining the Department of Polymer Engineering at the University of Akron in 1983, he was a post-doctoral research fellow at the Department of Chemistry, McGill University, Montreal, Canada in 1980-81 and a research associate at the Polymer Research Institute, University of Massachusetts, Amherst, in 1981-83. Currently, he is a distinguished professor at the Department of Polymer Engineering. His research has culminated in some 230 refereed papers, 5 patents, and 3 books.

Awards/Accomplishments:

- Outstanding Research Award, University of Akron (1998)
- Distinguished Professorship, University of Akron (2006)

Research Interests:

Kyu's research interest encompasses phase equilibria and kinetics of phase separation in polymer blends; phase field modeling on pattern formation aspects of crystalline polymers; molecular composites; ion-exchange membranes for proton fuel cells; secondary rechargeable Li ion batteries; phase transitions of liquid crystals; electro-optical properties of dispersed liquid crystal and photonic crystals; biodegradable polymers, all the way to phytochemicals modified membranes for dialysis.



Figure. Solvent free polymer electrolyte membrane fabricated by photo-curing a 28/42/30 PEGDA/SCN/LiTFSI mixture. This self standing film is light weight, transparent, and flexible which can be stretched, bended or twisted, and molded in any forms. Its room temperature ionic conductivity is on the order of E-3 S/cm that reaches E-2 S/cm at elevated temperatures above 50 C.

Industrial Sector Focus:

Flexible liquid crystal displays – Chiral liquid crystals for flexible displays, development of optical adhesives for flexible devices.

Flexible, stretchable polymer electrolyte membranes – Light weight, solid state secondary lithium ion battery with extremely high ionic conductivity exceeding conventional Li ion batteries.

Biomedical engineering – Phytochemically modified polymer membranes, electrospun fibers, hydrogels with enhanced anti-oxidant, anti-inflammatory for hemodialysis, wound dressing, and topical applications.

Unique Laboratory Facilities:

Functional materials development – Structural characterization, AC impedance spectroscopy, time-resolved light scattering, modeling and simulation on development of phase separated structures in electro-spun fibers.

Recent Publications/Patents:

- N. Kim and T. Kyu, "Phase Equilibria and Photopolymerization Induced Phase Transitions of Mesogenic Diacrylate Monomer and Low Molecular Mass Liquid Crystal Mixture," *Liquid Crystals*, 39, 745- 754 (2012)
- T. Chang, T. Kyu, L.A. DeFine, and T.S. Alexander, "In Vitro Investigation of Anti-oxidant, Anti-Inflammatory and Anti-platelet Adhesion Properties of Genistein Modified Poly(ethersulfone)/ Poly(vinyl pyrrolidone) Hemodialysis Membranes," *J. Biomed. Mater. Res. B*, 103, 539-547 (2015)
- R. He, M. Echeverri, D. Ward, and T. Kyu, "Effect of Molecular Weight of Network Precursor on Mechanical and Electrochemical Properties of Photo-polymerized Solid-State Polymer Electrolyte Membrane Networks," *J. Membr. Sci.*, 498, 208–217 (2016)