

UCSD NANOENGINEERING / CHEMICAL ENGINEERING
SEMINAR SERIES

Wednesday, October 16, 2019

Seminar Presentation: 11:00am - 12:00pm

SME room 248***“Multifunctional Polymers for Energy, Healthcare, & Artificial Touch”*****Darren J. Lipomi Ph.D.***Professor**Department of NanoEngineering
and Program in Chemical Engineering
University of California, San Diego*

Abstract: Mechanical deformability underpins many of the advantages of semiconducting and stimuli-responsive polymers in applications from flexible solar cells to wearable devices for healthcare and virtual touch. The mechanical properties of these materials are, however, diverse, and the molecular characteristics that permit deformability while retaining function remain poorly understood. In this talk, I describe the ways in which molecular structure and solid-state packing structure govern the mechanical properties of organic semiconductors, especially of π -conjugated polymers. In particular, I describe how low modulus, good adhesion, and absolute extensibility prior to fracture enable robust performance. I will also present my group's recent work on the intersection between the science of soft materials and the science of touch. This field, which we have named “organic haptics,” combines active polymers, contact mechanics, and psychophysics. We are beginning to understand the ways in which stick slip friction, adhesion, and capillary forces between planar surfaces and human skin affect the ways materials produce tactile objects in consciousness as mediated by the sense of touch. This work, which combines human subject experiments, laboratory mockups of human skin, and analytical models accounting for friction, has led to several important observations. In particular, we have elucidated the mechanism by which humans can differentiate hydrophilic from hydrophobic surfaces when bulk parameters such as hardness, roughness, and thermal conductivity are held constant. We have taken the insights from these psychophysical experiments to design new electroactive and ionically conductive materials to produce haptic biomaterials whose goal is to produce realistic sensations for applications in tactile therapy, instrumented prostheses, education and training, and virtual and augmented reality.

Teaching and Education

Prof. Lipomi also has a popular YouTube channel ([youtube.com/user/djlipomi](https://www.youtube.com/user/djlipomi)) on which he has posted his course lectures and professional seminars on topics such as presentation skills, scholarly writing, time management, and active learning.

Biosketch: Darren J. Lipomi earned his bachelor's degree in chemistry with a minor in physics from Boston University in 2005. He earned his PhD in chemistry at Harvard University in 2010, with Prof. George M. Whitesides. From 2010 – 2012, he was an Intelligence Community Postdoctoral Fellow in the laboratory of Prof. Zhenan Bao at Stanford University. He is now a Professor in the Department of NanoEngineering and Program in Chemical Engineering at the University of California, San Diego. He is the recipient of the NSF BRIGE award, the AFOSR Young Investigator Program award, the NIH Director's New Innovator Award, and the Presidential Early Career Award for Scientists and Engineers. His research website is lipomigroup.org.