MRSEC SEMINAR SERIES

"Molecularly Stretchable Electronics for Energy and Healthcare."

The term "plastic electronics" masks the wide range of mechanical behavior possessed by films of π-conjugated (semiconducting) small molecules and polymers. There is also an apparent trade-off between electronic performance and mechanical compliance in films of some of the best-performing conjugated polymers, which fracture at tensile strains not significantly greater than those at which conventional inorganic semiconductors fail. The design of materials that can be deformed significantly would facilitate roll-to-roll production, mechanical robustness for potable applications, conformal bonding to curved surfaces (i.e., for wearable and implantable biomedical devices). This seminar will describe my group's efforts to understand and control the structural parameters that influence the mechanical properties of modern conjugated polymers. Our conclusions include the strong effect of the side chain in determining the elasticity, ductility, and adhesion of polymers and their blends with fullerenes (i.e., for organic solar cells), and how this effect can be predicted by theory and computation. Mechanical, electronic, and spectroscopic evidence suggest that compliance and electronic performance need not be in competition, and could inform the engineering of the next generation of semiconducting polymers for mechanically tough, ultra-flexible, and stretchable applications. This seminar will also describe my group's work on methods of producing graphene with low waste in ways that are compatible with roll-to-roll printing. These large-area films could be used simultaneously as both the transparent electrodes and barrier films for stretchable and ultra-flexible organic optoelectronic devices for, among other examples, glove-like strain sensors for wireless transmission and decoding of American Sign Language. I will also describe the scalable fabrication and physical self-assembly of new types of nanostructures templated by graphene, and their applications as ultra-sensitive strain sensors for wearable health monitors and as signal transducers for cellular electrophysiology.

Darren J. Lipomi, Ph.D.
Department of NanoEngineering
University of California, San Diego

Wednesday May 11, 2016
Ryan 4003
11:00 a.m. – 12:00 p.m.