UC San Diego
JACOBS SCHOOL OF ENGINEERING
NanoEngineering

UCSD NanoEngineering/Chemical Engineering

SEMINAR SERIES

Wednesday, November 6, 2019

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

SME room 248

"Precise engineering of semiconducting polymers for organic electronics"

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Abstract: π-Conjugated polymers are being used in the fabrication of a wide variety of organic electronic devices such as organic field-effect transistors (OFETs), organic photovoltaic (OPV) devices, and organic light-emitting diodes (OLEDs). Since the seminal work on the conductivity of polyacetylene by Heeger, MacDiarmid, and Shirakawa was published in 1970s, the field of organic electronics has grown exponentially. Our group has been studying and developing techniques to grow semiconducting polymers using a living polymerization method. This has allowed us to synthesize polymer architectures that we haven't been able to access till now including polythiophene brushes, star-shaped P3HT, as well as hyperbranched P3HT. It also allows us to accurately control the molecular weights of P3HT and produce materials with a narrow molecular weight distribution. Our unique synthetic capabilities allows us to specifically control defects in these polymers. Our work in controlling polymer defects and their effect on microstructure and thus optoelectronic properties will be presented.

More recently, we have begun to study the mechanical properties of semiconducting polymers. As the polymers' practical applications have extended into the health and life sciences areas (e.g., electronic skins and artificial muscles), the mechanical compliance (i.e., low stiffness and high ductility) has become increasingly important. This in turn requires one to establish an understanding of the relationship between polymer structure and their mechanical properties as well as their (opto)electronic properties. In this presentation, the synthesis of a series of indacenodithiophene-based semiconducting polymers will be discussed along with the feasibility of using these polymers in stretchable devices.

Biosketch: Christine Luscombe grew up in Kobe, Japan. After receiving her Bachelor's degree in Natural Sciences from the University of Cambridge in 2000, she worked with Profs. Andrew Holmes and Wilhelm Huck in the Melville Laboratory of Polymer Synthesis at the University of Cambridge where her research focused on surface modifications using supercritical carbon dioxide for her PhD. She received the Syngenta Award for best organic chemistry project for her PhD. In January 2004, she joined the group of Prof. Jean Fréchet for her post-doctoral studies where she began her research on semiconducting polymers for organic photovoltaics. She was the recipient of the Lindemann Fellowship as well as the Trinity College Junior Research Fellowship (University of Cambridge) for her post-doctoral studies.

In September 2006, she joined the Materials Science and Engineering Department at the University of Washington, Seattle. She received a number of young faculty awards including the NSF CAREER Award, DARPA Young Faculty Award, as well as the Sloan Research Fellowship. Her current research focuses on the synthesis of semiconducting polymers for energy applications. She is currently serving on the Editorial Advisory Boards for a number of journals including Polymer International, Advanced Electronic Materials, ACS Applied Materials and Interfaces, Journal of Applied Physics, and Advanced Functional Materials. She is an Associate Editor for Macromolecules, is serving on the IUPAC Polymer Education and Polymer Terminology Subcommittees, and is the Vice President of the IUPAC Polymer Division. She is currently the Director of the Clean Energy to Bridge (CEBR) REU program and the Executive Director for an NSF MRSEC Molecular Engineering Materials Center (MEM-C).