Michigan State University
Science at the Edge
Engineering Seminar

February 13th, 2015
11:30 a.m., Room1400 Biomedical and Physical Sciences Building
Refreshments served at 11:15 a.m.

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New Materials and Printing Processes for Flexible Electronics

Abstract

Currently there is great interest in developing manufacturing methods for integrating electronic circuitry into flexible and stretchable substrates for a spectrum of applications including roll-up displays, wearable biosensors, smart labels, and electronic skins ('e-skins') for robotics, for example. One fabrication strategy that has captured imaginations involves the use of digital or analog printing techniques to pattern electronically functional inks onto paper, plastic, rubber, or metal foils. However, "printed electronics" has a number of significant challenges, including spatial resolution, pattern registration, and printed circuit performance. In this talk, I will describe a multi-pronged approach to address these challenges that may bring roll-to-roll printed electronics closer to reality. To begin, I will show that innovations in materials allow the fabrication of printable, low voltage thin film transistors (TFTs), the key building blocks of flexible circuits, and that these can be incorporated into simple printed circuit demonstrations involving two dozen TFTs and an equivalent number of printed resistors and capacitors. The second half of the talk will describe a novel liquid-based fabrication approach that we term SCALE, or Self-Aligned Capillarity-Assisted Lithography for Electronics. The SCALE process employs a combination of digital printing and in-substrate capillary flow to produce self-aligned devices with feature sizes that are currently as small as 1 □m. The talk will finish with a discussion of the new opportunities in flexible microelectronics afforded by liquid-based processing.

Bio

C. Daniel Frisbie is Distinguished McKnight University Professor and Head of Chemical Engineering and Materials Science at the University of Minnesota. He obtained a PhD in physical chemistry at MIT in 1993 and was an NSF Postdoctoral Fellow at Harvard. His research focuses on materials for printed electronics, including organic semiconductors and their applications in devices such as transistors and solar cells. Research themes include the synthesis of novel organic semiconductors, structure-property relationships, organic device physics, and the application of scanning probe techniques. Recent efforts also include new manufacturing approaches to flexible electronics and the use of gel electrolytes as high capacitance gate insulators in OTFTs to lower drive voltages. From 2002-2014, Frisbie led a multi-investigator effort in Organic Optoelectronics at the University of Minnesota, sponsored by the Materials Research Science and Engineering Center (MRSEC) program of the NSF. He is currently the lead investigator on a Multi-University Research Initiative (MURI) grant funded by the Office of Naval Research for development of a roll-to-roll printed electronics manufacturing platform.

For further information please contact Prof. Richard Lunt, Department of Chemical Engineering and Materials Science at rlunt@egr.msu.edu

Persons with disabilities have the right to request and receive reasonable accommodation. Please call the Department of Chemical Engineering and Materials Science at 355-5135 at least one day prior to the seminar; requests received after this date will be met when possible.