

Electronics on Anything: How Thin Film Electronics can Instrument the World

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ABSTRACT: Silicon electronics have revolutionized the processing and handling of information. The high temperatures required to create crystalline silicon devices, however, has limited the application of crystalline silicon to sensing systems that work in a small and mechanically rigid form factor. The development of inorganic and organic thin film electronics has launched a second revolution in electronics, granting the ability to process electronically active materials at low temperatures. This has allowed for two exciting opportunities: the ability to build electronic devices on the same size scale as the systems they interact with, and the ability to integrate electronic materials on a range of substrates including electronically active and flexible materials. Our group has been working on the hybrid integration of organic semiconductors and SLS laser-recrystallized silicon with active substrates to implement sensing, display, and mechanical actuation functionalities. In this presentation, I'll show how thin film electronics and the hybrid integration enabled by new semiconductor systems and process options allows for active and spatially localized control of systems that are typically used in a single element format. Using this capability we have demonstrated the electronic implementation of all five senses as well a new approaches to mechanical actuation in polymer materials and driving LEDs in display engines. In particular, I'll show how thin film transistors can be integrated with other active materials to build monolithically integrated microphones and pressure sensors, flexible sheet scanners, mass-based chemical sensors, high power light engines, and segmented polymer actuators. We hope that these devices will form some of the building blocks for future electronic systems and interface paradigms in a range of technological and healthcare areas.

BIOGRAPHY: John graduated with his SB, M.Eng., and Ph.D. degrees from MIT. His M.Eng. thesis was performed as a co-op at the IBM TJ Watson Research Lab on organic thin film transistors, and his Ph.D. was for work on field emission displays. He joined Columbia University in 2006 as an assistant professor. John has won a number of awards for his work, including the NSF CAREER award, the IEEE EDS Paul Rappaport award, the Vodaphone Americas Foundation Wireless Innovation Award, the MIT Clean Energy Prize, and several other foundation, corporate, and best paper awards. He is the editor in chief of the Journal of the Society for Information Display, and was the general chair for the 2014 Device Research Conference.



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