

THE DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING SPEAKER SERIES

PRESENTS



Is Bigger Better? Engineering Self-Assembly and Strain, From Nanometers to Centimeters

Edward T. Yu

The University of Texas at Austin
Austin, TX 78758 USA

Monday, 3/8 9:55 am

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LECTURE ABSTRACT

Engineering structure and composition at length scales small compared to electron and photon wavelengths has long been a cornerstone of advances in electronic and photonic materials. Doing so over large areas, and exercising similar control over material strain and deformation, remain outstanding challenges and opportunities. In this talk, we begin by discussing recent work from our laboratory in which new understanding we have developed of patterning techniques based on self-assembly, particularly nanosphere lithography, has enabled their extension to large ($>200\text{cm}^2$) areas and application to high-performance devices for solar energy harvesting. Specific examples will include (i) large-area, high-efficiency, mechanically flexible solar modules with broadband, omnidirectional nanostructured antireflection surfaces for application in high-altitude unmanned aerial vehicles, and (ii) high-performance silicon-based photoelectrodes for solar-powered splitting of water molecules into hydrogen and oxygen. We then discuss how lattice strain with spatial inhomogeneity at $\sim 1\text{-}100\text{nm}$ length scales in atomically thin materials, specifically semiconducting transition metal dichalcogenides, leads to piezoelectric and flexoelectric polarization effects that can exert a pronounced influence on electronic and optical behavior in a broad range of device geometries. Finally, we will discuss some of the activities of the Center for Dynamics and Control of Materials, an NSF MRSEC launched at UT Austin in 2017 that is providing a new umbrella for interdisciplinary materials research and education at and beyond the University of Texas.

SPEAKER BIOSKETCH

Edward Yu is Professor of Electrical & Computer Engineering and holds the Judson S. Swearingen Regents Chair in Engineering at the University of Texas at Austin. He received his A.B. (summa cum laude) and A.M. degrees in Physics from Harvard University in 1986, and his Ph.D. degree in Applied Physics from the California Institute of Technology in 1991. He was a postdoctoral fellow at the IBM Thomas J. Watson Research Center from 1991 until 1992, and a faculty member at the University of California, San Diego from 1992 until 2009, when he assumed his current position at the University of Texas. Professor Yu has been the recipient of an NSF CAREER Award, ONR Young Investigator Award, Alfred P. Sloan Research Fellowship, UCSD ECE Graduate Teaching Award, and UT Austin Lepley Memorial Teaching Award, and is an AVS and IEEE Fellow. He has served as a member and Chair of the DARPA Defense Sciences Research Council (DSRC), and currently serves at UT Austin as founding Director of the Center for Dynamics and Control of Materials: an NSF MRSEC. Current research interests in his laboratory include photovoltaics and other technologies for energy harvesting and generation; nanoscale imaging and characterization techniques; and solid-state nanoscience and nanotechnology generally. The results of his research have been reported in over 200 archival journal publications.

Contact Dr. Wei-Chuan Shih (wshih@uh.edu) for additional information