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MANUFACTURING AT SMALL DIMENSIONAL SCALES

ABSTRACT:

Mechanics and transport at the micro and nanoscale offer a rich set of efficient and controllable phenomena that can be exploited in processes for manufacturing at these scales. Using a manufacturing perspective, this talk will identify a few critical challenges in process development, tool design, metrology and integration. Within this framework, the talk will discuss electrochemical nanoimprinting, focusing on the exploiting of superionic conductivity in silver-based glassy electrolytes for patterning and direct-writing of silver nanostructures and some recent work on metal-assisted chemical etching of silicon. Further, motivated by heterogeneous functional integration, microscale assembly by transfer printing, specifically, laser micro-transfer printing will be discussed. A non-contact variant of micro-transfer printing that exploits thermally-driven thin-film delamination, this process opens up new possibilities for micro-scale distribution of mechanical to create mechanically-active composites. The mechanics and applications of the process will be discussed along with some of the characteristics of the assembled composites.



PLACID M. FERREIRA

*Assistant Professor
Department of Mechanical Science and
Engineering
University of Illinois at Urbana-
Champaign
Urbana, IL*

BIOGRAPHY:

Placid M. Ferreira is the Tungchao Julia Lu Professor of Mechanical Science and Engineering at Illinois. From 2003 to 2009, he was the director of the Center for Chemical-Electrical-Mechanical Manufacturing Systems (Nano-CEMMS), an NSF-sponsored Nanoscale Science and Engineering Center after which he served as the Head of the Department of Mechanical Science and Engineering at Illinois until August 2015. He graduated with a PhD in Industrial Engineering from Purdue University in 1987, M.Tech (Mechanical) from IIT Bombay, 1982 and B.E. (Mechanical) for University of Bombay in 1980. He has been on the mechanical engineering faculty at Illinois since 1987, serving as the associate head for graduate programs and research from 1999 to 2002.

Professor Ferreira's research and teaching interests are in precision manufacturing and includes computer-controlled machines, nanomanufacturing and metrology. Professor Ferreira received NSF's Presidential Young Investigator Award in 1990, SME's Outstanding Young Investigator Award in 1991, University of Illinois' University Scholar Award in 1994, ASME's Ennor Award for Manufacturing Technology in 2014. He is also a Fellow of ASME, SME and AAAS. He has served on the editorial board of a number of manufacturing-related journals.