Department of Mechanical Engineering Colloquium

UNIVERSITY OF CALIFORNIA
UC RIVERSIDE

The Department of Mechanical Engineering
Presents

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Associate Professor
Departments of Biomedical Engineering,
and Chemical Engineering & Materials Science
UC Irvine

Friday, May 2
11:10 AM - 12:00 PM
Winston Chung Hall 232

SMART: Shrink Manufacturing Advanced Research Tools

Abstract:
The challenge of micro- and nano-fabrication lies in the difficulties and costs associated with patterning at such high resolution. To make such promising technology – which could enable pervasive health monitoring and disease detection/surveillance – more accessible and pervasive, there is a critical need to develop a manufacturing approach such that prototypes as well as complete manufactured devices cost only pennies. To accomplish this, instead of relying on traditional fabrication techniques largely inherited from the semiconductor industry, we have pioneered a radically different approach. Leveraging the inherent heat-induced relaxation of pre-stressed thermoplastic sheets – commodity shrink-wrap film – we pattern in a variety of ways at the large scale and achieve our desired structures by controlled shrinking down to 5% of the original, patterned sizes. This enables us to 'beat' the limit of resolution inherent to traditional 'top-down' manufacturing approaches. With these tunable shape memory polymers, compatible with roll-to-roll as well as lithographic processing, we can robustly integrate extremely high surface area and high aspect ratio nanostructures directly into our microsystems. Importantly, our metallic nano structures (self-assembled due to the stiffness mismatch between the thin metal film deposited on the retracting plastic sheet) have demonstrated unprecedented electromagnetic field enhancements. This ultra rapid fabrication approach therefore results in field-compatible plastic based microfluidic systems with integrated nanostructures for robust signal amplification. This design-on-demand approach to create a suite of custom biomedical tools for low cost diagnostics including sample prep with magnetic nanotraps, embedded on-chip electrodes, microlens arrays, surface enhanced sensing substrates, patternable superhydrophobic surfaces for channeless microfluidics, and flexible electronics.

About the Speaker:
Michelle Khine is currently an Associate Professor of Biomedical Engineering, Chemical Engineering and Materials Science at UC Irvine. She was an Assistant & Founding Professor at UC Merced ('06-'09). Michelle received her BS and MS from UC Berkeley in Mechanical Engineering ('99 and '01, respectively) and her PhD under Luke P Lee in Bioengineering ('05) from UC Berkeley and UCSF. She was the Scientific Founder of Fluxion Biosciences, Shrink Nanotechnologies and, most recently, Novoheart. Michelle was the recipient of the TR35 Award and named one of Forbes '10 Revolutionaries' in 2009 and by Fast Company Magazine as one of the '100 Most Creative People in Business' in 2011. She was awarded the NIH New Innovator's Award, was named a finalist in the World Technology Awards for Materials, and was named by Marie-Claire magazine as 'Women on Top: Top Scientist'. She is currently working on starting a novel 'co-op' with her students, 'A Hundred Tiny Hands', and is spear-heading a new graduate program focused on Biomedical Engineering Entrepreneurship, BioENGINE, at UC Irvine.