INVITED LECTURE – JAMES LEE

26TH ANNUAL MEETING
POLYMER PROCESSING SOCIETY
July 4-8, 2010 | Banff, Canada

Design, Fabrication and Applications of Polymeric Blends

L. James Lee
Department of Chemical and Biomolecular Engineering
The Ohio State University
Columbus, Ohio
USA

Micro/Nanotechnology is initiated from the electronics industry. In recent years, it has been extended to micro/nano-electro-mechanic system (MEMS/NEMS) for producing miniature devices based on silicon and semi-conductor materials. However, the use of these hard materials alone is inappropriate for many biomedical devices. Soft polymeric materials possess many attractive properties such as high toughness and recyclability. Some possess excellent biocompatibility, are biodegradable, and can provide various biofunctionalities. In this talk, I will first give a brief overview of major research activities in our center on micro/nanoscale processing of polymeric materials and its biomedical applications. Several biochips will be discussed as examples for low-cost and mass-producible lab-on-a-chip platform for biological analyses and controlled drug delivery. One example is a microfluidic CD for Enzyme-Linked Immunosorbent Assays (ELISA) that reduces cost, accelerates detection, and improves reliability of analyses for food borne contaminants, cancer diagnoses and environmental contamination. The second example is microfluidics-electrospray enhanced synthesis of lipopolyplex nanoparticles that allows targeted delivery of multiple gene and drugs. The third example is nanochannel-based cell electroporation that allows dose-control of drug delivery to individual cells. All biochips share (1) biologically benign processing of polymeric materials at the micro/nanoscale, (2) surface modification for optimal binding of biomolecules onto polymer surface, and (3) integration of micro/nanofluidic designs into polymer processing.