The University of Texas at San Antonio

UTSA Physics and Astronomy

Dr. Ali Beskok

Southern Methodist University

Friday, October 19th, 2018
FLN 2.02.06
3:00 PM

Electrical Characterization and Manipulation of Biological Cells in Microfluidic Systems

The talk focuses on the theory and experimental validation of AC electrokinetic transport phenomena. Examples of microfluidic devices developed by our group for biological cell separation using dielectrophoresis (DEP) and cell characterization using impedance spectroscopy (IS) will be presented. Particularly, we developed a microfluidic system that captures individual cells in distinct micro-wells using positive dielectrophoresis, followed with the measurement of their dielectric properties using impedance spectroscopy, and cell release using negative dielectrophoresis (*Analytical Chemistry*, 2018). The device enables *real-time* measurements of the cytoplasmic resistance and cell membrane capacitance in response to changes in the buffer conductivity, pH and drug uptake. DEP and IS are often ineffective in high conductivity buffers, requiring sample dilution to adjust the conductivity. However, biological cells suspended in low conductivity buffers exhibit time dependent changes in their dielectric properties, making DEP based cell separation techniques challenging. On the other hand, DEP and IS conducted in physiological buffers suffer from severe electrode polarization effects (EPE). We addressed these problems by fabricating fractal nano-structured electrodes that minimize the EPE. The final part of the talk demonstrates *self-similarity* of interfacial impedance of electrodes, which enables universal characterization of EPE including the fractal nano-structured electrodes (*Analytical Chemistry*, 2017).

Department Contact Information
Veronica.Castellanos@utsa.edu
http://physics.utsa.edu