

CENTER FOR FLUID MECHANICS
AND
THE FLUIDS, THERMAL AND CHEMICAL PROCESSES GROUP
OF
THE DIVISION OF ENGINEERING
SEMINAR SERIES

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**AC Electrokinetic Manipulation of Colloids & Biological Particles
in Microfluidic Systems**

We present experimental and theoretical research on manipulation of colloids and biological particles in microfluidic systems using AC electric fields. Navigating the AC frequency-amplitude phase space, we effectively and reversibly tune colloidal interactions to yield various steady-state configurations. The colloidal system response can be predicted using a scaling analysis based on the relative importance of dielectrophoresis, electrophoresis, AC-electroosmosis, gravity and Brownian motion. Particularly we present the following applications:

1. *Colloidal Microfluidic Circuits*: Electric field-directed assembly of gold nano-particles in a microfluidic system enables modulation of the electrical properties within the circuit. Specifically, regulating the colloidal structures enables a single circuit element to act as a variable resistor, capacitor, or inductor in a reversible and switchable fashion. The colloidal microfluidic circuit has the potential for adaptive control of electromagnetic properties across a surface.
2. *Bacterial Spore Concentration Using Dielectrophoresis*: We present experimental results for concentration of *Clostridium Sporogenes* spores from various conductivity media, spanning from DI water to milk. Positive *DEP* diminishes quickly with increased conductivity, and one needs to design electrodes that amplify the negative *DEP* effects. We present bacterial spore capture in a wide spectrum of media that exhibit 5-orders of magnitudes variation in conductivity, and discuss utilization of the device for water and food safety applications.

Bio: Prof. Ali Beskok received his B.S. in Mechanical Engineering from Middle East Technical University, Ankara, Turkiye in 1988. He received an MS degree in Mechanical Engineering from Indiana University Purdue University in Indianapolis in 1991, and M.S. and Ph.D. degrees from Princeton University, Mechanical and Aerospace Engineering in 1994 and 1996, respectively. Dr. Beskok was a Visiting Scholar at Brown University, Center for Fluid Mechanics from 1994 to 1996, and a Post Doctoral Research Associate at Massachusetts Institute of Technology, Research Laboratory of Electronics from 1996-1998. He joined Texas A&M University Mechanical Engineering Department as an Assistant Professor in 1998, and became an Associate Professor in 2004. Currently, he is the Batten Professor of Computational Engineering, and a professor at Old Dominion University, Aerospace Engineering Department.

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