Designing microfluidic platforms via electrokinetics for medical diagnostics and environmental biotechnology applications

Electrokinetics, the phenomenon of using electric fields to direct the motion of particles, has been a useful tool in microfluidics. Combining this phenomenon with dielectrophoresis, the induced motion of particles under electric field gradients, has not only proven to be capable of identifying disease conditions in human and animal, but also found to be the way to go with regards to portable, quick, and high throughput disease diagnostic devices and other allied applications such as in environmental biotechnology. At MESA lab, we specialize in the design, fabrication, testing, and validation of such micro platforms. Prior to the utilization of COMSOL Multiphysics software for designing these platforms, we obtain the intrinsic dielectric property data of the particles in interest. These electrophysiological properties are unique towards each cell type and state which form the basis of our detection platforms. The performance of the device platform is validated with the obtained theoretical/numerical results and the results from other diagnostic methodologies. This lab-on-a-chip technology will ultimately yield a platform that could be applied to concentrate / enrich and/or detect / characterize any particle of interest with high selectivity and sensitivity that is minimally invasive, label-free, and less expensive compared to the current technology.

Soumya K. Srivastava
Department of Chemical and Materials Engineering
University of Idaho

Soumya K. Srivastava is an Assistant Professor of Chemical Engineering at University of Idaho, Moscow since 2013. Before joining U of I, she was an Assistant Research Professor in the Gene and Linda Voiland School of Chemical Engineering and Bioengineering at Washington State University during 2010-2013. She obtained her PhD in Chemical Engineering at Mississippi State University in August 2010, M.S from Illinois Institute of Technology, Chicago in 2005 and B.S from R.V. College of Engineering, Bangalore, India in 2001. Her research interests focus on microfluidics, bio-separations, designing lab-on-a-chip system for medical diagnostic applications using electrokinetics, modeling and simulations, and educational research. Dr. Srivastava is an active member of AIChE, AES, ASEE, SWE, and NOBCChE. She has won many accolades including the Innovative Engineering Educator by National Academy of Engineers in 2015, Inclusive Educator Excellence Award by Women in Engineering ProActive Network (WEPAN) in 2015, most cited article in 2011, and best paper award in 2009.