



JOHNS HOPKINS
Center for Environmental
& Applied Fluid Mechanics

Special CEA FM Seminar: Spring 2012

Wednesday, May 30, 2012

3:00 p.m. – 4:00 p.m.

Gilman 50 (Marjorie M. Fisher Hall)

"GAS-LIQUID MULTIPHASE FLOWS FOR HIGH SPEED MICROFLUIDICS"

Presented by

Dr. Carlos Hidrovo

(The University of Texas at Austin)

Abstract: The prospects and promises of ubiquitous portable microfluidics systems for biochemical detection and analysis can be hampered by throughput limitations. In this talk we will explore the use and fundamental physics limitations of multiphase flows to enhance transport in these microsystems. The first portion of the talk will focus on superhydrophobic friction reduction in pressure driven microchannel flow. Surface microtexturing can lead to a superhydrophobic Cassie state characterized by the presence of air pockets within the roughness that act as effective "shear free" regions. The effects of pressure on the degree of microtexturing wetting and corresponding friction reduction characteristics are addressed and discussed. In the second portion of the talk, gas-liquid droplets flows will be presented as a possible alternative to liquid-liquid droplet systems. The use of gas as the carrier fluid can potentially increase the speeds at which droplets are cycled and moved through the systems. It also opens the door for faster mixing processing times through impact coalescence droplet pair collisions. The role and limitations that inertial effects play on these two processes will be examined. A novel optical diagnostics technique and approach to droplet-pair mixing quantification will also be presented in this portion of the talk.

Bio: Dr. Carlos Hidrovo is an assistant professor of mechanical engineering at The University of Texas at Austin. He earned his Ph.D. in mechanical engineering from MIT in 2001. Dr. Hidrovo worked as a Research Scientist in the 3D Optical Systems group at MIT and as a Research Associate in the Micro Heat Transfer Laboratory at Stanford University before joining the faculty of UT Austin in September 2007. He is the recipient of a 2012 NSF CAREER Award from the Fluid Dynamics program, the 2008 DARPA Young Faculty Award, and the ASME 2001 Robert T. Knapp Award. Dr. Hidrovo research interests lie at the intersection of multiscale and multiphase flow and transport phenomena, surface tension interactions in micro/nanoengineered structures, and electrokinetic ion transport in porous media for applications in energy storage, portable biochemical diagnostics, thermal management, and water treatment systems. He is also actively involved in developing novel imaging and diagnostic tools in these areas.



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