

Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

3D flow focusing for microfluidic flow cytometry with ultrasonics

VASKAR GNYAWALI, Department of Mechanical and Industrial Engineering, Ryerson University, Toronto, Canada, ERIC M. STROHM, YASAMAN DAGHIGHI, MIA VAN DE VONDERVOORT, MICHAEL C. KOLIOS, Department of Physics, Ryerson University, Toronto, Canada, SCOTT S.H. TSAI, Department of Mechanical and Industrial Engineering, Ryerson University, Toronto, Canada — We are developing a flow cytometer that detects unique acoustic signature waves generated from single cells due to interactions between the cells and ultrasound waves. The generated acoustic waves depend on the size and biomechanical properties of the cells and are sufficient for identifying cells in the medium. A microfluidic system capable of focusing cells through a $10 \times 10 \mu\text{m}$ ultrasound beam cross section was developed to facilitate acoustic measurements of single cells. The cells are streamlined in a hydro-dynamically 3D focused flow in a $300 \times 300 \mu\text{m}$ channel made using PDMS. 3D focusing is realized by lateral sheath flows and an inlet needle (inner diameter $100 \mu\text{m}$). The accuracy of the 3D flow focusing is measured using a dye and detecting its localization using confocal microscopy. Each flowing cell would be probed by an ultrasound pulse, which has a center frequency of 375 MHz and bandwidth of 250 MHz. The same probe would also be used for recording the scattered waves from the cells, which would be processed to distinguish the physical and biomechanical characteristics of the cells, eventually identifying them. This technique has potential applications in detecting circulating tumor cells, blood cells and blood-related diseases.

Vaskar Gnyawali
Department of Mechanical and Industrial Engineering,
Ryerson University, Toronto, Canada

Date submitted: 17 Jul 2015

Electronic form version 1.4