

Abstract Submitted  
for the DFD07 Meeting of  
The American Physical Society

**Numerical simulation of slug formation in micro-channels<sup>1</sup>**  
SREEDHAR MANCHU, YVES DUBIEF, WILLIAM LOUISOS, TIM HARRIS,  
DARREN HITT, University of Vermont — We study the mixing of two immiscible fluids through a 90° junction of two micro-channels. The flow is simulated using both a particle-based method, dissipative particle dynamics (DPD), and a continuum Navier-Stokes approach with conservative level-set method. In both cases, immersed boundary methods simulate the walls. The Reynolds number is of the order of unity and the Weber number is varied for the purpose of the study. The measurement of the volume fraction of each fluid downstream of the junction exhibits a strongly periodic behavior. Under adequate conditions, micro-slugs that filled almost the entire width of the channel are formed. The simulation are compared with existing experimental data using water and octanol or aqueous glycerol. The flexibility of both codes is used to test optimization algorithms aiming at the control of the micro-slugs size and frequency. Preliminary results of this optimization study will be presented.

<sup>1</sup>This work is supported by the U.S. Air Force Office of Sponsored Research.

Yves Dubief  
University of Vermont

Date submitted: 07 Aug 2007

Electronic form version 1.4