Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Dynamics of droplet entrapment in a constricted microchannel MEHDI NEKOUEI, SWASTIKA BITHI, SIVA VANAPALLI, Texas Tech University, Department of Chemical Engineering — Droplet migration and clogging in confined geometries is a problem of fundamental importance in oil recovery and droplet microfluidics. A confined droplet flowing through a conduit can either be arrested at the constriction or squeeze through it. The dynamics of the trapped and squeezed states are expected to depend on capillary number, drop size, viscosity ratio. Although there have been a number of studies on the dynamics of droplets passing through a constriction, investigations of dynamics of trapped droplets in constricted microchannels is lacking. In this work, we performed three-dimensional simulations of droplet trapping and squeezing process in a constricted microchannel. We also conducted experiments to validate the key results of the simulations. We investigated the impact of different system parameters on the onset of droplet immobilization at the constriction. We found that the continuous phase flows through the corners of the droplet, i.e. gutter flows to play an important role in determining the transition between trapping and squeezing. Therefore we evaluated the effect of different system parameters on gutter flows and found that the hydrodynamic resistance of gutters depends on the viscosity, size and confinement of the droplet.

Mehdi Nekouei
Texas Tech University, Department of Chemical Engineering

Date submitted: 01 Aug 2016 Electronic form version 1.4