Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Oscillatory Motion of a Bi-Phasic Slug in a Teflon Reactor[1] MILAD ABOLHASANI, KLAVS JENSEN, Massachusetts Institute of Technology — Bi-phasic physical/chemical processes require transfer of solute/reagent molecules across the interface. Continuous multi-phase flow approaches (using gas as the continuous phase), usually fail in providing sufficient interfacial area for transfer of molecules between the aqueous and organic phases. In continuous segmented flow platforms (with a fluorinated polymer-based reactor), the higher surface tension of the aqueous phase compared to the organic phase of a bi-phasic slug, in combination with the low surface energy of the reactor wall result in a more facile motion of the aqueous phase. Thus, upon applying a pressure gradient across the bi-phasic slug, the aqueous phase of the slug moves through the organic phase and leads the bi-phasic slug, thereby limiting the available interfacial area for the bi-phasic mass transfer only to the semi-spherical interface between the two phases. Disrupting the quasi-equilibrium state of the bi-phasic slug through reversing the pressure gradient across the bi-phasic slug causes the aqueous phase to move back through the organic phase. In this work, we experimentally investigate the dynamics of periodic alteration of the pressure gradient across a bi-phasic slug, and characterize the resulting enhanced interfacial area on the bi-phasic mass transfer rate. We demonstrate the enhanced mass transfer rate of the oscillatory flow strategy compared to the continuous multi-phase approach using bi-phasic Pd catalyzed carbon-carbon and carbon-nitrogen cross coupling reactions.

[1]NSERC Postdoctoral Fellowship, Novartis Center for Continuous Manufacturing

Milad Abolhasani
Massachusetts Institute of Technology

Date submitted: 29 Jul 2015 Electronic form version 1.4