Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Effective mixing strategies with microbubble streaming flows CHENG WANG[1], BHARGAV RALLABANDI, LIN GUO, SASCHA HILGENFELDT, Department of Mechanical Science and Engineering, University of Illinois at Urbana-Champaign — Homogeneous mixing of chemical/biological samples and reagents is one of the essential preparation steps for lab-on-a-chip systems. As effective Stokes flows driven by fast time scale oscillatory flows, microbubble streaming flows are a tool uniquely positioned between passive and active mixing approaches. Guided by thorough theoretical understanding of the flows and of micromixing itself, we investigate various designs of microbubble mixers, employing two key strategies: (a) introducing controlled unsteadiness in the acoustic driving pattern, e.g. by duty-cycling and driving frequency modulation, and (b) optimizing the arrangement of multiple bubbles, such as the number, position, and orientation of the microbubbles, particularly to generate 3D chaotic flow patterns. Both of these approaches significantly improve mixing over that of previous steady 2D bubble micro-mixers, and the strategies can be combined for greater effect.

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Date submitted: 01 Aug 2013 Electronic form version 1.4