Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Investigation of Fluid Mixing in Channels with Microfabricated Ridges ZHENG XIA, LOUIS CATTAFESTA, RENWEI MEI, MARK SHEPLAK, Z. HUGH FAN, Department of Mechanical and Aerospace Engineering, University of Florida — Microflows in complex channels often present unusual flow behavior compared to their macroscale counterparts. Channels with microfabricated ridges are created in a plastic device using photolithography and molding. To study fluid mixing, a novel visualization technique is developed. This approach couples a conventional optical microscope with a computational deconvolution algorithm to produce the images of three dimensional flows, which are obtained by (1) optically sectioning the flow in the microchannel by collecting a series of fluorescence images at different focal planes along the optical axis, and (2) removing the out-of-focus fluorescence signal by the deconvolution method to reconstruct a corrected three-dimensional concentration image. With the counter interaction of applied pressure and electric potential fields, recirculation in the flow in these ridged channels is observed. The circulation is demonstrated by mixing a fluorescent stream and a water stream in the microchannels, as well as using microparticles. Circulation results in enhanced fluid mixing; the fluorescence intensity variation at the cross section is calculated as an index of mixing. The preliminary results show the rapid mixing in the ridged channels, verifying the existence of circulation. We also compared the experimental results with that from computational fluid dynamics simulation.

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Date submitted: 28 Aug 2006 Electronic form version 1.4