Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Acoustic Droplet Vaporization in Microchannels DAVID LI, MARIO FABIILLI, OLIVER KRIPFGANS, J. BRIAN FOWLKES, JOSEPH BULL, University of Michigan — Gas embolotherapy is a proposed cancer therapy where gas bubbles acting as embolic agents are selectively generated near the tumor site to block blood supply, resulting to tumor necrosis. The gas bubbles are generated by using focused ultrasound to selective vaporize intravenously injected microdroplets. In this study, albumin encapsulated dodecafluorocarbon microdroplets were isolated in 25 to 100 micron diameter polydimethylsiloxane microchannels. The droplets were vaporized at 37 °C using a single pulse from a 7.5 MHz single element focused transducer with 8-32 cycles at 2.2 to 5.6 MPa peak negative pressure. The vaporization process was recorded using an ultra-high speed camera attached to an inverted microscope. A theoretical Rayleigh-Plesset like model was derived to describe the both the expansion of small spherical bubbles as well as cylindrical bubbles in a long microchannel. The gas phase was described as an ideal gas and the liquid DDFP and bulk fluid were viscous Newtonian fluids. Additionally, surface tension, viscous losses from the channel, and the phase change process were included in the model. The theoretical model matched very well to experiments with channel diameters or 50 micron or less. This work was supported by NIH grant R01EB006476.

Joseph Bull
University of Michigan

Date submitted: 01 Aug 2014 Electronic form version 1.4