Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Gas rivulets on a submerged solid surface: a new microfluidic technique to produce microbubbles MIGUEL A. HERRADA, ALFONSO M. GAÑÁN-CLAVO, University of Seville, JOSÉ M. MONTANERO, University of Extremadura — A general microfluidic technique is proposed to produce microbubbles from gas micro-rivulets formed on the surface of a solid over which a liquid is flowing. In the particular geometry considered in this work, a gaseous stream is injected through a T-junction into a channel transporting a liquid current. The gas adheres to a hydrophobic strip printed on the channel surface. When the gas and liquid flow rates are set appropriately, a gaseous rivulet flows over that strip. The rivulet breaks up downstream due to a capillary pearling instability, which leads to a monodisperse collection of microbubbles. The physics of the process is described from both the numerical simulation of the Navier-Stokes equations, and the linear stability analysis of an infinite gaseous rivulet driven by a coflowing liquid stream. This analysis allows one to determine a necessary condition to get this effect in a T-junction device. It also provides reasonably good predictions for the size of the produced microbubbles.

Miguel A. Herrada
University of Seville

Date submitted: 11 Jul 2013 Electronic form version 1.4