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Microbubbling in microfluidics using Flow Focusing for moderate-high Reynolds. JUAN M. FERNANDEZ, ALFONSO M. GANAN-CALVO, ESI, Universidad de Sevilla, Spain — A bubbly flow in a microfluidic substrate shows distinctive features which makes it attractive for a variety of important applications. Firstly, the liquid-gas surface per unit liquid volume is very high, and therefore the forces originated at the liquid-gas interfaces greatly affect the whole liquid bulk flow. Secondly, microfluidic geometries generally impose narrow passages which create regions where strong convective accelerations take place for moderate-high Reynolds flows. In particular, strong convective accelerations can be locally enhanced using Flow Focusing geometrical configurations, increasingly used in microfluidics (axisymmetric, planar, etc.). These combined effects cause strong local instabilities in the flow leading to a robust and perfectly controllable microbubbling with a remarkable regularity and characteristic frequencies in the KHz-MHz range, when using Flow Focusing and moderate-high Reynolds liquid flow. The size of the microbubbles produced spans from the micrometric to the nanometric range. The intriguing physics behind these microbubbling phenomena can be globally described by scaling laws which have been extensively compared with experiments, showing a remarkable agreement. These scaling laws are fundamentally dictated by the microfluidic geometry used, and by the gas to liquid flow rates ratio. Their wide-range applications will be outlined.

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