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Transient Pressure Measurements in Microscale Bubble Flows SIAVASH ASLANBEIGI, Department of Physics, University of Toronto, MICHAEL MCNEIL, LIAN LENG, AXEL GUENTHER, Department of Mechanical and Industrial Engineering, University of Toronto — Microscale bubble flows have found a wide range of applications in lab-on-a-chip systems and for microchemical synthesis. Most previous studies of these flows have relied on optical micrographs of the fluid phase distribution. We present time-resolved measurements of the fluid pressure during steady flow along the channel that provide for a very sensitive tool to discriminate between flow regimes, to determine bubble/droplet velocities and – in multichannel arrangements - to achieve flow synchronization. We integrated piezoresistive pressure transducers in soft lithographically patterned microfluidic devices. On-chip integration significantly reduced the available dead volume and removed any unwanted bubbles in the sensing channel. The integrated pressure sensors were calibrated and electrically amplified. Dynamic pressure measurements at millisecond time resolution and a sensitivity exceeding the capillary pressure by at least one order of magnitude were obtained. The presented results were obtained at different wetting conditions and for segmented gas-liquid flows at Capillary numbers of 0.001-0.05.

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