

Gas Bubble Generation

Demonstration of the Mitos P-Pump for use in the generation of monodisperse compressed air bubbles in mineral oil on a microfluidic chip



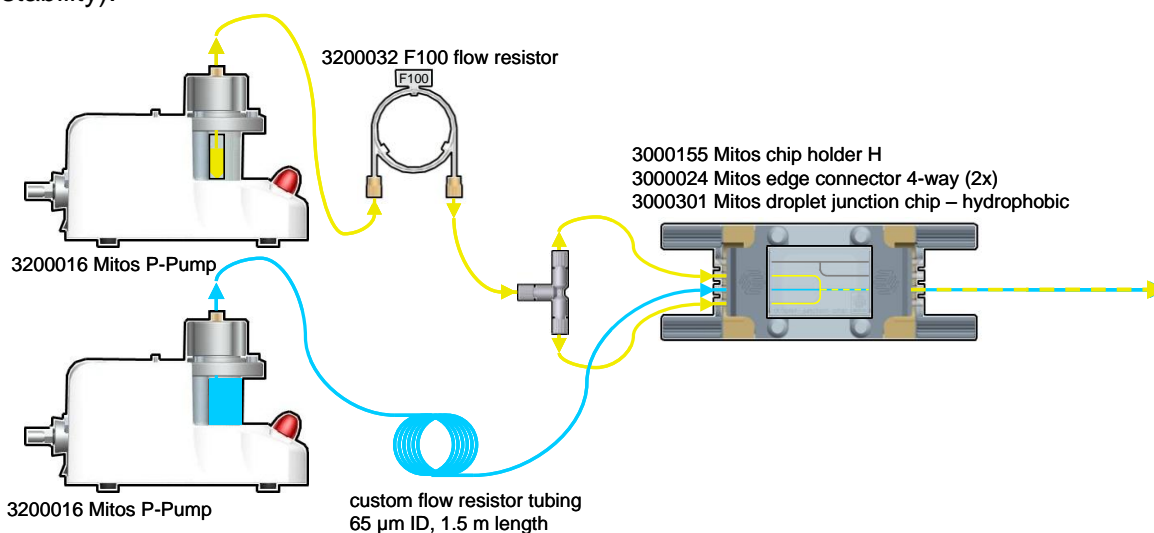
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About Gas Bubble Generation

Gas bubble generation on microfluidic chips is useful for the production of foams with micrometer sized gas bubbles dispersed in a liquid. Research in this field is enabling the development of advanced materials for science and industry. For many applications, it is important to generate monodisperse bubbles to obtain foams with consistent characteristics. This application note presents the Mitos P-Pump and Mitos Droplet Junction Chip for the generation of monodisperse gas bubbles.

Gas Bubble Generation Test Set-up

Gas was delivered to the chip using a Mitos P-Pump with custom flow resistor to bring the gas into the required flow rate range. The custom flow resistor interfaced directly into the chip to minimize the compressible volume downstream. A second P-Pump provided the carrier oil flow into the chip via the Mitos flow resistor F100. A high speed video was captured of the gas bubble generation and the bubble monodispersity was measured using image analysis software. The gas used was compressed air and the carrier liquid was mineral oil with 5% v/v Span 80 (Span 80 is a surfactant used to increase droplet stability).



Experimental set-up for the generation of monodisperse gas bubbles on the Mitos droplet junction chip – hydrophobic with flow provided by the Mitos P-Pump

Results

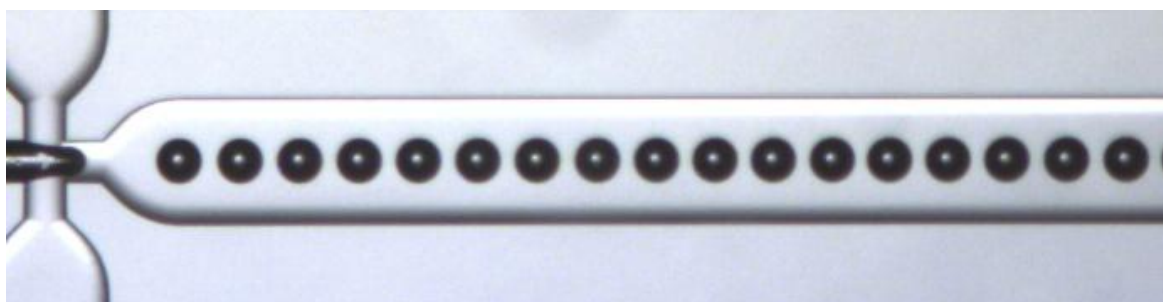
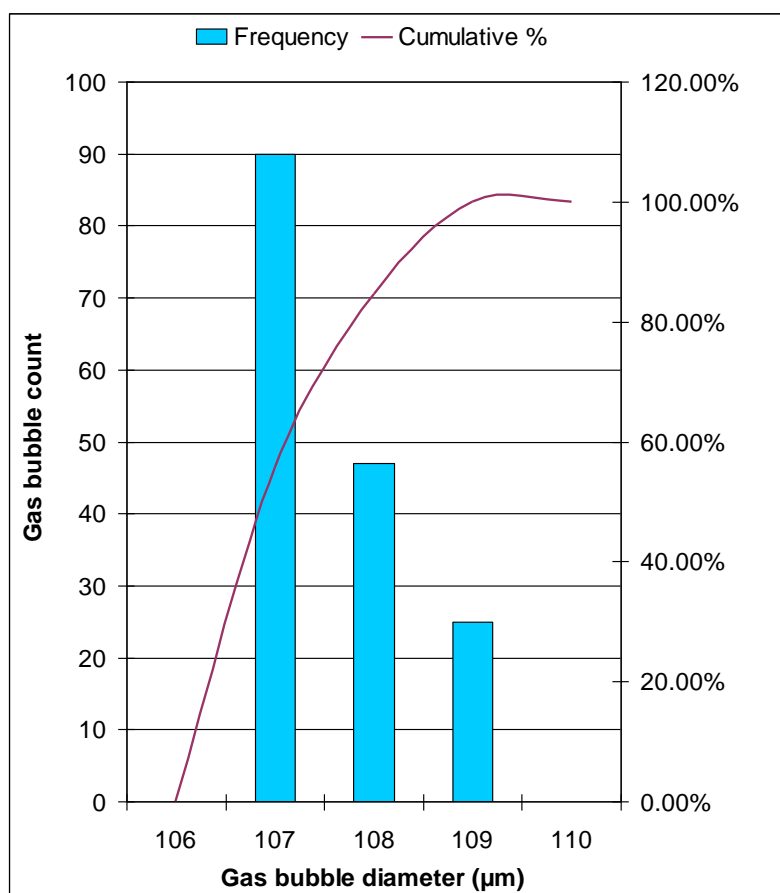


Image of compressed air bubbles (flow rate 2.1 µl/min) in a carrier phase of mineral oil with 5% v/v Span 80 (flow rate 16 µl/min) formed on the Mitos Droplet Junction Chip - Hydrophobic



Histogram of gas bubble size distribution with compressed air flow rate of 2.1 µl/min and mineral oil with 5% v/v Span 80 flow rate of 16 µl/min. Sample data obtained with test set-up described above and processed using image analysis software

Measure of Distribution	Value
Mean Droplet Diameter	106.9 µm
Standard Deviation	0.7 µm
Minimum Droplet Diameter	106.4 µm
Maximum Droplet Diameter	108.9 µm
Coefficient of Variation	0.7 %

Table showing variation in gas bubble size

Conclusions

Highly monodisperse gas bubbles have been successfully generated on the Mito Droplet Junction Chip – Hydrophobic. Monodispersity was achieved with the pulseless pressure pump technology of the Mito P-Pump. This demonstration provides a test system and initial operating conditions for research into foam production.



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